DEPARTMENT OF AUTOMOBILE ENGINEERING

B.E. AUTOMOBILE ENGINEERING

CURRICULUM & SYLLABI

Regulation 2020

K.S.R. College of Engineering (Autonomous)

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in **Website: www.ksrce.ac.in**

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**
Department	Department of Automobile Engineering	
Programme	B.E – Automobile Engineering	

Vision of the Institution

IV	We envision to achieve status as an excellent Educational Institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	Education and research to meet the need of global automotive industry and society.

Mission of the Department

DM 1	Quality education through flexible curriculum, research and self-learning.
DM 2	Training via automotive industry for a sustainable society and social development.

Program Educational Objectives (PEOs)

The graduates of the programme will be able to	
PEO 1	**Core expertise:** Apply technical knowledge and competitive in automobile engineering field.
PEO 2	**Sustainable Solutions:** Impart inter-disciplinary skills and innovations for challenges that emerge in automobile sector.
PEO 3	**Ethical Proficiency**: Enhance knowledge with professional ethics, attitude, communication and leadership skills.

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Professional competency:** Design and analyze automotive components, electrical and electronic systems.
PSO2	**Troubleshoot Skills:** Develop as a professional in automotive systems maintenance.

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B.E. AUTOMOBILE ENGINEERING

CURRICULUM

Regulation 2020

(Applicable to candidates admitted in the academic year 2020 - 2021)

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Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - I

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common To All Branches)	HSMC	2	0	1	3	30	70	100
2.	20MA151	Engineering Mathematics – I (Common To All Branches)	BSC	3	1	0	4	30	70	100
3.	20PH051	Engineering Physics (Common To All Branches)	BSC	3	0	0	3	30	70	100
4.	20ME144	Engineering Drawing (Common To AU, ME & SF)	ESC	1	2	0	3	30	70	100
MANDATORY COURSES										
5.	20MC151	Induction Programming* (Common To All Branches)	MC	-	-	-	-	50	50	100
PRACTICAL										
6.	20PH028	Physics Laboratory (Common To All Branches)	BSC	0	0	3	1	50	50	100
7.	20AU026	Computer Aided Drawing Laboratory (Common To AU & ME)	ESC	0	0	3	1	50	50	100
8.	20GE028	Manufacturing Practices Laboratory (Common To All Branches)	ESC	0	0	3	1	50	50	100
Total				**9**	**3**	**10**	**16**	**800**		

*Induction programming will be conducted for three weeks as per AICTE guidelines

SEMESTER - II

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN251	Technical English–II (Common To All Branches)	HSMC	2	0	1	3	30	70	100
2.	20MA241	Engineering Mathematics– II (Common To AU,CE, ME & SF)	BSC	3	1	0	4	30	70	100
3.	20CH051	Engineering Chemistry (Common To All Branches)	BSC	3	0	0	3	30	70	100
4.	20CS241	Python Programming (Common To AU,CE,EC,EE,ME & SF)	ESC	3	0	0	3	30	70	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common To AU,CE,CS,IT,ME & SF)	ESC	3	0	0	3	30	70	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common To AU & SF)	ESC	3	1	0	4	30	70	100
PRACTICAL										
7.	20CH028	Chemistry Laboratory (Common To All Branches)	BSC	0	0	3	1	50	50	100
8.	20CS227	Python Programming Laboratory (Common To AU,CE,EC,EE,ME & SF)	ESC	0	0	3	1	50	50	100
Total				**17**	**2**	**7**	**22**	**800**		

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SEMESTER - III

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common To AU, ME & SF)	BSC	3	1	0	4	30	70	100
2.	20AU312	Fluid Mechanics and Hydraulic Machines	PC	3	0	0	3	30	70	100
3.	20AU313	Mechanics of Materials	PC	3	1	0	4	30	70	100
4.	20AU314	Automotive Manufacturing Technology	PC	3	0	0	3	30	70	100
5.	20AU315	Automotive Chassis	PC	3	0	0	3	30	70	100
MANDATORY COURSES										
6.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	50	50	100
PRACTICAL										
7.	20AU321	Fluid Mechanics and Mechanics of materials Laboratory	PC	0	0	3	1	50	50	100
8.	20AU322	Automotive Manufacturing Technology Laboratory	PC	0	0	3	1	50	50	100
9.	20HR351	Career Development Skills – I (Common To All Branches)	EEC	0	2	0	0	50	50	100
Total				**18**	**4**	**6**	**19**	**900**		

SEMESTER - IV

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU411	Engineering Thermodynamics and Heat Transfer	PC	3	1	0	4	30	70	100
2.	20AU412	Automotive Engines	PC	3	0	0	3	30	70	100
3.	20AU413	Material Science and Metallurgy	PC	3	0	0	3	30	70	100
4.	20AU414	Mechanics of Machines	PC	3	1	0	4	30	70	100
5.	20AU415	Automotive Electrical Engineering	PC	3	0	0	3	30	70	100
6.	20AU416	Automotive Fuels and Lubricants	PC	3	0	0	3	30	70	100
PRACTICAL										
7.	20AU421	Automotive Fuels and Lubricants Laboratory	PC	0	0	3	1	50	50	100
8.	20AU422	Automotive Components Laboratory	PC	0	0	3	1	50	50	100
9.	20HR412	Career Development Skills – II	EEC	0	2	0	0	50	50	100
Total				**18**	**4**	**6**	**22**	**900**		

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SEMESTER - V

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common To All Branches)	HSMC	3	0	0	3	30	70	100
2.	20AU512	Automotive Transmission	PC	3	0	0	3	30	70	100
3.	20AU513	Design of Machine Elements	PC	3	1	0	4	30	70	100
4.	20AU514	Vehicle Body Engineering	PC	3	0	0	3	30	70	100
5.	20AU515	Automotive Electronics	PC	3	0	0	3	30	70	100
6.		Open Elective – I	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20AU521	Automotive Components Design and Modeling Laboratory	PC	0	0	3	1	50	50	100
8.	20AU522	Automotive Electrical and Electronics Laboratory	PC	0	0	3	1	50	50	100
9.	20HR513	Career Development Skills – III	EEC	0	2	0	0	50	50	100
Total				**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU611	Automotive Engine Components Design	PC	3	1	0	4	30	70	100
2.	20AU612	Automotive Pollution and Control	PC	3	0	0	3	30	70	100
3.	20AU613	Finite Element Analysis	PC	3	1	0	4	30	70	100
4.		Professional Elective – I	PEC	3	0	0	3	30	70	100
5.		Open Elective – II	OEC	3	0	0	3	30	70	100
6.		Open Elective – III	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20AU621	Vehicle Components Design and Analysis Laboratory	PC	0	0	3	1	50	50	100
8.	20AU622	Engine Performance and Emission Testing Laboratory	PC	0	0	3	1	50	50	100
9.	20HR614	Career Development Skills – IV	EEC	0	2	0	0	50	50	100
Total				**18**	**4**	**6**	**22**	**1000**		

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SEMESTER - VII

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU711	Vehicle Dynamics	PC	3	0	0	3	30	70	100
2.	20AU712	Electric and Hybrid Vehicles	PC	3	0	0	3	30	70	100
3.	20AU713	Vehicle Maintenance and Testing	PC	3	0	0	3	30	70	100
4.		Professional Elective – II	PEC	3	0	0	3	30	70	100
5.		Professional Elective – III	PEC	3	0	0	3	30	70	100
6.		Open Elective – IV	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	20AU721	Vehicle Maintenance and Reconditioning Laboratory	PC	0	0	3	1	50	50	100
8.	20AU722	Industrial Training and Seminar	EEC	0	0	3	1	50	50	100
9.	20AU723	Project – I	EEC	0	0	6	3	50	50	100
Total				**18**	**0**	**12**	**23**	**900**		

SEMESTER - VIII

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU811	Transport Management	PC	3	0	0	3	30	70	100
2.		Professional Elective – IV	PEC	3	0	0	3	30	70	100
3.		Professional Elective – V	PEC	3	0	0	3	30	70	100
PRACTICAL										
4.	20AU821	Project – II	EEC	0	0	12	6	50	50	100
Total				**9**	**0**	**12**	**15**	**400**		

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List of Electives

PROFESSIONAL ELECTIVE – I (SEMESTER – VI)

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU661	Automotive Air-Conditioning	S1	PEC	3	0	0	3	30	70	100
2.	20AU662	Alternative Fuels and Energy Systems	S1	PEC	3	0	0	3	30	70	100
3.	20AU663	Autonomous Vehicle Technology	S2	PEC	3	0	0	3	30	70	100
4.	20AU664	Tyre Technology	S2	PEC	3	0	0	3	30	70	100
5.	20AU665	Automotive Aerodynamics	S3	PEC	3	0	0	3	30	70	100
6.	20AU666	Computational Fluid Dynamics	S3	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – II (SEMESTER – VII)

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU761	Advanced Theory of I.C. Engines	S1	PEC	3	0	0	3	30	70	100
2.	20AU762	Automotive Vehicle Safety	S2	PEC	3	0	0	3	30	70	100
3.	20AU763	Two and Three Wheelers	S2	PEC	3	0	0	3	30	70	100
4.	20AU764	Design of Chassis Components	S3	PEC	3	0	0	3	30	70	100
5.	20AU765	Industrial Robotics and Expert Systems	S4	PEC	3	0	0	3	30	70	100
6.	20AU766	Battery Technology	S5	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VII)

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU767	Combustion Thermodynamics and Heat Transfer	S1	PEC	3	0	0	3	30	70	100
2.	20AU768	Vehicle Control Systems	S2	PEC	3	0	0	3	30	70	100
3.	20AU769	Intelligent Vehicles Technology	S2	PEC	3	0	0	3	30	70	100
4.	20AU771	Computer Simulation of IC Engine Processes	S3	PEC	3	0	0	3	30	70	100
5.	20AU772	Product Life Cycle Management	S4	PEC	3	0	0	3	30	70	100
6.	20AU773	Additive Manufacturing	S4	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VIII)											
Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU861	Fuel Cells and Applications	S2	PEC	3	0	0	3	30	70	100
2.	20AU862	Special Purpose Vehicles	S2	PEC	3	0	0	3	30	70	100
3.	20AU863	Design Thinking	S3	PEC	3	0	0	3	30	70	100
4.	20AU864	New Product Development	S4	PEC	3	0	0	3	30	70	100
5.	20AU865	Entrepreneurship Development	S5	PEC	3	0	0	3	30	70	100
6.	20AU866	Engineering Economics and Finance	S5	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VIII)											
Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	30	70	100
2.	20AU868	Noise, Vibration and Harshness	S2	PEC	3	0	0	3	30	70	100
3.	20AU869	Vehicle Dealership Management	S5	PEC	3	0	0	3	30	70	100
4.	20AU871	Industry 4.0	S4	PEC	3	0	0	3	30	70	100
5.	20AU872	Production Planning and Control	S4	PEC	3	0	0	3	30	70	100
6.	20HS002	Total Quality Management (Common To All Branches)	S4	PEC	3	0	0	3	30	70	100

S1 –Thermal Engineering
S2 –Automobile Engineering
S3 – Design
S4 –Manufacturing Engineering
S5 – Management

OPEN ELECTIVE COURSES

Open Elective courses offered by other branches

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
CIVIL ENGINEERING											
1.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	30	70	100
2.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	30	70	100
3.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	30	70	100
4.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	30	70	100
5.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	30	70	100
6.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	30	70	100
7.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	30	70	100
8.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	30	70	100

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					L	T	P	C	CA	ES	Total
9.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	30	70	100
10.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	30	70	100
Computer Science and Engineering											
11.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	30	70	100
12.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	30	70	100
13.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	30	70	100
14.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	30	70	100
15.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	30	70	100
16.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	30	70	100
17.	20CS907	Green Technology	CSE	OEC	3	0	0	3	30	70	100
18.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	30	70	100
19.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	30	70	100
20.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	30	70	100
Electronics and Communication Engineering											
21.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	30	70	100
22.	20EC902	NANO Technology	EC	OEC	3	0	0	3	30	70	100
23.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	30	70	100
24.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	30	70	100
25.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	30	70	100
26.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	30	70	100
27.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	30	70	100
28.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	30	70	100
Electrical and Electronics Engineering											
29.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	30	70	100
30.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	30	70	100
31.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	30	70	100
32.	20EE904	Control Engineering	EE	OEC	3	0	0	3	30	70	100
33.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	30	70	100
34.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	30	70	100
35.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	30	70	100
36.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	30	70	100
37.	20EE909	Fundamentals of Electrical	EE	OEC	3	0	0	3	30	70	100

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
		Machinery									
38.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	30	70	100
39.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	30	70	100
Information Technology											
40.	20IT901	Data Science using R	IT	OEC	3	0	0	3	30	70	100
41.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	30	70	100
42.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	30	70	100
43.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	30	70	100
44.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	30	70	100
45.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	30	70	100
46.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	30	70	100
47.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	30	70	100
48.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	30	70	100
49.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	30	70	100
Mechanical Engineering											
50.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	30	70	100
51.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	30	70	100
52.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	30	70	100
53.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	30	70	100
54.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	30	70	100
55.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	30	70	100
56.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	30	70	100
57.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	30	70	100
58.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	30	70	100
59.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	30	70	100
Safety and Fire Engineering											
60.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	30	70	100
61.	20SF902	Construction Safety	SF	OEC	3	0	0	3	30	70	100
62.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	30	70	100
63.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	30	70	100
64.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	30	70	100
65.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	30	70	100
66.	20SF907	Food Safety	SF	OEC	3	0	0	3	30	70	100

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
67.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	30	70	100
68.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	30	70	100
69.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	30	70	100
Science and Humanities											
70.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	30	70	100
71.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	30	70	100
72.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	30	70	100
73.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	30	70	100
74.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	30	70	100
75.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	30	70	100

Open Elective courses offered by Automobile Engineering to other branches

Sl. No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	30	70	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	30	70	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	30	70	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	30	70	100
5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	30	70	100
6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	30	70	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	30	70	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	30	70	100

LIST OF VALUE ADDED COURSES

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1.	20AUV01	Automotive Styling	15	Internal / External
2.	20AUV02	Vehicle Service Management	15	Internal / External
3.	20AUV03	Accident and Insurance Survey	15	Internal / External
4.	20AUV04	Logistic Management	15	Internal / External
5.	20AUV05	Electronic Engine Management System	15	Internal / External
6.	20AUV06	Instrumentation and Control in Automobile Engineering	15	Internal/ External
7.	20AUV07	Tractor and Farm Equipment	15	Internal / External

COURSE COMPONENT SUMMARY

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	**HSMC**	3	3	-	-	3	-	-	-	9	5.62
2.	**BSC**	8	8	4	-	-	-	-	-	20	12.5
3.	**ESC**	5	11	-	-	-	-	-	-	16	10
4.	**PC**	-	-	15	22	15	13	10	3	78	48.75
5.	**PEC**	-	-	-	-	-	3	6	6	15	9.38
6.	**OEC**	-	-	-	-	3	6	3	-	12	7.5
7.	**EEC**	-	-	-	-	-	-	4	6	10	6.25
TOTAL		**16**	**22**	**19**	**22**	**21**	**22**	**23**	**15**	**160**	**100**

Total No. of Credits = 160

DEPARTMENT OF AUTOMOBILE ENGINEERING

B.E. AUTOMOBILE ENGINEERING

CURRICULUM

Regulation 2020

(Applicable to candidates admitted in the academic year 2021 - 2022)

K.S.R. College of Engineering (Autonomous)

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in **Website: www.ksrce.ac.in**

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**
Department	Department of Automobile Engineering	
Programme	B.E – Automobile Engineering	

Vision of the Institution

IV	We envision to achieve status as an excellent Educational Institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	Education and research to meet the need of global automotive industry and society.

Mission of the Department

DM 1	Quality education through flexible curriculum, research and self-learning.
DM 2	Training via automotive industry for a sustainable society and social development.

Program Educational Objectives (PEOs)

The graduates of the programme will be able to	
PEO 1	**Core expertise:** Apply technical knowledge and competitive in automobile engineering field.
PEO 2	**Sustainable Solutions:** Impart inter-disciplinary skills and innovations for challenges that emerge in automobile sector.
PEO 3	**Ethical Proficiency**: Enhance knowledge with professional ethics, attitude, communication and leadership skills.

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Professional competency:** Design and analyze automotive components, electrical and electronic systems.
PSO2	**Troubleshoot Skills:** Develop as a professional in automotive systems maintenance.

KSR College of Engineering	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020

Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA151	Engineering Mathematics – I (Common to All Branches)	BSC	3	1	0	4	40	60	100
3.	20PH051	Engineering Physics (Common to All Branches)	BSC	3	0	0	3	40	60	100
4.	20ME144	Engineering Drawing (Common To AU, ME & SF)	ESC	1	2	0	3	40	60	100
PRACTICAL										
5.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
6.	20AU026	Computer Aided Drawing Laboratory (Common to AU & ME)	ESC	0	0	3	1	60	40	100
7.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	60	40	100
MANDATORY COURSE										
8.	20MC151	Induction Programming* (Common to All Branches)	MC	3	-	-	-	*	*	*
Total				**12**	**3**	**10**	**16**	**700**		

*Induction programming will be conducted for three weeks as per AICTE guidelines

SEMESTER - II

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN251	Technical English–II (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA241	Engineering Mathematics– II (Common to AU,CE, ME & SF)	BSC	3	1	0	4	40	60	100
3.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,EC,EE,ME & SF)	ESC	3	0	0	3	40	60	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,IT,ME & SF)	ESC	3	0	0	3	40	60	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common to AU & SF)	ESC	3	1	0	4	40	60	100
PRACTICAL										
7.	20CH028	Chemistry Laboratory (Common To All Branches)	BSC	0	0	3	1	60	40	100
8.	20CS227	Python Programming Laboratory (Common to AU,CE,EC,EE,ME & SF)	ESC	0	0	3	1	60	40	100
Total				**17**	**2**	**7**	**22**	**800**		

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**

Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common to AU, ME & SF)	BSC	3	1	0	4	40	60	100
2.	20AU312	Fluid Mechanics and Hydraulic Machines	PC	3	0	0	3	40	60	100
3.	20AU313	Mechanics of Materials	PC	3	1	0	4	40	60	100
4.	20AU314	Automotive Manufacturing Technology	PC	3	0	0	3	40	60	100
5.	20AU315	Automotive Chassis	PC	3	0	0	3	40	60	100
PRACTICAL										
6.	20AU321	Fluid Mechanics and Mechanics of materials Laboratory	PC	0	0	3	1	60	40	100
7.	20AU322	Automotive Manufacturing Technology Laboratory	PC	0	0	3	1	60	40	100
8.	20HR351	Career Development Skills – I (Common to All Branches)	EEC	0	2	0	0	60	40	100
MANDATORY COURSES										
9.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	40	60	100
Total				**18**	**4**	**6**	**19**	**900**		

SEMESTER - IV

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU411	Engineering Thermodynamics and Heat Transfer	PC	3	1	0	4	40	60	100
2.	20AU412	Automotive Engines	PC	3	0	0	3	40	60	100
3.	20AU413	Material Science and Metallurgy	PC	3	0	0	3	40	60	100
4.	20AU414	Mechanics of Machines	PC	3	1	0	4	40	60	100
5.	20AU415	Automotive Electrical Engineering	PC	3	0	0	3	40	60	100
6.	20AU416	Automotive Fuels and Lubricants	PC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU421	Automotive Fuels and Lubricants Laboratory	PC	0	0	3	1	60	40	100
8.	20AU422	Automotive Components Laboratory	PC	0	0	3	1	60	40	100
9.	20HR412	Career Development Skills – II	EEC	0	2	0	0	60	40	100
Total				**18**	**4**	**6**	**22**	**900**		

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Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common To All Branches)	HSMC	3	0	0	3	40	60	100
2.	20AU512	Automotive Transmission	PC	3	0	0	3	40	60	100
3.	20AU513	Design of Machine Elements	PC	3	1	0	4	40	60	100
4.	20AU514	Vehicle Body Engineering	PC	3	0	0	3	40	60	100
5.	20AU515	Automotive Electronics	PC	3	0	0	3	40	60	100
6.		Open Elective – I	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU521	Automotive Components Design and Modeling Laboratory	PC	0	0	3	1	60	40	100
8.	20AU522	Automotive Electrical and Electronics Laboratory	PC	0	0	3	1	60	40	100
9.	20HR513	Career Development Skills – III	EEC	0	2	0	0	60	40	100
Total				**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU611	Automotive Engine Components Design	PC	3	1	0	4	40	60	100
2.	20AU612	Automotive Pollution and Control	PC	3	0	0	3	40	60	100
3.	20AU613	Finite Element Analysis	PC	3	1	0	4	40	60	100
4.		Professional Elective – I	PEC	3	0	0	3	40	60	100
5.		Open Elective – II	OEC	3	0	0	3	40	60	100
6.		Open Elective – III	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU621	Vehicle Components Design and Analysis Laboratory	PC	0	0	3	1	60	40	100
8.	20AU622	Engine Performance and Emission Testing Laboratory	PC	0	0	3	1	60	40	100
9.	20HR614	Career Development Skills – IV	EEC	0	2	0	0	60	40	100
Total				**18**	**4**	**6**	**22**	**900**		

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Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU711	Vehicle Dynamics	PC	3	0	0	3	40	60	100
2.	20AU712	Electric and Hybrid Vehicles	PC	3	0	0	3	40	60	100
3.	20AU713	Vehicle Maintenance and Testing	PC	3	0	0	3	40	60	100
4.		Professional Elective – II	PEC	3	0	0	3	40	60	100
5.		Professional Elective – III	PEC	3	0	0	3	40	60	100
6.		Open Elective – IV	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU721	Vehicle Maintenance and Reconditioning Laboratory	PC	0	0	3	1	60	40	100
8.	20AU722	Industrial Training and Seminar	EEC	0	0	3	1	60	40	100
9.	20AU723	Project – I	EEC	0	0	6	3	60	40	100
			Total	**18**	**0**	**12**	**23**	**900**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU811	Transport Management	PC	3	0	0	3	40	60	100
2.		Professional Elective – IV	PEC	3	0	0	3	40	60	100
3.		Professional Elective – V	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20AU821	Project – II	EEC	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

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Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

List of Electives

PROFESSIONAL ELECTIVE – I (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU661	Automotive Air-Conditioning	S1	PEC	3	0	0	3	40	60	100
2.	20AU662	Alternative Fuels and Energy Systems	S1	PEC	3	0	0	3	40	60	100
3.	20AU663	Autonomous Vehicle Technology	S2	PEC	3	0	0	3	40	60	100
4.	20AU664	Tyre Technology	S2	PEC	3	0	0	3	40	60	100
5.	20AU665	Automotive Aerodynamics	S3	PEC	3	0	0	3	40	60	100
6.	20AU666	Computational Fluid Dynamics	S3	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU761	Advanced Theory of I.C. Engines	S1	PEC	3	0	0	3	40	60	100
2.	20AU762	Automotive Vehicle Safety	S2	PEC	3	0	0	3	40	60	100
3.	20AU763	Two and Three Wheelers	S2	PEC	3	0	0	3	40	60	100
4.	20AU764	Design of Chassis Components	S3	PEC	3	0	0	3	40	60	100
5.	20AU765	Industrial Robotics and Expert Systems	S4	PEC	3	0	0	3	40	60	100
6.	20AU766	Battery Technology	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU767	Combustion Thermodynamics and Heat Transfer	S1	PEC	3	0	0	3	40	60	100
2.	20AU768	Vehicle Control Systems	S2	PEC	3	0	0	3	40	60	100
3.	20AU769	Intelligent Vehicles Technology	S2	PEC	3	0	0	3	40	60	100
4.	20AU771	Computer Simulation of IC Engine Processes	S3	PEC	3	0	0	3	40	60	100
5.	20AU772	Product Life Cycle Management	S4	PEC	3	0	0	3	40	60	100
6.	20AU773	Additive Manufacturing	S4	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VIII)											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU861	Fuel Cells and Applications	S2	PEC	3	0	0	3	40	60	100
2.	20AU862	Special Purpose Vehicles	S2	PEC	3	0	0	3	40	60	100
3.	20AU863	Design Thinking	S3	PEC	3	0	0	3	40	60	100
4.	20AU864	New Product Development	S4	PEC	3	0	0	3	40	60	100
5.	20AU865	Entrepreneurship Development	S5	PEC	3	0	0	3	40	60	100
6.	20AU866	Engineering Economics and Finance	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VIII)											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
2.	20AU868	Noise, Vibration and Harshness	S2	PEC	3	0	0	3	40	60	100
3.	20AU869	Vehicle Dealership Management	S5	PEC	3	0	0	3	40	60	100
4.	20AU871	Industry 4.0	S4	PEC	3	0	0	3	40	60	100
5.	20AU872	Production Planning and Control	S4	PEC	3	0	0	3	40	60	100
6.	20HS002	Total Quality Management (Common To All Branches)	S4	PEC	3	0	0	3	40	60	100

S1 –Thermal Engineering
S2 –Automobile Engineering
S3 – Design
S4 –Manufacturing Engineering
S5 – Management

B.E./B.TECH. HONOURS (SPECIALIZATION IN THE SAME DISCIPLINE) : VERTICALS

Emerging Areas: Automobile Engineering

(i) B.E Honours (specialization in the same discipline)

a. The student should have earned additionally a minimum of 18 credits from a specified group of Professional Electives of the same programme.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(ii) B.E Honours

a. The students should have taken additional courses from more than one vertical of the same Programme and earned a minimum of 18 credits.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(iii) B.E. minor in other specialization.

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E programmes

- Out of these 18 credits students can earn a maximum of 6 credits in online mode (SWAYAM platform), as approved by Centre for Academic Courses.
- B.E./ B. Tech. (Hons) Specialization in the same discipline, B.E / B.Tech. Honors and B.E./B.Tech. Minor in other specialization degree will be optional for students.
- For the categories (i) to (ii), the students shall be permitted to register for the courses from the V Semester onwards provided the students has earned a minimum CGPA 7.50 of until III Semester and has cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted, to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses, which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

Registration of Professional Elective courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VIII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. The student should have earned additionally a minimum of 18 credits in any one of the verticals for obtaining B.E./B.Tech. Honours with specialization in the same disciplines.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

S. No.	Emerging Area 1 e-Management	Emerging Area 2 Electric Vehicle
1.	20AU663 Autonomous Vehicle Technology	20AU766 Battery Technology
2.	20AU762 Automotive Vehicle Safety	20AU861 Fuel Cells and Applications
3.	20AU768 Vehicle Control Systems	20AU867 IoT in Automobiles
4.	20AU867 IoT in Automobiles	20AU881 Electric Two and Three Wheeler
5.	20AU868 Noise, Vibration and Harshness	20AU882 Motors and Drivers
6.	20AU873 Reliability Engineering	20AU883 Electric Vehicle Dynamics
7.	20AU874 Predictive Maintenance	20AU884 Electric Vehicle Maintenance
8.	20AU875 Connected Cars and Advanced Driver Assistance System	20AU885 Operations Research

EMERGING AREA FOR HONOURS DEGREE SPECIALISATION											
EMERGING AREA 1 – e-MANAGEMENT											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU663	Autonomous Vehicle Technology	S2	PEC	3	0	0	3	40	60	100
2.	20AU762	Automotive Vehicle Safety	S2	PEC	3	0	0	3	40	60	100
3.	20AU768	Vehicle Control Systems	S2	PEC	3	0	0	3	40	60	100
4.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
5.	20AU868	Noise, Vibration and Harshness	S2	PEC	3	0	0	3	40	60	100
6.	20AU873	Reliability Engineering	S2	PEC	3	0	0	3	40	60	100
7.	20AU874	Predictive Maintenance	S2	PEC	3	0	0	3	40	60	100
8.	20AU875	Connected Cars and Advanced Driver Assistance System	S2	PEC	3	0	0	3	40	60	100

EMERGING AREA FOR HONOURS DEGREE SPECIALISATION											
EMERGING AREA 2 – ELECTRIC VEHICLE											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU766	Battery Technology	S2	PEC	3	0	0	3	40	60	100
2.	20AU861	Fuel Cells and Applications	S2	PEC	3	0	0	3	40	60	100
3.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
4.	20AU881	Electric Two and Three Wheeler	S2	PEC	3	0	0	3	40	60	100
5.	20AU882	Motors and Drivers	S2	PEC	3	0	0	3	40	60	100
6.	20AU883	Electric Vehicle Dynamics	S2	PEC	3	0	0	3	40	60	100
7.	20AU884	Electric Vehicle Maintenance	S2	PEC	3	0	0	3	40	60	100
8.	20AU885	Operations Research	S2	PEC	3	0	0	3	40	60	100

OPEN ELECTIVE COURSES

Open Elective courses offered by other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
CIVIL ENGINEERING											
1.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	40	60	100
2.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	40	60	100
3.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	40	60	100
4.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	40	60	100
5.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	40	60	100
6.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	40	60	100
7.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	40	60	100
8.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	40	60	100
9.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	40	60	100
10.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	40	60	100
COMPUTER SCIENCE AND ENGINEERING											
11.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	40	60	100
12.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	40	60	100
13.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	40	60	100
14.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	40	60	100
15.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	40	60	100
16.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	40	60	100
17.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
18.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
19.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
20.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
ELECTRONICS AND COMMUNICATION ENGINEERING											
21.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
22.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
23.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
24.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
25.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
26.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
27.	20EC907	Internet of Things Sensing and	EC	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
		Actuator Devices									
28.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100
ELECTRICAL AND ELECTRONICS ENGINEERING											
29.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
30.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
31.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
32.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
33.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
34.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
35.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
36.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
37.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
38.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
39.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
INFORMATION TECHNOLOGY											
40.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
41.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
42.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
43.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	40	60	100
44.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
45.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
46.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
47.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
48.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
49.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
MECHANICAL ENGINEERING											
50.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
51.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
52.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
53.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
54.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
55.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100
56.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
57.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
58.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
59.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100
SAFETY AND FIRE ENGINEERING											
60.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
61.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
62.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
63.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
64.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
65.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
66.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
67.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
68.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
69.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
SCIENCE AND HUMANITIES											
70.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
71.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
72.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
73.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
74.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
75.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

Open Elective courses offered by Automobile Engineering to other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	40	60	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	40	60	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	40	60	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	40	60	100

5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	40	60	100
6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	40	60	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	40	60	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	40	60	100

LIST OF VALUE ADDED COURSES

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1.	20AUV01	Automotive Styling	15	Internal / External
2.	20AUV02	Vehicle Service Management	15	Internal / External
3.	20AUV03	Accident and Insurance Survey	15	Internal / External
4.	20AUV04	Logistic Management	15	Internal / External
5.	20AUV05	Electronic Engine Management System	15	Internal / External
6.	20AUV06	Instrumentation and Control in Automobile Engineering	15	Internal/ External
7.	20AUV07	Tractor and Farm Equipment	15	Internal / External

COURSE COMPONENT SUMMARY

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	**HSMC**	3	3	-	-	3	-	-	-	9	5.62
2.	**BSC**	8	8	4	-	-	-	-	-	20	12.5
3.	**ESC**	5	11	-	-	-	-	-	-	16	10
4.	**PC**	-	-	15	22	15	13	10	3	78	48.75
5.	**PEC**	-	-	-	-	-	3	6	6	15	9.38
6.	**OEC**	-	-	-	-	3	6	3	-	12	7.5
7.	**EEC**	-	-	-	-	-	-	4	6	10	6.25
TOTAL		**16**	**22**	**19**	**22**	**21**	**22**	**23**	**15**	**160**	**100**

Total No. of Credits = 160

DEPARTMENT OF AUTOMOBILE ENGINEERING

B.E. AUTOMOBILE ENGINEERING

CURRICULUM

Regulation 2020

(Applicable to candidates admitted in the academic year 2022 - 2023)

K.S.R. College of Engineering (Autonomous)

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in Website: www.ksrce.ac.in

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**
Department	Department of Automobile Engineering	
Programme	B.E – Automobile Engineering	

Vision of the Institution

IV	We envision to achieve status as an excellent Educational Institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	Education and research to meet the need of global automotive industry and society.

Mission of the Department

DM 1	Quality education through flexible curriculum, research and self-learning.
DM 2	Training via automotive industry for a sustainable society and social development.

Program Educational Objectives (PEOs)

The graduates of the programme will be able to	
PEO 1	**Core expertise:** Apply technical knowledge and competitive in automobile engineering field.
PEO 2	**Sustainable Solutions:** Impart inter-disciplinary skills and innovations for challenges that emerge in automobile sector.
PEO 3	**Ethical Proficiency**: Enhance knowledge with professional ethics, attitude, communication and leadership skills.

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Professional competency:** Design and analyze automotive components, electrical and electronic systems.
PSO2	**Troubleshoot Skills:** Develop as a professional in automotive systems maintenance.

K.S.R. COLLEGE OF ENGINEERING (Autonomous): TIRUCHENGODE - 637 215

DEPARTMENT OF AUTOMOBILE ENGINEERING

(REGULATIONS 2020) (Amendments)

With reference to the Centre for academic courses, Anna University, letter no. 618/CAC/TC/2023 dated 01.03.2023 two tamil language courses **"தமிழர் மரபு – HERITAGE OF TAMILS" & "தமிழரும் தொழில்நுட்பமும் - TAMILS AND TECHNOLOGY"** are introduced in the regulation 2020 and offered to the student batch 2022 – 2026 admitted in the academic year 2022–2023 during the II Semester and III Semester respectively.

The same courses are followed for student batches admitted from the academic year 2023-2024 during the I Semester and II Semester respectively.

Course Code & Course Title	Core/Elective	Semester	Credits	Applicable to candidates admitted in the academic year
Heritage of Tamils & தமிழர் மரபு	Mandatory Course	II	1	2022 – 2023
Tamils and Technology & தமிழரும் தொழில்நுட்பமும்		III	1	
Heritage of Tamils & தமிழர் மரபு		I	1	2023- 2024
Tamils and Technology & தமிழரும் தொழில்நுட்பமும்		II	1	

KSR College of Engineering	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020

Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA151	Engineering Mathematics – I (Common to All Branches)	BSC	3	1	0	4	40	60	100
3.	20PH051	Engineering Physics (Common to All Branches)	BSC	3	0	0	3	40	60	100
4.	20ME144	Engineering Drawing (Common To AU, ME & SF)	ESC	1	2	0	3	40	60	100
PRACTICAL										
5.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
6.	20AU026	Computer Aided Drawing Laboratory (Common to AU & ME)	ESC	0	0	3	1	60	40	100
7.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	60	40	100
MANDATORY COURSE										
8.	20MC151	Induction Programming* (Common to All Branches)	MC	3	-	-	-	*	*	*
Total				**12**	**3**	**10**	**16**	**700**		

*Induction programming will be conducted for three weeks as per AICTE guidelines

SEMESTER - II

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN251	Technical English–II (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA241	Engineering Mathematics– II (Common to AU,CE, ME & SF)	BSC	3	1	0	4	40	60	100
3.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,EC,EE,ME & SF)	ESC	3	0	0	3	40	60	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,IT,ME & SF)	ESC	3	0	0	3	40	60	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common to AU & SF)	ESC	3	1	0	4	40	60	100
PRACTICAL										
7.	20CH028	Chemistry Laboratory (Common To All Branches)	BSC	0	0	3	1	60	40	100
8.	20CS227	Python Programming Laboratory (Common to AU,CE,EC,EE,ME & SF)	ESC	0	0	3	1	60	40	100
MANDATORY COURSE										
9.	20GE051	தமிழர் மரபு – Heritage of Tamils (Common to All Branches)	MC	1	0	0	1	40	60	100
Total				**18**	**2**	**7**	**23**	**900**		

KSR College of Engineering	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020

Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common to AU, ME & SF)	BSC	3	1	0	4	40	60	100
2.	20AU312	Fluid Mechanics and Hydraulic Machines	PC	3	0	0	3	40	60	100
3.	20AU313	Mechanics of Materials	PC	3	1	0	4	40	60	100
4.	20AU314	Automotive Manufacturing Technology	PC	3	0	0	3	40	60	100
5.	20AU315	Automotive Chassis	PC	3	0	0	3	40	60	100
PRACTICAL										
6.	20AU321	Fluid Mechanics and Mechanics of materials Laboratory	PC	0	0	3	1	60	40	100
7.	20AU322	Automotive Manufacturing Technology Laboratory	PC	0	0	3	1	60	40	100
8.	20HR351	Career Development Skills – I (Common to All Branches)	EEC	0	2	0	0	60	40	100
MANDATORY COURSES										
9.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	40	60	100
10.	20GE052	தமிழரும் தொழில்நுட்பமும் - Tamils and Technology (Common to All Branches)	MC	1	0	0	1	40	60	100
Total				**19**	**4**	**6**	**20**	**1000**		

SEMESTER - IV

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU411	Engineering Thermodynamics and Heat Transfer	PC	3	1	0	4	40	60	100
2.	20AU412	Automotive Engines	PC	3	0	0	3	40	60	100
3.	20AU413	Material Science and Metallurgy	PC	3	0	0	3	40	60	100
4.	20AU414	Mechanics of Machines	PC	3	1	0	4	40	60	100
5.	20AU415	Automotive Electrical Engineering	PC	3	0	0	3	40	60	100
6.	20AU416	Automotive Fuels and Lubricants	PC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU421	Automotive Fuels and Lubricants Laboratory	PC	0	0	3	1	60	40	100
8.	20AU422	Automotive Components Laboratory	PC	0	0	3	1	60	40	100
9.	20HR412	Career Development Skills – II	EEC	0	2	0	0	60	40	100
Total				**18**	**4**	**6**	**22**	**900**		

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**

Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common To All Branches)	HSMC	3	0	0	3	40	60	100
2.	20AU512	Automotive Transmission	PC	3	0	0	3	40	60	100
3.	20AU513	Design of Machine Elements	PC	3	1	0	4	40	60	100
4.	20AU514	Vehicle Body Engineering	PC	3	0	0	3	40	60	100
5.	20AU515	Automotive Electronics	PC	3	0	0	3	40	60	100
6.		Open Elective – I	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU521	Automotive Components Design and Modeling Laboratory	PC	0	0	3	1	60	40	100
8.	20AU522	Automotive Electrical and Electronics Laboratory	PC	0	0	3	1	60	40	100
9.	20HR513	Career Development Skills – III	EEC	0	2	0	0	60	40	100
Total				**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU611	Automotive Engine Components Design	PC	3	1	0	4	40	60	100
2.	20AU612	Automotive Pollution and Control	PC	3	0	0	3	40	60	100
3.	20AU613	Finite Element Analysis	PC	3	1	0	4	40	60	100
4.		Professional Elective – I	PEC	3	0	0	3	40	60	100
5.		Open Elective – II	OEC	3	0	0	3	40	60	100
6.		Open Elective – III	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU621	Vehicle Components Design and Analysis Laboratory	PC	0	0	3	1	60	40	100
8.	20AU622	Engine Performance and Emission Testing Laboratory	PC	0	0	3	1	60	40	100
9.	20HR614	Career Development Skills – IV	EEC	0	2	0	0	60	40	100
Total				**18**	**4**	**6**	**22**	**900**		

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Department	Department of Automobile Engineering	
Programme	B.E – Automobile Engineering	

SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU711	Vehicle Dynamics	PC	3	0	0	3	40	60	100
2.	20AU712	Electric and Hybrid Vehicles	PC	3	0	0	3	40	60	100
3.	20AU713	Vehicle Maintenance and Testing	PC	3	0	0	3	40	60	100
4.		Professional Elective – II	PEC	3	0	0	3	40	60	100
5.		Professional Elective – III	PEC	3	0	0	3	40	60	100
6.		Open Elective – IV	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU721	Vehicle Maintenance and Reconditioning Laboratory	PC	0	0	3	1	60	40	100
8.	20AU722	Industrial Training and Seminar	EEC	0	0	3	1	60	40	100
9.	20AU723	Project – I	EEC	0	0	6	3	60	40	100
Total				**18**	**0**	**12**	**23**	**900**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU811	Transport Management	PC	3	0	0	3	40	60	100
2.		Professional Elective – IV	PEC	3	0	0	3	40	60	100
3.		Professional Elective – V	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20AU821	Project – II	EEC	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

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Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

List of Electives

PROFESSIONAL ELECTIVE – I (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU661	Automotive Air-Conditioning	S1	PEC	3	0	0	3	40	60	100
2.	20AU662	Alternative Fuels and Energy Systems	S1	PEC	3	0	0	3	40	60	100
3.	20AU663	Autonomous Vehicle Technology	S2	PEC	3	0	0	3	40	60	100
4.	20AU664	Tyre Technology	S2	PEC	3	0	0	3	40	60	100
5.	20AU665	Automotive Aerodynamics	S3	PEC	3	0	0	3	40	60	100
6.	20AU666	Computational Fluid Dynamics	S3	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU761	Advanced Theory of I.C. Engines	S1	PEC	3	0	0	3	40	60	100
2.	20AU762	Automotive Vehicle Safety	S2	PEC	3	0	0	3	40	60	100
3.	20AU763	Two and Three Wheelers	S2	PEC	3	0	0	3	40	60	100
4.	20AU764	Design of Chassis Components	S3	PEC	3	0	0	3	40	60	100
5.	20AU765	Industrial Robotics and Expert Systems	S4	PEC	3	0	0	3	40	60	100
6.	20AU766	Battery Technology	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU767	Combustion Thermodynamics and Heat Transfer	S1	PEC	3	0	0	3	40	60	100
2.	20AU768	Vehicle Control Systems	S2	PEC	3	0	0	3	40	60	100
3.	20AU769	Intelligent Vehicles Technology	S2	PEC	3	0	0	3	40	60	100
4.	20AU771	Computer Simulation of IC Engine Processes	S3	PEC	3	0	0	3	40	60	100
5.	20AU772	Product Life Cycle Management	S4	PEC	3	0	0	3	40	60	100
6.	20AU773	Additive Manufacturing	S4	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VIII)											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU861	Fuel Cells and Applications	S2	PEC	3	0	0	3	40	60	100
2.	20AU862	Special Purpose Vehicles	S2	PEC	3	0	0	3	40	60	100
3.	20AU863	Design Thinking	S3	PEC	3	0	0	3	40	60	100
4.	20AU864	New Product Development	S4	PEC	3	0	0	3	40	60	100
5.	20AU865	Entrepreneurship Development	S5	PEC	3	0	0	3	40	60	100
6.	20AU866	Engineering Economics and Finance	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VIII)											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
2.	20AU868	Noise, Vibration and Harshness	S2	PEC	3	0	0	3	40	60	100
3.	20AU869	Vehicle Dealership Management	S5	PEC	3	0	0	3	40	60	100
4.	20AU871	Industry 4.0	S4	PEC	3	0	0	3	40	60	100
5.	20AU872	Production Planning and Control	S4	PEC	3	0	0	3	40	60	100
6.	20HS002	Total Quality Management (Common To All Branches)	S4	PEC	3	0	0	3	40	60	100

S1 –Thermal Engineering
S2 –Automobile Engineering
S3 – Design
S4 –Manufacturing Engineering
S5 – Management

B.E./B.TECH. HONOURS (SPECIALIZATION IN THE SAME DISCIPLINE) : VERTICALS

Emerging Areas: Automobile Engineering

(ii) B.E Honours (specialization in the same discipline)

a. The student should have earned additionally a minimum of 18 credits from a specified group of Professional Electives of the same programme.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(ii) B.E Honours

a. The students should have taken additional courses from more than one vertical of the same Programme and earned a minimum of 18 credits.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(iii) B.E. minor in other specialization.

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E programmes

- Out of these 18 credits students can earn a maximum of 6 credits in online mode (SWAYAM platform), as approved by Centre for Academic Courses.
- B.E./ B. Tech. (Hons) Specialization in the same discipline, B.E / B.Tech. Honors and B.E./B.Tech. Minor in other specialization degree will be optional for students.
- For the categories (i) to (ii), the students shall be permitted to register for the courses from the V Semester onwards provided the students has earned a minimum CGPA 7.50 of until III Semester and has cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted, to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses, which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

Registration of Professional Elective courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VIII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. The student should have earned additionally a minimum of 18 credits in any one of the verticals for obtaining B.E./B.Tech. Honours with specialization in the same disciplines.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

S. No.	Emerging Area 1 e-Management	Emerging Area 2 Electric Vehicle
9.	20AU663 Autonomous Vehicle Technology	20AU766 Battery Technology
10.	20AU762 Automotive Vehicle Safety	20AU861 Fuel Cells and Applications
11.	20AU768 Vehicle Control Systems	20AU867 IoT in Automobiles
12.	20AU867 IoT in Automobiles	20AU881 Electric Two and Three Wheeler
13.	20AU868 Noise, Vibration and Harshness	20AU882 Motors and Drivers
14.	20AU873 Reliability Engineering	20AU883 Electric Vehicle Dynamics
15.	20AU874 Predictive Maintenance	20AU884 Electric Vehicle Maintenance
16.	20AU875 Connected Cars and Advanced Driver Assistance System	20AU885 Operations Research

EMERGING AREA FOR HONOURS DEGREE SPECIALISATION											
EMERGING AREA 1 – e-MANAGEMENT											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
9.	20AU663	Autonomous Vehicle Technology	S2	PEC	3	0	0	3	40	60	100
10.	20AU762	Automotive Vehicle Safety	S2	PEC	3	0	0	3	40	60	100
11.	20AU768	Vehicle Control Systems	S2	PEC	3	0	0	3	40	60	100
12.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
13.	20AU868	Noise, Vibration and Harshness	S2	PEC	3	0	0	3	40	60	100
14.	20AU873	Reliability Engineering	S2	PEC	3	0	0	3	40	60	100
15.	20AU874	Predictive Maintenance	S2	PEC	3	0	0	3	40	60	100
16.	20AU875	Connected Cars and Advanced Driver Assistance System	S2	PEC	3	0	0	3	40	60	100

EMERGING AREA FOR HONOURS DEGREE SPECIALISATION											
EMERGING AREA 2 – ELECTRIC VEHICLE											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
9.	20AU766	Battery Technology	S2	PEC	3	0	0	3	40	60	100
10.	20AU861	Fuel Cells and Applications	S2	PEC	3	0	0	3	40	60	100
11.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
12.	20AU881	Electric Two and Three Wheeler	S2	PEC	3	0	0	3	40	60	100
13.	20AU882	Motors and Drivers	S2	PEC	3	0	0	3	40	60	100
14.	20AU883	Electric Vehicle Dynamics	S2	PEC	3	0	0	3	40	60	100
15.	20AU884	Electric Vehicle Maintenance	S2	PEC	3	0	0	3	40	60	100
16.	20AU885	Operations Research	S2	PEC	3	0	0	3	40	60	100

OPEN ELECTIVE COURSES

Open Elective courses offered by other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
CIVIL ENGINEERING											
1.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	40	60	100
2.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	40	60	100
3.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	40	60	100
4.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	40	60	100
5.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	40	60	100
6.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	40	60	100
7.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	40	60	100
8.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	40	60	100
9.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	40	60	100
10.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	40	60	100
Computer Science and Engineering											
11.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	40	60	100
12.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	40	60	100
13.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	40	60	100
14.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	40	60	100
15.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	40	60	100
16.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	40	60	100
17.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
18.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
19.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
20.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
Electronics and Communication Engineering											
21.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
22.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
23.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
24.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
25.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
26.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
27.	20EC907	Internet of Things Sensing and	EC	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
		Actuator Devices									
28.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100
Electrical and Electronics Engineering											
29.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
30.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
31.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
32.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
33.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
34.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
35.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
36.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
37.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
38.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
39.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
Information Technology											
40.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
41.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
42.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
43.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	40	60	100
44.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
45.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
46.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
47.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
48.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
49.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
Mechanical Engineering											
50.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
51.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
52.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
53.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
54.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
55.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100
56.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
57.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
58.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
59.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100
Safety and Fire Engineering											
60.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
61.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
62.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
63.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
64.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
65.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
66.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
67.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
68.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
69.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
Science and Humanities											
70.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
71.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
72.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
73.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
74.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
75.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

Open Elective courses offered by Automobile Engineering to other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	40	60	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	40	60	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	40	60	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	40	60	100

5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	40	60	100
6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	40	60	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	40	60	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	40	60	100

LIST OF VALUE ADDED COURSES

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1.	20AUV01	Automotive Styling	15	Internal / External
2.	20AUV02	Vehicle Service Management	15	Internal / External
3.	20AUV03	Accident and Insurance Survey	15	Internal / External
4.	20AUV04	Logistic Management	15	Internal / External
5.	20AUV05	Electronic Engine Management System	15	Internal / External
6.	20AUV06	Instrumentation and Control in Automobile Engineering	15	Internal/ External
7.	20AUV07	Tractor and Farm Equipment	15	Internal / External

COURSE COMPONENT SUMMARY

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	**HSMC**	3	3	-	-	3	-	-	-	9	5.56
2.	**BSC**	8	8	4	-	-	-	-	-	20	12.35
3.	**ESC**	5	11	-	-	-	-	-	-	16	9.87
4.	**MC**	-	1	1	-	-	-	-	-	02	1.23
5.	**PC**	-	-	15	22	15	13	10	3	78	48.15
6.	**PEC**	-	-	-	-	-	3	6	6	15	9.26
7.	**OEC**	-	-	-	-	3	6	3	-	12	7.41
8.	**EEC**	-	-	-	-	-	-	4	6	10	6.17
TOTAL		**16**	**23**	**20**	**22**	**21**	**22**	**23**	**15**	**162**	**100**

Total No. of Credits = 162

DEPARTMENT OF AUTOMOBILE ENGINEERING

B.E. AUTOMOBILE ENGINEERING

CURRICULUM

Regulation 2020

(Applicable to candidates admitted in the academic year 2023 - 2024)

K.S.R. College of Engineering (Autonomous)

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in **Website: www.ksrce.ac.in**

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**
Department	Department of Automobile Engineering	
Programme	B.E – Automobile Engineering	

Vision of the Institution

IV	We envision to achieve status as an excellent Educational Institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain mutually beneficial partnership with global industries and Institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	Education and research to meet the need of global automotive industry and society.

Mission of the Department

DM 1	Quality education through flexible curriculum, research and self-learning.
DM 2	Training via automotive industry for a sustainable society and social development.

Program Educational Objectives (PEOs)

The graduates of the programme will be able to	
PEO 1	**Core expertise:** Apply technical knowledge and competitive in automobile engineering field.
PEO 2	**Sustainable Solutions:** Impart inter-disciplinary skills and innovations for challenges that emerge in automobile sector.
PEO 3	**Ethical Proficiency**: Enhance knowledge with professional ethics, attitude, communication and leadership skills.

Program Outcomes (POs)	
PO1	**Engineering Graduates will be able to:** **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO1	**Professional competency:** Design and analyze automotive components, electrical and electronic systems.
PSO2	**Troubleshoot Skills:** Develop as a professional in automotive systems maintenance.

K.S.R. COLLEGE OF ENGINEERING (Autonomous): TIRUCHENGODE - 637 215

DEPARTMENT OF AUTOMOBILE ENGINEERING

(REGULATIONS 2020) (Amendments)

With reference to the Centre for academic courses, Anna University, letter no. 618/CAC/TC/2023 dated 01.03.2023 two tamil language courses **"தமிழர் மரபு - HERITAGE OF TAMILS" & "தமிழரும் தொழில்நுட்பமும் - TAMILS AND TECHNOLOGY"** are introduced in the regulation 2020 and offered to the student batch 2022 – 2026 admitted in the academic year 2022–2023 during the II Semester and III Semester respectively.

The same courses are followed for student batches admitted from the academic year 2023-2024 during the I Semester and II Semester respectively.

Course Code & Course Title	Core/Elective	Semester	Credits	Applicable to candidates admitted in the academic year
Heritage of Tamils & தமிழர் மரபு	Mandatory Course	II	1	2022 – 2023
Tamils and Technology & தமிழரும் தொழில்நுட்பமும்		III	1	
Heritage of Tamils & தமிழர் மரபு		I	1	2023- 2024
Tamils and Technology & தமிழரும் தொழில்நுட்பமும்		II	1	

KSR College of Engineering	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2020

Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN151	Technical English – I (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA151	Engineering Mathematics – I (Common to All Branches)	BSC	3	1	0	4	40	60	100
3.	20PH051	Engineering Physics (Common to All Branches)	BSC	3	0	0	3	40	60	100
4.	20ME144	Engineering Drawing (Common To AU, ME & SF)	ESC	1	2	0	3	40	60	100
PRACTICAL										
5.	20PH028	Physics Laboratory (Common to All Branches)	BSC	0	0	3	1	60	40	100
6.	20AU026	Computer Aided Drawing Laboratory (Common to AU & ME)	ESC	0	0	3	1	60	40	100
7.	20GE028	Manufacturing Practices Laboratory (Common to All Branches)	ESC	0	0	3	1	60	40	100
MANDATORY COURSES										
8.	20MC151	Induction Programming* (Common to All Branches)	MC	3	-	-	-	*	*	*
9.	20GE051	தமிழர் மரபு – Heritage of Tamils (Common to All Branches)	MC	1	0	0	1	40	60	100
Total				**13**	**3**	**10**	**17**	**800**		

*Induction programming will be conducted for three weeks as per AICTE guidelines

SEMESTER - II

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20EN251	Technical English–II (Common to All Branches)	HSMC	2	0	1	3	40	60	100
2.	20MA241	Engineering Mathematics– II (Common to AU,CE, ME & SF)	BSC	3	1	0	4	40	60	100
3.	20CH051	Engineering Chemistry (Common to All Branches)	BSC	3	0	0	3	40	60	100
4.	20CS241	Python Programming (Common to AU,CE,EC,EE,ME & SF)	ESC	3	0	0	3	40	60	100
5.	20EE041	Basics of Electrical and Electronics Engineering (Common to AU,CE,CS,CSD,IOT,IT,ME & SF)	ESC	3	0	0	3	40	60	100
6.	20AU231	Fundamentals of Engineering Mechanics (Common to AU & SF)	ESC	3	1	0	4	40	60	100
PRACTICAL										
7.	20CH028	Chemistry Laboratory (Common To All Branches)	BSC	0	0	3	1	60	40	100
8.	20CS227	Python Programming Laboratory (Common to AU,CE,EC,EE,ME & SF)	ESC	0	0	3	1	60	40	100
MANDATORY COURSE										
9.	20GE052	தமிழரும் தொழில்நுட்பமும் - Tamils and Technology (Common to All Branches)	MC	1	0	0	1	40	60	100
Total				**18**	**2**	**7**	**23**	**900**		

KSR College of Engineering	**K.S.R. COLLEGE OF ENGINEERING (Autonomous)** **(Approved by AICTE & Affiliated to Anna University)** **K.S.R. Kalvi Nagar, Tiruchengode - 637 215**	**CURRICULUM** **UG** **R - 2020**

Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20MA341	Statistics and Numerical Methods (Common to AU, ME & SF)	BSC	3	1	0	4	40	60	100
2.	20AU312	Fluid Mechanics and Hydraulic Machines	PC	3	0	0	3	40	60	100
3.	20AU313	Mechanics of Materials	PC	3	1	0	4	40	60	100
4.	20AU314	Automotive Manufacturing Technology	PC	3	0	0	3	40	60	100
5.	20AU315	Automotive Chassis	PC	3	0	0	3	40	60	100
PRACTICAL										
6.	20AU321	Fluid Mechanics and Mechanics of materials Laboratory	PC	0	0	3	1	60	40	100
7.	20AU322	Automotive Manufacturing Technology Laboratory	PC	0	0	3	1	60	40	100
8.	20HR351	Career Development Skills – I (Common to All Branches)	EEC	0	2	0	0	60	40	100
MANDATORY COURSES										
9.	20MC052	Environmental Science and Engineering (Common to All Branches)	MC	3	0	0	0	40	60	100
Total				**18**	**4**	**6**	**19**	**900**		

SEMESTER - IV

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU411	Engineering Thermodynamics and Heat Transfer	PC	3	1	0	4	40	60	100
2.	20AU412	Automotive Engines	PC	3	0	0	3	40	60	100
3.	20AU413	Material Science and Metallurgy	PC	3	0	0	3	40	60	100
4.	20AU414	Mechanics of Machines	PC	3	1	0	4	40	60	100
5.	20AU415	Automotive Electrical Engineering	PC	3	0	0	3	40	60	100
6.	20AU416	Automotive Fuels and Lubricants	PC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU421	Automotive Fuels and Lubricants Laboratory	PC	0	0	3	1	60	40	100
8.	20AU422	Automotive Components Laboratory	PC	0	0	3	1	60	40	100
9.	20HR412	Career Development Skills – II	EEC	0	2	0	0	60	40	100
Total				**18**	**4**	**6**	**22**	**900**		

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Department	Department of Automobile Engineering
Programme	B.E – Automobile Engineering

SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20HS051	Universal Human Values and Understanding Harmony (Common To All Branches)	HSMC	3	0	0	3	40	60	100
2.	20AU512	Automotive Transmission	PC	3	0	0	3	40	60	100
3.	20AU513	Design of Machine Elements	PC	3	1	0	4	40	60	100
4.	20AU514	Vehicle Body Engineering	PC	3	0	0	3	40	60	100
5.	20AU515	Automotive Electronics	PC	3	0	0	3	40	60	100
6.		Open Elective – I	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU521	Automotive Components Design and Modeling Laboratory	PC	0	0	3	1	60	40	100
8.	20AU522	Automotive Electrical and Electronics Laboratory	PC	0	0	3	1	60	40	100
9.	20HR513	Career Development Skills – III	EEC	0	2	0	0	60	40	100
Total				**18**	**3**	**6**	**21**	**900**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU611	Automotive Engine Components Design	PC	3	1	0	4	40	60	100
2.	20AU612	Automotive Pollution and Control	PC	3	0	0	3	40	60	100
3.	20AU613	Finite Element Analysis	PC	3	1	0	4	40	60	100
4.		Professional Elective – I	PEC	3	0	0	3	40	60	100
5.		Open Elective – II	OEC	3	0	0	3	40	60	100
6.		Open Elective – III	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU621	Vehicle Components Design and Analysis Laboratory	PC	0	0	3	1	60	40	100
8.	20AU622	Engine Performance and Emission Testing Laboratory	PC	0	0	3	1	60	40	100
9.	20HR614	Career Development Skills – IV	EEC	0	2	0	0	60	40	100
Total				**18**	**4**	**6**	**22**	**900**		

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Programme	B.E – Automobile Engineering	

SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU711	Vehicle Dynamics	PC	3	0	0	3	40	60	100
2.	20AU712	Electric and Hybrid Vehicles	PC	3	0	0	3	40	60	100
3.	20AU713	Vehicle Maintenance and Testing	PC	3	0	0	3	40	60	100
4.		Professional Elective – II	PEC	3	0	0	3	40	60	100
5.		Professional Elective – III	PEC	3	0	0	3	40	60	100
6.		Open Elective – IV	OEC	3	0	0	3	40	60	100
PRACTICAL										
7.	20AU721	Vehicle Maintenance and Reconditioning Laboratory	PC	0	0	3	1	60	40	100
8.	20AU722	Industrial Training and Seminar	EEC	0	0	3	1	60	40	100
9.	20AU723	Project – I	EEC	0	0	6	3	60	40	100
Total				**18**	**0**	**12**	**23**	**900**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	20AU811	Transport Management	PC	3	0	0	3	40	60	100
2.		Professional Elective – IV	PEC	3	0	0	3	40	60	100
3.		Professional Elective – V	PEC	3	0	0	3	40	60	100
PRACTICAL										
4.	20AU821	Project – II	EEC	0	0	12	6	60	40	100
			Total	**9**	**0**	**12**	**15**	**400**		

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Department	Department of Automobile Engineering	
Programme	B.E – Automobile Engineering	

List of Electives

PROFESSIONAL ELECTIVE – I (SEMESTER – VI)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU661	Automotive Air-Conditioning	S1	PEC	3	0	0	3	40	60	100
2.	20AU662	Alternative Fuels and Energy Systems	S1	PEC	3	0	0	3	40	60	100
3.	20AU663	Autonomous Vehicle Technology	S2	PEC	3	0	0	3	40	60	100
4.	20AU664	Tyre Technology	S2	PEC	3	0	0	3	40	60	100
5.	20AU665	Automotive Aerodynamics	S3	PEC	3	0	0	3	40	60	100
6.	20AU666	Computational Fluid Dynamics	S3	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU761	Advanced Theory of I.C. Engines	S1	PEC	3	0	0	3	40	60	100
2.	20AU762	Automotive Vehicle Safety	S2	PEC	3	0	0	3	40	60	100
3.	20AU763	Two and Three Wheelers	S2	PEC	3	0	0	3	40	60	100
4.	20AU764	Design of Chassis Components	S3	PEC	3	0	0	3	40	60	100
5.	20AU765	Industrial Robotics and Expert Systems	S4	PEC	3	0	0	3	40	60	100
6.	20AU766	Battery Technology	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – III (SEMESTER – VII)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU767	Combustion Thermodynamics and Heat Transfer	S1	PEC	3	0	0	3	40	60	100
2.	20AU768	Vehicle Control Systems	S2	PEC	3	0	0	3	40	60	100
3.	20AU769	Intelligent Vehicles Technology	S2	PEC	3	0	0	3	40	60	100
4.	20AU771	Computer Simulation of IC Engine Processes	S3	PEC	3	0	0	3	40	60	100
5.	20AU772	Product Life Cycle Management	S4	PEC	3	0	0	3	40	60	100
6.	20AU773	Additive Manufacturing	S4	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VIII)											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU861	Fuel Cells and Applications	S2	PEC	3	0	0	3	40	60	100
2.	20AU862	Special Purpose Vehicles	S2	PEC	3	0	0	3	40	60	100
3.	20AU863	Design Thinking	S3	PEC	3	0	0	3	40	60	100
4.	20AU864	New Product Development	S4	PEC	3	0	0	3	40	60	100
5.	20AU865	Entrepreneurship Development	S5	PEC	3	0	0	3	40	60	100
6.	20AU866	Engineering Economics and Finance	S5	PEC	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – V (SEMESTER – VIII)											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
2.	20AU868	Noise, Vibration and Harshness	S2	PEC	3	0	0	3	40	60	100
3.	20AU869	Vehicle Dealership Management	S5	PEC	3	0	0	3	40	60	100
4.	20AU871	Industry 4.0	S4	PEC	3	0	0	3	40	60	100
5.	20AU872	Production Planning and Control	S4	PEC	3	0	0	3	40	60	100
6.	20HS002	Total Quality Management (Common To All Branches)	S4	PEC	3	0	0	3	40	60	100

S1 –Thermal Engineering
S2 –Automobile Engineering
S3 – Design
S4 –Manufacturing Engineering
S5 – Management

B.E./B.TECH. HONOURS (SPECIALIZATION IN THE SAME DISCIPLINE) : VERTICALS

Emerging Areas: Automobile Engineering

(iii) B.E Honours (specialization in the same discipline)

a. The student should have earned additionally a minimum of 18 credits from a specified group of Professional Electives of the same programme.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(ii) B.E Honours

a. The students should have taken additional courses from more than one vertical of the same Programme and earned a minimum of 18 credits.
b. Should have passed all the courses in the first attempt.
c. Should have earned a minimum of 7.50 CGPA.

(iii) B.E. minor in other specialization.

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E programmes

- Out of these 18 credits students can earn a maximum of 6 credits in online mode (SWAYAM platform), as approved by Centre for Academic Courses.
- B.E./ B. Tech. (Hons) Specialization in the same discipline, B.E / B.Tech. Honors and B.E./B.Tech. Minor in other specialization degree will be optional for students.
- For the categories (i) to (ii), the students shall be permitted to register for the courses from the V Semester onwards provided the students has earned a minimum CGPA 7.50 of until III Semester and has cleared all the courses in the first attempt.
- For the category (iii), the students will be permitted, to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.
- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses, which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

Registration of Professional Elective courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VIII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. The student should have earned additionally a minimum of 18 credits in any one of the verticals for obtaining B.E./B.Tech. Honours with specialization in the same disciplines.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

S. No.	Emerging Area 1 e-Management	Emerging Area 2 Electric Vehicle
17.	20AU663 Autonomous Vehicle Technology	20AU766 Battery Technology
18.	20AU762 Automotive Vehicle Safety	20AU861 Fuel Cells and Applications
19.	20AU768 Vehicle Control Systems	20AU867 IoT in Automobiles
20.	20AU867 IoT in Automobiles	20AU881 Electric Two and Three Wheeler
21.	20AU868 Noise, Vibration and Harshness	20AU882 Motors and Drivers
22.	20AU873 Reliability Engineering	20AU883 Electric Vehicle Dynamics
23.	20AU874 Predictive Maintenance	20AU884 Electric Vehicle Maintenance
24.	20AU875 Connected Cars and Advanced Driver Assistance System	20AU885 Operations Research

EMERGING AREA FOR HONOURS DEGREE SPECIALISATION											
EMERGING AREA 1 – e-MANAGEMENT											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
17.	20AU663	Autonomous Vehicle Technology	S2	PEC	3	0	0	3	40	60	100
18.	20AU762	Automotive Vehicle Safety	S2	PEC	3	0	0	3	40	60	100
19.	20AU768	Vehicle Control Systems	S2	PEC	3	0	0	3	40	60	100
20.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
21.	20AU868	Noise, Vibration and Harshness	S2	PEC	3	0	0	3	40	60	100
22.	20AU873	Reliability Engineering	S2	PEC	3	0	0	3	40	60	100
23.	20AU874	Predictive Maintenance	S2	PEC	3	0	0	3	40	60	100
24.	20AU875	Connected Cars and Advanced Driver Assistance System	S2	PEC	3	0	0	3	40	60	100

EMERGING AREA FOR HONOURS DEGREE SPECIALISATION											
EMERGING AREA 2 – ELECTRIC VEHICLE											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
17.	20AU766	Battery Technology	S2	PEC	3	0	0	3	40	60	100
18.	20AU861	Fuel Cells and Applications	S2	PEC	3	0	0	3	40	60	100
19.	20AU867	IoT in Automobiles	S2	PEC	3	0	0	3	40	60	100
20.	20AU881	Electric Two and Three Wheeler	S2	PEC	3	0	0	3	40	60	100
21.	20AU882	Motors and Drivers	S2	PEC	3	0	0	3	40	60	100
22.	20AU883	Electric Vehicle Dynamics	S2	PEC	3	0	0	3	40	60	100
23.	20AU884	Electric Vehicle Maintenance	S2	PEC	3	0	0	3	40	60	100
24.	20AU885	Operations Research	S2	PEC	3	0	0	3	40	60	100

OPEN ELECTIVE COURSES

Open Elective courses offered by other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
CIVIL ENGINEERING											
1.	20CE901	Architectural Heritage of India	CE	OEC	3	0	0	3	40	60	100
2.	20CE902	Building Planning and Construction	CE	OEC	3	0	0	3	40	60	100
3.	20CE903	Elementary Civil Engineering	CE	OEC	3	0	0	3	40	60	100
4.	20CE904	Energy and Environment	CE	OEC	3	0	0	3	40	60	100
5.	20CE905	Environmental Laws and Policies	CE	OEC	3	0	0	3	40	60	100
6.	20CE906	Global Warming and Climate Change	CE	OEC	3	0	0	3	40	60	100
7.	20CE907	Introduction to Disaster Management and Mitigation	CE	OEC	3	0	0	3	40	60	100
8.	20CE908	Introduction to Earthquake Engineering	CE	OEC	3	0	0	3	40	60	100
9.	20CE909	Solid Waste Management	CE	OEC	3	0	0	3	40	60	100
10.	20CE910	Water and Air Pollution Management	CE	OEC	3	0	0	3	40	60	100
Computer Science and Engineering											
11.	20CS901	Programming in Java	CSE	OEC	3	0	0	3	40	60	100
12.	20CS902	Basic concepts of Data Structure	CSE	OEC	3	0	0	3	40	60	100
13.	20CS903	Fundamentals of Database Concepts	CSE	OEC	3	0	0	3	40	60	100
14.	20CS904	Internet Programming	CSE	OEC	3	0	0	3	40	60	100
15.	20CS905	Fundamentals of Mobile Application Development	CSE	OEC	3	0	0	3	40	60	100
16.	20CS906	Principles of Ethical Hacking	CSE	OEC	3	0	0	3	40	60	100
17.	20CS907	Green Technology	CSE	OEC	3	0	0	3	40	60	100
18.	20CS908	Artificial Intelligence and Robotics	CSE	OEC	3	0	0	3	40	60	100
19.	20CS909	Big Data and Analytics	CSE	OEC	3	0	0	0	40	60	100
20.	20CS910	Hardware and Trouble Shooting	CSE	OEC	3	0	0	3	40	60	100
Electronics and Communication Engineering											
21.	20EC901	Basics of Medical Electronics	EC	OEC	3	0	0	3	40	60	100
22.	20EC902	NANO Technology	EC	OEC	3	0	0	3	40	60	100
23.	20EC903	Electronics and Microprocessor	EC	OEC	3	0	0	3	40	60	100
24.	20EC904	Analog and Digital Communication	EC	OEC	3	0	0	3	40	60	100
25.	20EC905	Principles of Communication	EC	OEC	3	0	0	3	40	60	100
26.	20EC906	Fundamentals of Robotics	EC	OEC	3	0	0	3	40	60	100
27.	20EC907	Internet of Things Sensing and Actuator Devices	EC	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
28.	20EC908	Consumer Electronics	EC	OEC	3	0	0	3	40	60	100
Electrical and Electronics Engineering											
29.	20EE901	Electrical Drives and Control	EE	OEC	3	0	0	3	40	60	100
30.	20EE902	Power Semiconductor Devices	EE	OEC	3	0	0	3	40	60	100
31.	20EE903	Electrical Power Generation Systems	EE	OEC	3	0	0	3	40	60	100
32.	20EE904	Control Engineering	EE	OEC	3	0	0	3	40	60	100
33.	20EE905	Industrial Automation	EE	OEC	3	0	0	3	40	60	100
34.	20EE906	Electrical Instruments and Measurements	EE	OEC	3	0	0	3	40	60	100
35.	20EE907	Energy Conservation and Management	EE	OEC	3	0	0	3	40	60	100
36.	20EE908	Electrical Wiring, Estimation and Costing	EE	OEC	3	0	0	3	40	60	100
37.	20EE909	Fundamentals of Electrical Machinery	EE	OEC	3	0	0	3	40	60	100
38.	20EE910	Principles of Soft Computing Techniques	EE	OEC	3	0	0	3	40	60	100
39.	20EE911	Embedded System Technology	EE	OEC	3	0	0	3	40	60	100
Information Technology											
40.	20IT901	Data Science using R	IT	OEC	3	0	0	3	40	60	100
41.	20IT902	Principles of Cyber Security	IT	OEC	3	0	0	3	40	60	100
42.	20IT903	Fundamentals of Business Intelligence	IT	OEC	3	0	0	3	40	60	100
43.	20IT904	Block chain Technologies	IT	OEC	3	0	0	3	40	60	100
44.	20IT905	Internet of Things and Applications	IT	OEC	3	0	0	3	40	60	100
45.	20IT906	Principles of Software Testing	IT	OEC	3	0	0	3	40	60	100
46.	20IT907	Foundation Skills in Logic Building	IT	OEC	3	0	0	3	40	60	100
47.	20IT908	Principles of Cloud Computing	IT	OEC	3	0	0	3	40	60	100
48.	20IT909	Open Source Technologies	IT	OEC	3	0	0	3	40	60	100
49.	20IT910	Principles of Software Engineering	IT	OEC	3	0	0	3	40	60	100
Mechanical Engineering											
50.	20ME901	Basic Mechanical Engineering	ME	OEC	3	0	0	3	40	60	100
51.	20ME902	Solar Energy Utilization	ME	OEC	3	0	0	3	40	60	100
52.	20ME903	Production Technology of Agricultural Machinery	ME	OEC	3	0	0	3	40	60	100
53.	20ME904	Selection of Materials	ME	OEC	3	0	0	3	40	60	100
54.	20ME905	Marine Vehicles	ME	OEC	3	0	0	3	40	60	100
55.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
56.	20ME907	Energy Auditing	ME	OEC	3	0	0	3	40	60	100
57.	20ME908	Fiber Reinforced Plastics	ME	OEC	3	0	0	3	40	60	100
58.	20ME909	Lean Manufacturing	ME	OEC	3	0	0	3	40	60	100
59.	20ME910	Surface Engineering	ME	OEC	3	0	0	3	40	60	100
Safety and Fire Engineering											
60.	20SF901	Occupational Health and Hygiene	SF	OEC	3	0	0	3	40	60	100
61.	20SF902	Construction Safety	SF	OEC	3	0	0	3	40	60	100
62.	20SF903	Building Fire Safety	SF	OEC	3	0	0	3	40	60	100
63.	20SF904	Safety in Electrical Engineering	SF	OEC	3	0	0	3	40	60	100
64.	20SF905	Legal Aspects of Safety	SF	OEC	3	0	0	3	40	60	100
65.	20SF906	Safety in Industries	SF	OEC	3	0	0	3	40	60	100
66.	20SF907	Food Safety	SF	OEC	3	0	0	3	40	60	100
67.	20SF908	Safety Management and its Principles	SF	OEC	3	0	0	3	40	60	100
68.	20SF909	Safety in Automobile Engineering	SF	OEC	3	0	0	3	40	60	100
69.	20SF910	Safety in Transportation	SF	OEC	3	0	0	3	40	60	100
Science and Humanities											
70.	20SH901	Applications of Statistics	FYA	OEC	3	0	0	3	40	60	100
71.	20SH902	Combinatorics and Graph Theory	FYA	OEC	3	0	0	3	40	60	100
72.	20SH903	Optimization Techniques	FYA	OEC	3	0	0	3	40	60	100
73.	20SH904	Basic Military Education and Training	FYA	OEC	3	0	0	3	40	60	100
74.	20SH905	Professional Communication	FYA	OEC	3	0	0	3	40	60	100
75.	20SH906	Fundamentals of Nanoscience and Technology	FYA	OEC	3	0	0	3	40	60	100

Open Elective courses offered by Automobile Engineering to other branches

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	20AU901	Basics of Automobile Engineering	AE	OEC	3	0	0	3	40	60	100
2.	20AU902	Automotive Engine Technology	AE	OEC	3	0	0	3	40	60	100
3.	20AU903	Automotive Vehicle Technology	AE	OEC	3	0	0	3	40	60	100
4.	20AU904	Automotive Safety	AE	OEC	3	0	0	3	40	60	100
5.	20AU905	Hybrid Vehicles	AE	OEC	3	0	0	3	40	60	100

6.	20AU906	Off Highway Vehicles	AE	OEC	3	0	0	3	40	60	100
7.	20AU907	Modern and Intelligent Vehicle System	AE	OEC	3	0	0	3	40	60	100
8.	20AU908	Vehicle Maintenance	AE	OEC	3	0	0	3	40	60	100

LIST OF VALUE ADDED COURSES

Sl. No.	Course Code	Course Name	Number of Hours	Offered by Internal / External
1.	20AUV01	Automotive Styling	15	Internal / External
2.	20AUV02	Vehicle Service Management	15	Internal / External
3.	20AUV03	Accident and Insurance Survey	15	Internal / External
4.	20AUV04	Logistic Management	15	Internal / External
5.	20AUV05	Electronic Engine Management System	15	Internal / External
6.	20AUV06	Instrumentation and Control in Automobile Engineering	15	Internal/ External
7.	20AUV07	Tractor and Farm Equipment	15	Internal / External

COURSE COMPONENT SUMMARY

S. No.	Subject Area	Credits Per Semester								Credits Total	Percentage Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	**HSMC**	3	3	-	-	3	-	-	-	9	5.56
2.	**BSC**	8	8	4	-	-	-	-	-	20	12.35
3.	**ESC**	5	11	-	-	-	-	-	-	16	9.87
4.	**MC**	1	1	-	-	-	-	-	-	02	1.23
5.	**PC**	-	-	15	22	15	13	10	3	78	48.15
6.	**PEC**	-	-	-	-	-	3	6	6	15	9.26
7.	**OEC**	-	-	-	-	3	6	3	-	12	7.41
8.	**EEC**	-	-	-	-	-	-	4	6	10	6.17
TOTAL		**17**	**23**	**19**	**22**	**21**	**22**	**23**	**15**	**162**	**100**

Total No. of Credits = 162

DEPARTMENT OF AUTOMOBILE ENGINEERING

B.E. AUTOMOBILE ENGINEERING

SYLLABUS

Regulation 2020

K.S.R. College of Engineering (Autonomous)

(Approved by AICTE, Accredited by NAAC with A++ grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email: info@ksrce.ac.in **Website: www.ksrce.ac.in**

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20EN151	**TECHNICAL ENGLISH – I** (common to all branches)	2	0	1	3

Prerequisite: *-*

Course Objectives : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Comprehend and apply Grammar in context for professional communication*	*Understand*
CO2:	*Infer the gist and specific information.*	*Apply*
CO3:	*Discuss, express and interact in the society and place of study.*	*Create*
CO4:	*Critically interpret and comprehend a given text.*	*Evaluate*
CO5:	*Prioritize the listening skills for academic and professional purposes.*	*Apply*

UNIT - I **[09]**

Synonyms & Antonyms –- Use of Modal Auxiliaries – Infinitive and Gerund –-Parts of Speech -Intensive Reading – Predicting Content – Interpretation - Active Listening - Listening for the main idea - Need based Correspondence (request for joining hostel, bonafide certificate)-Self Introduction- Introducing others

UNIT - II **[09]**

British & American Terminology –- Tenses (Simple Present, Present Continuous, Present Perfect, Simple Past, and Simple Future) -Predicting Content - Drawing inferences - Listening for specific details - Listening to News – Job Application and Resume – Writing Instructions- Delivering Welcome Address

UNIT - III **[09]**

Standard Abbreviations and Acronyms -Preposition of Time, Place and Movement – Active Voice & Passive Voice – Consonant Sounds – Pronunciation guidelines related to Vowels and Consonant – Skimming & Scanning - Inference – Context Based Meaning – Recommendation Writing - Proposing Vote of Thanks.

UNIT - IV **[09]**

Vocabulary Building – Phrasal Verbs (Put, Give, Look, Take, Get, Call)- Impersonal passive -Newspaper Reading –- Note making – Listening to Dialogues – E Mail Etiquettes & E-mail Writing.- MoC – Anchoring – Role play in academic context

UNIT - V **[09]**

Homonyms - Concord (Subject & Verb Agreement)- Rearranging the jumbled sentences - Listening to Telephonic Conversation - Letter of Invitation (inviting, accepting and declining) – Paragraph writing - Letter to the Editor of a Newspaper – Drills using Minimal pairs – Presentation Skills.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Meenakshi Raman, Technical Communcation, Oxford University Press, New Delhi, First Edition, 2017

2 S.Sumant, Technical English – I, Vijay Nicole, Chennai, Second Edition, 2018

Reference Books :

1 Dr.P.Rathna, English Work Book – I, VRB Publishers Pvt. Ltd., Chennai, Second Edition,2018

2 Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, First Edition, 2016

3 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, First Edition, 2005

4 P.Kiranmani Dutt, A course in Communication Skills, Cambridge University Press, New Delhi, First Edition, 2014

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20EN151 **Course name : TECHNICAL ENGLISH I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Comprehend and apply Grammar in context for professional communication	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	Infer the gist and specific information.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3	Discuss, express and interact in the society and place of study.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	Critically interpret and comprehend a given text.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5	Prioritize the listening skills for academic and professional purposes.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
	Average	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**2**	**3**	**-**	**1**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20MA151	**ENGINEERING MATHEMATICS – I** (Common to All Branches)	3	1	0	4

Prerequisite: -

Course Outcomes : On *successful* completion of this course, the student will be able to **Cognitive Level**

CO1:	*Interpret the concepts of Matrix applications in the field of engineering.*	*Understand*
CO2:	*Acquire knowledge in solving ordinary differential equations.*	*Evaluate*
CO3:	*Extend and apply the concepts of differential calculus problems.*	*Apply*
CO4:	*Develop the skills in solving the functions of several variables.*	*Remember*
CO5:	*Applying the concepts and solving the Vector Calculus problems.*	*Apply*

UNIT– I LINEAR ALGEBRA [12]

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (Excluding proof) – Cayley Hamilton theorem (excluding proof) – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT – II ORDINARY DIFFERENTIAL EQUATIONS [12]

Linear differential equations of second and higher order with constant coefficients – Differential equations with variable coefficients – Cauchy's and Legendre's linear equations – Method of variation of parameters.

UNIT – III DIFFERENTIAL CALCULUS [12]

Curvature – Radius of curvature (Cartesian co-ordinates only) – Centre of curvature and Circle of curvature – Involutes and Evolutes.

UNIT – IV FUNCTIONS OF SEVERAL VARIABLES [12]

Partial derivatives – Total derivatives – Euler's theorem for homogenous functions – Taylor's series expansion – Maxima and Minima for functions of two variables – Method of Lagrangian multipliers.

UNIT – V VECTOR CALCULUS [12]

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Green's theorem in plane, Gauss divergence theorem and Stoke's theorem – Problems in Cube, Cuboid and Rectangular parallelopiped only.

Total (L: 45 T:15) = 60 Periods

Text Books :

1. Ravish R Singh and Mukul Bhatt, Engineering Mathematics – I, McGraw Hill Publications, Fourth Edition, New Delhi 2016.
2. Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, Forty Third Edition, New Delhi, 2015.

Reference Books :

1. Bali N. P and Manish Goyal, Textbook on Engineering Mathematics, Laxmi Publications (p) Ltd., Seventh Edition, 2016.
2. H.K. Dass, Advance Engineering Mathematics, S. Chand and company, Eleventh Edition, 2015.
3. Jain R.K. and Iyengar S.R.K., - Advanced Engineering Mathematics, Narosa Publicaitons, Eighth Edition, 2012.
4. Narayanan.S and Manicavachagom Pillai. T.K. – Calculas vol I and Vol II, S.chand & Co. Sixth Edition, 2014.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20MA151 **Course name : ENGINEERING MATHEMATICS – I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Interpret the concepts of Matrix applications in the field of engineering.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Acquire knowledge in solving ordinary differential equations.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Extend and apply the concepts of differential calculus problems.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Develop the skills in solving the functions of several variables.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Applying the concepts and solving the Vector Calculus problems.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

ENGINEERING PHYSICS

20PH051 (Common to All Branches)

L	T	P	C
3	0	0	3

Prerequisite: -

Course Outcomes : On *successful* completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Describe the impact of engineering solutions in the constructional and designing environment.*	*Remember*
CO2:	*Categorize the types of laser and utilize it for specific application based on their desirable requisite.*	*Analyze*
CO3:	*Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.*	*Apply*
CO4:	*Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems.*	*Apply*
CO5:	*Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications*	*Understand*

UNIT– I ACOUSTICS AND ULTRASONICS [09]

Acoustics–Introduction – Classification of sound – Characteristics of musical sound – Loudness – Weber – Fechner law – Decibel – Absorption coefficient – Reverberation – Reverberation time – Sabine's formula: growth and decay (derivation) – Factors affecting acoustics of buildings and their remedies. Ultrasonics – Production – piezoelectric method – Properties – Velocity measurement: acoustical grating –Engineering applications– SONAR.

UNIT – II LASER TECHNOLOGY [09]

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping – Einstein's A and B coefficients (derivation). Types of lasers – Nd-YAG, CO_2 and Semiconductor lasers (homo-junction and hetero-junction) – Qualitative Industrial Applications: Lasers in welding, heat treatment and cutting – Medical applications – Holography (construction and reconstruction of images).

UNIT – III CRYSTAL PHYSICS [09]

Introduction to crystalline and amorphous solids – lattice and unit cell – seven crystal system and Bravais lattices – Miller indices(hkl) –d-spacing in cubic lattice – atomic radius – coordination number – packing factor calculation for sc, bcc, fcc and hcp– crystal defects – point, line and surface defects.

UNIT – IV QUANTUM PHYSICS [09]

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect - Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box.

UNIT – V OPTOELECTRONIC DEVICES [09]

Photoconductive materials – Light Dependent Resistor (LDR) – Working – Applications – Photovoltaic materials – Solar cell – Construction, working and applications – Light Emitting Diode (LED) – Principle, construction and working - Liquid crystal Display (LCD) – Types and applications.

Total = 45 Periods

Text Books :

1. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, seventh Edition, 2014.
2. R.K.Gaur & S.L.Gupta, Engineering Physics, Dhanpat Rai Publication, New Delhi, seventh Edition, 2014.

Reference Books :

1. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, John Wiley & sons, USA, nineth Edition, 2011.
2. V. Rajendran, Engineering Physics, Tata McGraw Hill, New Delhi, first Edition, 2011.
3. R. A. Serway and J. W. Jewett, Physics for Scientists and Engineers with Modern Physics, nineth edition, Cengage Learning, USA, 2013.
4. Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, New Delhi, sixth Edition, 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20PH051 **Course name : ENGINEERING PHYSICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the impact of engineering solutions in the constructional and designing environment.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO2	Categorize the types of laser and utilize it for specific application based on their desirable requisite.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO3	Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO4	Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO5	Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
	Average	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20ME144	**ENGINEERING DRAWING** (Common to AU, ME & SF)	1	2	0	3

Prerequisite: *No Prerequisites are needed for enrolling into the course.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Gain knowledge on basic drafting convention and perform sketching of basic geometrical constructions and Orthographic projections of Engineering components.*	*Understanding*
CO2:	*Draw orthographic projection of points, lines and plane surfaces inclined to principle planes.*	*Creating*
CO3:	*Practicing projections of simple solids which are inclined to reference planes by change of position method.*	*Analyzing*
CO4:	*Construct sectional views and development of surfaces of simple and truncated solids.*	*Creating*
CO5:	*Prepare isometric views of simple solids and perspective projections of solids by visual ray method.*	*Applying*

UNIT - I PLANE CURVES AND ORTHOGRAPHIC PROJECTION [09]

Introduction on drafting instruments, BIS conventions and specifications, Lettering and Dimensioning-Conics-Construction of ellipse, parabola and hyperbola by eccentricity method -Construction of cycloid-Construction of involutes-Drawing of tangents and normal to the above curves. Representation of three dimensional objects-General principles of orthographic projection- First angle projection.

UNIT - II PROJECTION OF POINTS, LINES AND PLANE SURFACES [09]

Projection of points and straight lines located in the first quadrant -Determination of true lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to any one reference plane.

UNIT - III PROJECTION OF SOLIDS [09]

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT - IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES [09]

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other- Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids-Prisms, pyramids, cylinders and cones.

UNIT - V ISOMETRIC AND PERSPECTIVE PROJECTIONS [09]

Principles of isometric projection - isometric scale -isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method.

Total (L : 15 T : 30) = 45 Periods

Text Books :

1 Natarajan, K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2019.

2 Kumar, M.S., Engineering Graphics, D.D. Publications, 2019.

Reference Books :

1 Venugopal & Prabhu Raja, V., Engineering Graphics, New Age International (P) Limited, 2009.

2 Bhatt, N.D., Engineering Drawing, Charotar Publishing House, Fifty Third Edition, 2014.

3 Shah, B., and Rana, B.C., Engineering Drawing, Pearson Education, 2009.

4 Gopalakrishna, K.R., Engineering Drawing (Vol.I & II), Subhas Publications, 2010.

5 Basant Agarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, 2018.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20ME144 **Course name : ENGINEERING DRAWING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Gain knowledge on basic drafting convention and perform sketching of basic geometrical constructions and Orthographic projections of Engineering components.	3	3	2	-	1	-	-	-	-	-	-	2	-	-
CO2	Draw orthographic projection of points, lines and plane surfaces inclined to principle planes.	3	3	2	-	1	-	-	-	-	-	-	2	-	-
CO3	Practicing projections of simple solids which are inclined to reference planes by change of position method.	3	3	2	-	1	-	-	-	-	-	-	2	-	-
CO4	Construct sectional views and development of surfaces of simple and truncated solids.	3	2	2	-	1	-	-	-	-	-	-	2	-	-
CO5	Prepare isometric views of simple solids and perspective projections of solids by visual ray method.	3	2	2	-	1	-	-	-	-	-	-	2	-	-
	Average	3	3	2	-	1	-	-	-	-	-	-	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20MC151	**INDUCTION PROGRAMMING** (Common to All Branches)	0	0	0	0

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Involve in physical activity, creative arts and culture and feel comfortable in the new environment.*	*Understand*
CO2:	*Build relationship between teachers and students and make familiarizing with departments.*	*Understand*
CO3:	*Concentrate on literary activities.*	*Apply*
CO4:	*Develop the required skills through lectures and workshops.*	*Remember*
CO5:	*Acquire skills in extracurricular activities.*	*Analyze*

List of activities during the three weeks Students Induction Programme (SIP): **3 Weeks**

MODULE I : PHYSICAL ACTIVITY

- This would involve a daily routine of physical activity with games and sports. There would be games in the evening. These would help develop team work besides health.

MODULE II : CREATIVE ARTS & CULTURE

- Every student would choose one skill related to the arts whether visual arts or performing arts such as painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the program.
- These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would help in engineering design later.

MODULE III : MENTORING AND CONNECTING THE STUDENTS WITH FACULTY

- Mentoring takes place in the context and setting of Universal Human Values. It gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer and take decisions with courage, be aware of relationships and be sensitive to others.
- Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

MODULE IV: FAMILIRIZATION WITH COLLEGE/DEPARTMENTS & BRANCHES

- They should be shown their department, and told what it means to get into the branch or department. Describe what role the technology related to their department plays in society and after graduation what role the student would play in society as an engineer in that branch. A lecture by an alumnus of the Dept. would be very helpful in this regard. They should also be shown the laboratories, workshops and other facilities.

MODULE V: LITERARY ACTIVITIES

- Literary activity would encompass reading a book, writing a summary, debating, enacting a play etc.

MODULE VI: PROFICIENCY MODULES:

- The induction program period can be used to overcome some critical lacunas that students might have difficulties in communication skills. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially.

MODULE VII: LECTURES & WORKSHOPS

- Lectures by eminent people to be organized, say, once a week. It would give the students exposure to people who are eminent, in industry or engineering, in social service, or in public life. Alumni could be invited as well.
- Motivational lectures about life, meditation, etc. by Ramakrishna Mission, Art of Living, Vivekanand Kendras, S-VYASA, etc. may be organized. (3 sessions, 9 hours).

MODULE VIII: EXTRA CURRICULAR ACTIVITIES

- The new students should be introduced to the extra-curricular activities at the college.
- They should be shown the facilities and informed about activities related to different clubs etc. This is when selected senior students involved in or leading these activities can give presentations, under faculty supervision.

MODULE IX: FEED BACK & REPORT ON THE PROGRAMMES:

- Students should be asked to give their mid-program feedback. They should be asked to write their opinions about the program at the end of the first week.
- Finally, at the end of the program, each group (of 20 students) should be asked to prepare a single report on their experiences of the program. On the second last day, each group should present their report in front of other groups. Immediately after their presentation, they should submit their written report. This will also serve as a closure to the program.

  Finally, a formal written or online anonymous feedback should be collected at the end of the program.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20MC151 **Course name : INDUCTION PROGRAMMING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Involve in physical activity, creative arts and culture and feel comfortable in the new environment.	3	-	-	-	-	3	3	2	3	2	-	3	-	-
CO2	Build relationship between teachers and students and make familiarizing with departments.	3	-	-	-	-	3	3	3	1	3	-	3	-	-
CO3	Concentrate on literary activities.	3	-	-	-	-	2	3	3	3	3	-	3	-	-
CO4	Develop the required skills through lectures and workshops.	3	-	-	-	-	3	3	3	2	3	-	3	-	-
CO5	Acquire skills in extracurricular activities.	3	-	-	-	-	3	3	3	3	3	-	3	-	-
	Average	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**2**	**3**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20PH028	**PHYSICS LABORATORY** (Common to All Branches)	0	0	3	1

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Comprehend the different physical parameters of optics.*	*Analyze*
CO2:	*Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid*	*Remember*
CO3:	*Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.*	*Apply*
CO4:	*Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.*	*Understand*
CO5:	*Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.*	*Analyze*

List of Experiments:

1. Determination of wavelength of Laser using grating and the Size of the Particles.
2. Determination of thickness of the given material by Air – wedge method.
3. Determination of velocity of Ultrasonic waves and compressibility using Ultrasonic interferometer.
4. Spectrometer grating - Determination of wavelength of mercury spectrum.
5. Determination of thermal conductivity of a bad conductor by Lee's disc method.
6. Determination of Young's modulus of the material of a uniform bar by Non – Uniform bending method.
7. Determination of Band gap energy of a semiconductor.
8. Determination of Viscosity of a given liquid by Poiseuille's method.
9. Torsional pendulum - Determination of rigidity modulus of a given wire.
10. V-I Characteristics of Solar Cell.

Total = 30 Periods

Text Book :

1. Faculty Members of Physics, Physics Lab manual, Department of Physics, K.S.R. College of Engineering, Namakkal, seventeenth Edition, 2018.
2. Dr. P. Mani, Physics Lab Manual & Observation Book, Dhanam Publications, tweleth Edition, Chennai 2017.

Reference :

1. Dr. G. Senthilkumar, Physics Lab manual, VRB Publications Pvt. Ltd., Chennai, tenth Edition, 2006.
2. R Suresh & Dr. C. Kalyanasundaram, Physics Laboratory, Sri Krishna Hitech Publishing Company Pvt. Ltd., Chennai, fifth Edition, 2017.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20PH028 **Course name : PHYSICS LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Comprehend the different physical parameters of optics.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO2	Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO3	Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO4	Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO5	Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.	3	3	-	-	2	-	-	1	-	2	-	2	-	-
	Average	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20AU026	**COMPUTER AIDED DRAWING LABORATORY** (Common To AU & ME)	0	0	3	1

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate graphical skills like drafting and modeling using the software packages.*	*Remember*
CO2:	*Draw the engineering curves and title block with text and projection symbol.*	*Understand*
CO3:	*Create 2D models of engineering components and residential building, steel truss.*	*Understand*
CO4:	*Construct the sectional views and isometric projection of the solid objects.*	*Understand*
CO5:	*Create, render and manipulate 3D drawings and obtain 2D drawings from 3D drawing.*	*Understand*

List of Experiments:

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, in volute using B spine or cubic spine.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and dimensioning.
5. Drawing of front view, top view and side view of objects from the given pictorial views (e.g. V block, base of a mixie, simple stool, objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc.
9. Drawing isometric projection of simple objects.
10. Creation of 3D models of simple objects and obtaining 2D multi-view drawings from 3D model.

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20AU026 **Course name : COMPUTER AIDED DRAWING ABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate graphical skills like drafting and modeling using the software packages.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO2	Draw the engineering curves and title block with text and projection symbol.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO3	Create 2D models of engineering components and residential building, steel truss.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	Construct the sectional views and isometric projection of the solid objects.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO5	Create, render and manipulate 3D drawings and obtain 2D drawings from 3D drawing.	3	3	3	2	2	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

20GE028	**MANUFACTURING PRACTICES LABORATORY** (Common to All Branches)	L	T	P	C
		0	0	3	1

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Prepare green sand mould for simple patterns and carpentry components with simple joints.*	*Creating*
CO2:	*Perform welding practice to join simple structures.*	*Applying*
CO3:	*Practice simple operations in lathe and drilling machine.*	*Understanding*

GROUP A (CIVIL & MECHANICAL)

LIST OF EXPERIMENTS

1. Study of fitting, smithy, plastic moulding and glass cutting.
2. Prepare a mould using solid/split patterns in Foundry.
3. Make Lap joint / Butt joint / T joint from the given wooden pieces using carpentry tools.
4. Make a Butt joint / Lap joint / Tee joints using arc / gas welding equipment.
5. Perform simple Facing and Turning operation using Centre Lathe.
6. Make holes as per the given dimensions using drilling machine.

LIST OF EQUIPMENT

1. Fitting tools and its accessories	- 15 Sets
2. Smithy tools and Open hearth furnace setup	- 2 Sets
3. Foundry tools and its accessories	- 5 Sets
4. Carpentry tools and its accessories	- 15 Sets
5. Arc Welding equipments and its accessories	- 5 Sets
6. Oxy Acetylene welding setup and its accessories	- 1 Set
7. Centre Lathe with its accessories	- 2 Nos.
8. Pillar type drilling machine	- 1 No.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**: I**	**Regulation**	**:**	**R2020**	
Course code	**: 20GE028**	**Course name**	**:**	**MANUFACTURING PRACTICES LABORATORY GROUP A (CIVIL & MECHANICAL)**	

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	Prepare green sand mould for simple patterns and carpentry components with simple joints.	2	-	-	3	-	-	-	3	1	-	-	3	3	1
CO2	Perform welding practice to join simple structures.	2	-	-	3	-	-	-	3	1	-	-	3	3	1
CO3	Practice simple operations in lathe and drilling machine.	2	-	-	3	-	-	-	3	1	-	-	3	3	1
	Average	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**1**			**3**	**3**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – I

		L	T	P	C
20GE028	**GROUP B (ELECTRICAL & ELECTRONICS)** (Common to all Branches)	0	0	3	1

Prerequisite: -

Course Outcomes: On successful completion of this course , the student will be able to ***Cognitive level***

CO1:	*Construct different types of wiring used in house.*	*Understand*
CO2:	*Calibrate single phase Energy meter.*	*Understand*
CO3:	*Demonstrate different electronic components, logic gates and CRO.*	*Understand*

List of Experiments:

ELECTRICAL ENGINEERING

1. Fluorescent lamp wiring & Stair-case wiring.
2. Residential house wiring using switches, fuse, indicator, lamp and fan.
3. Calibration of Single phase Energy meter.

ELECTRONICS ENGINEERING

1. Study of Electronic components and Soldering practice.
2. Study of logic gates AND, OR, EX-OR, NOT, Half and Full Adder.
3. Study of CRO.

Total : 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**

Course code : 20GE028 **Course name : MANUFACTURING PRACTICES LABORATORY GROUP B (ELECTRICAL & ELECTRONICS)**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Construct different types of wiring used in house	3	2	3	-	-	-	-	1	1	-	-	3	-	-
CO2	Calibrate single phase Energy meter.	3	1	2	-	-	-	-	1	1	-	-	3	-	-
CO3	Demonstrate different electronic components, logic gates and CRO.	3	2	3	-	-	-	-	1	1	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20GE051	**HERITAGE OF TAMILS** (common to all branches)	1	0	0	1

Prerequisite(s): *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the extensive literature of Tamil and its classical nature.*	*Understand*
CO2:	*Apprehend the heritage of sculpture, painting and musical instruments of ancient people.*	*Understand*
CO3:	*Review on folk and martial arts of tamil people.*	*Understand*
CO4:	*Insight thinai concepts, trade and victory of Chozha dynasty.*	*Understand*
CO5:	*Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.*	*Understand*

UNIT - I LANGUAGE AND LITERATURE [03]

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT - II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE [03]

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT - III FOLK AND MARTIAL ARTS [03]

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT - IV THINAI CONCEPT OF TAMILS [03]

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT - V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE [03]

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1. Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
2. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)

Reference Books :

1. Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).
2. The Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (Puplished by International Institute of Tamil Studies).
3. Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology &Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
4. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20GE051 **Course name : HERITAGE OF TAMILS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the extensive literature of Tamil and its classical nature.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	Apprehend the heritage of sculpture, painting and musical instruments of ancient people.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	Review on folk and martial arts of tamil people.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	Insight thinai concepts, trade and victory of Chozha dynasty.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	Realize the contribution of Tamil in Indian freedom struggle, self-esteem movement and siddha medicine.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	-	-	-	-	-	-	**3**	**3**	**-**	**2**	**-**	**3**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

		L	T	P	C
20GE051	**தமிழர்மரபு** (**அனைத்து துறைகளுக்கும் பொதுவானது**)	1	0	0	1

முன்கூட்டிய துறைசார் அறிவு : தேவை இல்லை

பாடம் கற்றத்தின் விளைவுகள் :பாடத்தை வெற்றிகரகமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்		அறிவாற்றல் நிலை
CO1:	*தமிழ்மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்த தெரிதல்*	*புரிதல்*
CO2:	*தமிழர்களின் சிற்பக்கலை , ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு*	*புரிதல்*
CO3:	*தமிழர்களின் நாட்டுப் புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு*	*புரிதல்*
CO4:	*தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககாலவணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.*	*புரிதல்*
CO5:	*இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்தவம் பற்றிய புரிதல்.*	*புரிதல்*

அலகு – I மொழி மற்றும் இலக்கியம் **[03]**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலயக்கிகியங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ் காப்பியங்கள், தமிழகத்தில் சமணபௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலகியங்கள் தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு – II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை **[03]**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனியில் திருவள்ளுவர் சிலை – இசை கருவிகள் – மிருதங்கம், பறை. வீணை. யாழ். நாதஸ்வரம் – தமிழர்களின் சமூகபொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு – III நாட்டுப் புறக் கலைகள் மற்றும் வீர விளையாட்டுக்கள் **[03]**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவை**க்** கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு – IV தமிழர்களின் திணைக் கோட்பாடுகள் **[03]**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்கக்காலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு – V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு **[03]**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறபகுதிகளில் தமிழ் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு கல்வெட்டுகள் கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்கள்களின் அச்சு வரலாறு.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1 தமிழகவரலாறு-மக்களும்பண்பாடும்-கேகேபிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்) ,உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை, 2002

2 கணினித்தமிழ்முனைவர் இல. சுந்தரம், விகடன் பிரசுரம், 2016

Reference Books :

1 கீழடி-வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்.(தொல்லியல்துறைவெளியீடு)
2 பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
3 Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
4 Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

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DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : I **Regulation : R2020**
Course code : 20GE051 **Course name : தமிழர்மரபு**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*தமிழ் மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்ததெரிதல்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	*தமிழர்களின் சிற்பக்கலை , ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	*தமிழர்களின் நாட்டுப்புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	*தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள்.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	*இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்தவம் பற்றிய புரிதல்.*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

1. சிறிது (குறைந்த) 2. மிதமான (நடுத்தர) 3. கணிசமான (உயர்)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20EN251	**TECHNICAL ENGLISH – II** (common to all branches)	2	0	1	3

Prerequisite: -

Course Objectives : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.*	*Understand*
CO2:	*Identify and use Standard English in diverse situations.*	*Apply*
CO3:	*Interpret by reading a text and comprehend a given text.*	*Create*
CO4:	*Organize and compose business letters.*	*Evaluate*
CO5:	*Prioritize the listening skill for academic and personal development purposes.*	*Apply*

UNIT - I **[09]**

Technical Vocabulary – Changing words from one form to another - Articles – Compound Nouns - Introducing Oneself – Biased Listening- Critical reading - Need based Correspondence (In plant training & Industrial Visit) - Context based meaning - Writing short Essays.

UNIT - II **[09]**

Prefixes & Suffixes - Numerical Adjectives – If Conditionals – Making Requests – Seeking Information - Listening for main ideas –Intensive Reading - E-mail Writing– Describing Likes & Dislikes - Report Writing.

UNIT - III **[09]**

Types of Collocations - Framing Questions – 'Wh' Question – Yes / No Question –Cause and Effect Expression - Greetings and Introductions — Inviting People - Listening and Note taking - Critical reading- Making inference - Transcoding (Interpretation of Charts).

UNIT - IV **[09]**

Common English idioms and phrases - Expression of Purpose – Editing text for Spelling and Punctuation - Oral Presentation – Extensive Listening - Short Comprehension Passages - Business Correspondence – Calling for Quotations, Seeking Clarification, placing order and Complaint .

UNIT - V **[09]**

Confused and misused words - Discourse markers – Redundancies - Instructions – Describing – Listening to fill up forms and gapped texts - Reading Short texts from Journals and Newspapers - Telephone Etiquette - Check list – Essay Writing.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Dr.S.Sumant,Technical English II, Tata McGraw Hill, New Delhi, Second Edition, 2016

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2004.

Reference Books :

1 Michael Swan, Practical English Usage, Oxford University Press, New Delhi, First Edition, 2015.

2 Dept. of Humanities and social sciences, Anna University, Chennai, English for Engineers and Technologists, Orient Longman, First Edition, 2014

3 Hory Sankar Mukerjee, Business Communication, Oxford University Press, New Delhi, First Edition, 2013.

4 Department of English, English for Technologists and Engineers, Orient Black Swan, Chennai, First Edition, 2016

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DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20EN251 **Course name : TECHNICAL ENGLISH II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Infer and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO2	Identify and use Standard English in diverse situations.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO3	Interpret by reading a text and comprehend a given text.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO4	Organize and compose business letters.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
CO5	Prioritize the listening skill for academic and personal development purposes.	-	-	-	-	-	-	-	-	2	3	-	1	-	-
	Average	**-**	**-**	**-**	**-**	**-**		**-**	**-**	**2**	**3**	**-**	**1**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20MA241	**ENGINEERING MATHEMATICS – II** (COMMON TO AU, CE, ME & SF)	3	1	0	4

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On *successful* completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Apply the concepts of analytic functions, conformal mapping and bilinear transformations.*	*Remember*
CO2:	*Solve the of Complex Integration problems.*	*Understand*
CO3:	*Solve the Fourier series problems.*	*Understand*
CO4:	*Analyze the partial differential equations and its applications.*	*Remember*
CO5:	*Apply Laplace transform, Inverse Laplace transform in the Engineering fields.*	*Apply*

UNIT - I ANALYTIC FUNCTIONS [12]

Functions of a complex variable – Analytic functions – Necessary and sufficient conditions: Cauchy – Riemann Equation (excluding proof) – Harmonic functions – Construction of analytic functions (Milne Thomson method) – Conformal mapping: w = z+c, cz, 1/z and bilinear transformation.

UNIT - II COMPLEX INTEGRATION [12]

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Laurent's series expansion – Singular points – Residues – Cauchy's residue theorem – Evaluation of real and definite integrals on unit circle and semi – circular contour (excluding poles on boundaries).

UNIT - III FOURIER SERIES [12]

Dirichlet's conditions – General Fourier series - Odd and Even functions – Half range sine and cosine series – Harmonic analysis.

UNIT - IV PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS [12]

Formation of partial differential equations – Lagrange's linear equation - Solutions of one dimensional wave equation – Problems on vibrating string with zero and non - zero initial velocity – One dimensional heat equation – Problems of steady state condition with zero and non- zero boundary values.

UNIT - V LAPLACE TRANSFORMATION [12]

Laplace transforms – Conditions for existence – Transform of elementary functions – Basic properties– Transform of Derivatives – Initial and final value theorems (excluding proof). Transform of periodic functions. Inverse Laplace transforms (partial fraction method only) – Solution of linear ordinary differential equations of second order with constant coefficients.

Total (L: 45 T:15) = 60 Periods

Text Books :

1. Ravish R Singh and Mukul Bhatt, Engineering Mathematics - II, McGraw Hill Publications, New Delhi, Third Edition, 2016.
2. Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, Forty third Edition, New Delhi, 2015.

Reference Books :

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, New Delhi, Seventh Edition, 2016.
2. Bali N.P and Manish Goyal, Engineering Mathematics, Laxmi Pub, Chennai, Seventh edition, 2016
3. P. Anuradha and V. Sudhakar, Transforms and Partial Differential Equations, Scitech publication, chennai, Second edition, 2014.
4. Ian Sneddon, Elements of Partial Differential Equations, McGraw-Hill International Editions, New Delhi, Thirty Fifth edition, 2012.

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DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20MA241 **Course name : ENGINEERING MATHEMATICS – II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply the concepts of analytic functions, conformal mapping and bilinear transformations.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Solve the of Complex Integration problems.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Solve the Fourier series problems.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Analyze the partial differential equations and its applications.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Apply Laplace transform, Inverse Laplace transform in the Engineering fields.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CH051	**ENGINEERING CHEMISTRY** (Common To All Branches)	3	0	0	3

Prerequisite: *-*

	Course Outcomes : On successful completion of this course, the student will be able to	***Cognitive Level***
CO1:	*Make use of the manufacture, properties and uses of advanced engineering materials.*	*Understand*
CO2:	*Explain the concept of corrosion and its control.*	*Understand*
CO3:	*Use the concept of thermodynamics in engineering applications.*	*Understand*
CO4:	*Recall the periodic properties such as ionization energy, electron affinity and electro negativity.*	*Remember*
CO5:	*Analyze the usage of various spectroscopic techniques.*	*Understand*

UNIT – I ADVANCED ENGINEERING MATERIALS [09]

Abrasives – Moh's scale of hardness – types – natural [Diamond] – synthetic [SiC]; Refractories – characteristics – classifications [Acidic, basic and neutral refractories] – properties – refractoriness – RUL – porosity – thermal spalling; Lubricants – definition – function – characteristics – properties – viscosity index, flash and fire points, cloud and pour points, oiliness; Solid lubricants – graphite and MoS_2; Nano materials – CNT– synthesis [CVD, laser evaporation, pyrolysis] – applications – medicine, electronics, biomaterials and environment.

UNIT – II ELECTROCHEMISTRY AND CORROSION [09]

Introduction – electrode potential – Nernst equation – EMF series and its significance – types of cells (Electrolytic & electrochemical); Corrosion – causes, consequences – classification – chemical corrosion – electro chemical corrosion – mechanism; Galvanic & differential aeration corrosion – factors influencing corrosion – corrosion control – corrosion inhibitors.

UNIT – III CHEMICAL THERMODYNAMICS [09]

Terminology of thermodynamics – second law; Entropy – entropy change for an ideal gas – reversible and irreversible processes – entropy of phase transition – Clausius inequality; Free energy and work function – Helmholtz and Gibb's free energy functions – criteria of spontaneity; Gibb's – Helmholtz equation (Problems); Maxwell's relations – Van't Hoff isotherm and isochore.

UNIT– IV ATOMIC STRUCTURE AND CHEMICAL BONDING [09]

Effective nuclear charge – orbitals – variations of s, p, d and f orbital – electronic configurations – ionization energy – electron affinity and electro negativity; Types of bonding – ionic, covalent and coordination bonding – hydrogen bonding and its types; Crystal field theory – the energy level diagram for transition metal complexes ($[Fe(CN)_6]^{3-}$, $[Ni(CN)_4]^{2-}$ and $[CoCl_4]^{2-}$ only); Role of transition metal ions in biological system; Band theory of solids.

UNIT – V PHOTOCHEMISTRY AND SPECTROSCOPIC TECHNIQUES [09]

Laws of photochemistry – Grotthuss Draper law – Stark-Einstein law – Beer-Lambert law – phosphorescence – fluorescence and it's applications in medicine – chemiluminescence; Colorimetry – principle – instrumentation (block diagram only) – estimation of iron by colorimetry; principles of spectroscopy – selection rules – vibrational and rotational spectroscopy – applications; Flame photometry – principle – instrumentation (block diagram only) – estimation of sodium; Atomic absorption spectroscopy – principle – instrumentation (block diagram only) – estimation of nickel.

Total = 45 Periods

Text Books :

1. Dr. A. Ravikrishnan, Engineering Chemistry, Srikrishna Hi-tech Publishing Company Private Limited, Chennai, Seventeenth Edition, 2016.
2. P.C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing company, New Delhi, Seventeenth Edition, 2015.

Reference Books :

1. S S. Dara and S. S. Umare, A Text book of Engineering Chemistry, S. Chand & Company Limited, New Delhi, Fifth Edition, 2015.
2. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, PHI Learning Private Limited, New Delhi, Third Edition, 2014.
3. S. Vairam, P. Kalyani and Suba Ramesh, Engineering Chemistry, Wiley India Private Limited, New Delhi, First Edition, 2013.
4. B. Sivasankar, Engineering Chemistry, Tata McGraw – Hill Education Private Limited, New Delhi, First Edition, 2008.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20CH051 **Course name : ENGINEERING CHEMISTRY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Make use of the manufacture, properties and uses of advanced engineering materials.	3	3	2	-	-	-	2	-	-	-	-	1	-	-
CO2	Explain the concept of corrosion and its control.	3	3	2	-	-	-	3	-	-	-	-	2	-	-
CO3	Use the concept of thermodynamics in engineering applications.	3	3	2	-	-	-	2	-	-	-	-	2	-	-
CO4	Recall the periodic properties such as ionization energy, electron affinity and electro negativity.	3	3	2	-	-	-	2	-	-	-	-	1	-	-
CO5	Analyze the usage of various spectroscopic techniques.	3	3	2	-	-	-	3	-	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CS241	**PYTHON PROGRAMMING** (Common to AU, CE, EE, EC, ME & SF)	3	0	0	3

Prerequisite: *Basic knowledge of C programming.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate basic concepts of python programming.*	*Understand*
CO2:	*Apply the necessary data structures includes list, tuple and dictionary in the required fields.*	*Apply*
CO3:	*Analyze, design and implement the problems using OOPs technology*	*Analyze*
CO4:	*Demonstrate the simple file operations*	*Evaluate*
CO5:	*Design web site using GUI.*	*Create*

UNIT – I FUNDAMENTALS OF PYTHON [9]

Introduction to Python – Advantages of Python programming – Variables and Data types – Comments – I/O function – Operators – Selection control structures – Looping control structures – Functions: Declaration – Types of arguments – Anonymous functions: Lambda.

UNIT – II DATA STRUCTURES AND PACKAGES [9]

Strings – List – Tuples – Dictionaries – Sets – Exception Handling: Built-in Exceptions – User-defined exception– Modules and Packages.

UNIT – III OBJECT ORIENTED PROGRAMMING [9]

Object Oriented Programming basics – Inheritance and Polymorphism – Operator Overloading and Overriding – Get and Set Attribute Values – Name Mangling – Duck Typing – Relationships.

UNIT – IV FILES AND DATA BASES [9]

File I/O operations – Directory Operations – Reading and Writing in Structured Files: CSV and JSON – Data manipulation using Oracle, MySQL and SQLite.

UNIT – V GUI AND WEB [9]

UI design: Tkinter – Events – Socket Programming – Sending email – CGI: Introduction to CGI Programming, GET and POST Methods, File Upload.

Total = 45 Periods

Text Books :

1 Mark Lutz, “Learning Python”, O'Reilly Media, Fifth Edition, 2013

2 Wesley J.Chun, “Core Python Programming”, Pearson Education, Second Edition, 2017

References :

1 Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", O'Reilly Media, First Edition, 2014.

2 David Beazley, Brian K. Jones, "Python Cookbook", O'Reilly Media, Third Edition, 2013

3 Mark Lutz, “Python Pocket Reference”, O'Reilly Media, Fifth Edition, 2014

4 www.python.org and www.diveintopython3.net

5 To practice: www.codeacademy.com and https://codingbat.com/python

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20CS241 **Course name : PYTHON PROGRAMMING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate basic concepts of python programming.	3	3	2	2	1	-	-	-	1	-	-	1	-	-
CO2	Apply the necessary data structures includes list, tuple and dictionary in the required fields.	3	3	3	2	2	-	-	-	1	-	-	1	-	-
CO3	Analyze, design and implement the problems using OOPs technology	3	3	3	2	2	-	-	-	1	-	-	1	-	-
CO4	Demonstrate the simple file operations	3	3	3	3	2	-	-	-	1	-	-	1	-	-
CO5	Design web site using GUI.	3	3	3	3	2	-	-	-	1	-	-	1	-	-
	Average	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20EE041	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING** (Common To AU, CE, CS, IT, ME & SF)	3	0	0	3

Prerequisite: *Engineering Mathematics, Engineering Physics*

Course Outcomes : On successful completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Solve the electric circuits by applying basic circuital laws for various combinations of circuit elements.*	*Apply*
CO2:	*Explain the construction, operating principle and application of DC motor and transformers.*	*Understand*
CO3:	*Enlighten the construction, operating principle and application of AC motors and Special Machines.*	*Understand*
CO4:	*Illustrate the function of various measuring instruments.*	*Understand*
CO5:	*Discuss the characteristics of Diodes, BJT and Digital systems.*	*Understand*

UNIT – I ELECTRICAL CIRCUITS [09]

Structural of Electrical Power System – Ohm's Law – Kirchhoff's Laws – Circuit Analysis – Introduction to AC Circuits: R, RL & RLC series circuits, Average and RMS Value – Power and Power factor for single phase Circuits – Three Phase Star and Delta Connections – Electrical safety.

UNIT – II DC MOTOR AND TRANSFORMERS [09]

Faraday's Law – Lenz's Law – Fleming's left hand and right hand rule, DC Motor: Construction – Operation-series and shunt motor Characteristics Applications. Single Phase Transformer: Construction – Operation – EMF Equation – Types – Applications.

UNIT – III AC MOTORS & SPECIAL MACHINES [09]

Single Phase Induction Motor: Construction – Operation – Split Phase Induction Motor and Capacitor Start Induction Run Motor – Applications, Three Phase Induction Motor: Construction – Operation – Types – Applications. Special Machines: Stepper Motor.

UNIT– IV MEASURING INSTRUMENTS [09]

Basic Methods of Measurements: Direct and Indirect, Functional elements of an instrument – Errors in measurements – Analog and Digital Instruments – Basic Principle of Indicating Instruments – Moving Coil and Moving Iron Ammeter and Voltmeter. Dynamometer type Wattmeter – Induction type Energy Meter – Cathode Ray Oscilloscope.

UNIT – V ANALOG AND DIGITAL ELECTRONICS [09]

Semiconductor devices: PN Junction Diode, Zener diode: Operation and Characteristics – Bipolar Junction Transistor – CE Configurations and its Characteristics. Review of number systems – Digital logic gates – Introduction to Microprocessors.

Total = 45 Periods

Text Books :

1. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, PHI Learning Private Limited, New Delhi, Second Edition, 2007.
2. Jegathesan, V., VinothKumar, K., Saravanakumar, R., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, First Edition, 2012.

Reference Books :

1. Muthusubramanian, R., Salivahanan, S., and Muraleedharan, K.A., Basic Electrical, Electronics and Computer Engineering, Tata McGraw Hill, New Delhi, Second Edition, 2006.
2. Nagsarkar, T.K., and Sukhija M.S., Basics of Electrical Engineering, Oxford University press, New Delhi, Ninth Edition, 2005.
3. Mehta, V.K and Rohit Mehta, Principle of Electrical Engineering, S Chand & Company, New Delhi, Second Edition, 2008.
4. Mahmood Nahvi and Joseph A. Edminister, Electric Circuits, Schaum Outline Series, McGraw Hill, New Delhi, Fifth Edition, 2002.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**II**	**Regulation**	**:**	**R2020**
Course code	**:**	**20EE041**	**Course name**	**:**	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Solve the electric circuits by applying basic circuital laws for various combinations of circuit elements.	3	2	2	-	-	-	-	-	-	-	-	1	-	-
CO2	Explain the construction, operating principle and application of DC motor and transformers.	3	3	2	-	-	2	1	1	-	-	-	1	-	-
CO3	Enlighten the construction, operating principle and application of AC motors and Special Machines.	3	2	2	-	-	2	1	1	-	-	-	1	-	-
CO4	Illustrate the function of various measuring instruments.	3	3	2	-	-	2	1	1	-	-	-	1	-	-
CO5	Discuss the characteristics of Diodes, BJT and Digital systems.	3	3	2	-	-	2	1	1	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**2**	**1**	**1**		-	-	**1**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20AU231	**FUNDAMENTALS OF ENGINEERING MECHANICS** (Common To AU & SF)	3	1	0	4

Prerequisite: *-*

Course Outcomes : On successful completion of this course, the student will be able to ***Cognitive Level***

CO1: *Recall the fundamental knowledge on the laws of mechanics and identify the equilibrium conditions of particles to find the resultant force for the given system of forces.* *Understand*

CO2: *Analyze the various types of supports and their reactions to different loading conditions.* *Understand*

CO3: *Apply the parallel and perpendicular axis theorems to find out moment of inertia and polar moment of inertia of various sections.* *Apply*

CO4: *Analyze the relation motion, curvilinear motion, projectile motion, Newton's law, D'Alembert's principle and work energy equation.* *Understand*

CO5: *Recognize the concept of friction at the contact surfaces of various engineering systems.* *Understand*

UNIT – I BASICS AND STATICS OF PARTICLES [12]

Introduction – Units and dimensions – Laws of mechanics – Lami's theorem, parallelogram and triangular law of forces – Vectorial representation of forces – Vector operations of forces – additions, subtraction, dot product, cross product – Coplanar forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.

UNIT – II EQUILIBRIUM OF RIGID BODIES [12]

Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of rigid bodies in two dimensions – Equilibrium of rigid bodies in three dimensions.

UNIT – III PROPERTIES OF SURFACES AND SOLIDS [12]

Determination of areas and volumes – First moment of area and centroid of sections – simple and compound sections by using standard formula – second and product moments of plane area – simple and compound sections by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia.

UNIT– IV DYNAMICS OF PARTICLES [12]

Displacements, velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – D'Alembert's principle – Work energy equation – Impulse and momentum – Impact of elastic bodies.

UNIT – V FRICTION [12]

Friction force – Types of friction –Laws of Coulomb friction – Angle of repose – Simple contact friction –wedge friction, Screw friction, Rolling resistance, Ladder friction, Belt friction.

Total (L: 45 T:15) = 60 Periods

Text Books :

1 Beer, F.P and Johnston Jr. E.R., Vector Mechanics for Engineers (In SI Units): Statics and Dynamics, Tata McGraw-Hill Education, New Delhi, Eleventh Edition, 2017.

2 Vela Murali, Engineering Mechanics, Oxford University Press, New Delhi, First Edition 2010.

Reference Books :

1 Hibbeller. R.C and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, Pearson Education, New Delhi, Eleventh Edition, 2010.

2 Irving H. Shames and Krishna Mohana Rao. G., Engineering Mechanics – Statics and Dynamics, Pearson Education, New Delhi, Fourth Edition, 2005.

3 Rajasekaran S and Sankarasubramanian G., Engineering Mechanics Statics and Dynamics, Vikas Publishing House Pvt. Ltd., Chennai, Third Edition, 2005.

4 Kumar, K.L., Engineering Mechanics, Tata McGraw-Hill Education, New Delhi, Third Revised Edition, 2008.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**II**	**Regulation**	**:**	**R2020**
Course code	**:**	**20AU231**	**Course name**	**:**	**FUNDAMENTALS OF ENGINEERING MECHANICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recall the fundamental knowledge on the laws of mechanics and identify the equilibrium conditions of particles to find the resultant force for the given system of forces.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO2	Analyze the various types of supports and their reactions to different loading conditions.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO3	Apply the parallel and perpendicular axis theorems to find out moment of inertia and polar moment of inertia of various sections.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO4	Analyze the relation motion, curvilinear motion, projectile motion, Newton's law, D'Alembert's principle and work energy equation.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO5	Recognize the concept of friction at the contact surfaces of various engineering systems.	3	3	2	2	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CH028	**CHEMISTRY LABORATORY** (Common To All Branches)	0	0	3	1

Prerequisite: *NIL*

Course Outcomes: On successful completion of this course, the student will be able to		***Cognitive level***
CO1:	*Apply the principle of conductometric titration.*	*Understand*
CO2:	*Relate the role of pH in quantitative analysis of a solution.*	*Understand*
CO3:	*Perceive the knowledge of the concentration of Iron by electrochemical methods.*	*Understand*
CO4:	*Analyze the application of water in various fields.*	*Understand*
CO5:	*Recall the nature of corrosion process.*	*Remember*

LIST OF EXPERIMENTS:

1. Conductometric Titration – Strong Acid Vs. Strong Base.
2. Conductometric Titration – Mixture of Weak and Strong Acids Vs. Strong Base.
3. Conductometric Titration – Precipitation, $BaCl_2$ Vs. Na_2SO_4.
4. Estimation of Ferrous ion by Potentiometry – Fe^{2+} Vs $K_2Cr_2O_7$.
5. Estimation of Hydrochloric Acid by pH metry.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of hardness in water by EDTA method.
8. Estimation of chloride in water sample by Argentometry.
9. Estimation of dissolved oxygen (DO) in water by Winkler's method.
10. Determination of rate of corrosion of mild steel by weight loss method.

Total : 30 Periods

Text Book :

1 Department of Chemistry Staff members, Chemistry Laboratory Manual, K.S.R. College of Engineering, Tiruchengode, Fourth Edition, 2020.

2 I. Vogel, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & sons, Newyork, Eighth Edition, 2014.

Reference Books :

1 S. K. Bhasin and Sudha Rani, Laboratory Manual of Engineering Chemistry, Dhanpat Rai Publishing Company Private Limited, New Delhi, Third Edition, 2012.

2 I. Vogel and J. Mendham, Vogel's Textbook of Quantitative Chemical Analysis, Harlow, Prentice Hall, Sixth Edition, 2000.

3 G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denny, Vogel's Text book of quantitative analysis chemical analysis, Longman, Singapore publishers, Singapore, ELBS Fifth Edition, 1996.

4 B.S. Furniss, A.J, Hannaford, P.W.G. Smith and A.R. Tatchel, Vogels Textbook of practical organic chemistry, John Wiley & sons, Newyork, Fifth Edition, 1989.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20CH028 **Course name : CHEMISTRY LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply the principle of conductometric titration.	3	3	3	-	-	2	-	1	2	-	-	1	-	-
CO2	Relate the role of pH in quantitative analysis of a solution.	3	2	3	-	-	1	-	1	2	-	-	1	-	-
CO3	Perceive the knowledge of the concentration of Iron by electrochemical methods.	3	1	3	-	-	1	-	1	2	-	-	1	-	-
CO4	Analyze the application of water in various fields.	3	2	2	-	-	1	-	1	2	-	-	1	-	-
CO5	Recall the nature of corrosion process.	3	2	3	-	-	1	-	1	2	-	-	1	-	-
	Average	**3**	**2**	**3**	**-**	**-**	**1**	**-**	**1**	**2**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – II

		L	T	P	C
20CS227	**PYTHON PROGRAMMING LABORATORY** (Common to AU, CE, EE, EC, ME & SF)	0	0	3	1

Prerequisite: *Basic knowledge of C programming.*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Design simple programs using conditionals and loops.*	*Apply*
CO2:	*Write functions to solve mathematical problems.*	*Understand*
CO3:	*Demonstrate the use of files in python.*	*Analyze*
CO4:	*Develop simple applications using python.*	*Create*
CO5:	*Construct GUI applications using python programming.*	*Create*

List of Experiments

1. Write a program to display the largest number among three numbers.
2. Write a program to check the prime number and to display the twin prime numbers.
3. Write a program to display the Fibonacci series and multiplication table by using looping constructs.
4. Write a program for converting decimal to octal, hexadecimals and vice versa by using functions.
5. Write a function to compute the GCD of two numbers.
6. Write a function to perform sorting list of numbers.
7. With the help of string array or list, display a simple calendar in python program without using the calendar module.
8. Demonstrate class and inheritance in python.
9. Create a text file using python file I/O. Read the content of the file and change them from lower to upper case characters. Write the updated content in another file and display it.
10. Write a program to demonstrate the user-defined exception handling mechanism in Python.
11. Design and implement a graphical user interface to perform any arithmetic operation.
12. Write a python program to insert and retrieve data using MySQL.

Total : 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20CS227 **Course name : PYTHON PROGRAMMING LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Design simple programs using conditionals and loops.	2	3	3	2	2	-	-	-	1	-	-	1	-	-
CO2	Write functions to solve mathematical problems.	3	3	3	2	2	-	-	-	1	-	-	1	-	-
CO3	Demonstrate the use of files in python.	3	3	3	2	2	-	-	-	1	-	-	1	-	-
CO4	Develop simple applications using python.	3	3	3	1	3	-	-	-	1	-	-	1	-	-
CO5	Construct GUI applications using python programming.	3	3	3	1	3	-	-	-	1	-	-	1	-	-
	Average	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20GE052	**TAMILS AND TECHNOLOGY** (Common to All Branches)	1	0	0	1

Prerequisite(s): *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the weaving and ceramic technology of ancient Tamil People nature.*	*Understand*
CO2:	*Comprehend the construction technology, building materials in sangam Period and case studies.*	*Understand*
CO3:	*Infer the metal process, coin and beads manufacturing with relevant archeological evidence*	*Understand*
CO4:	*Realize the agriculture methods, irrigation technology and pearl diving.*	*Understand*
CO5:	*Apply the knowledge of scientific Tamil and Tamil computing.*	*Apply*

UNIT - I WEAVING AND CERAMIC TECHNOLOGY [03]

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT - II DESIGN AND CONSTRUCTION TECHNOLOGY [03]

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) – ThirumalaiNayakar Mahal – Chetti Nadu Houses, Indo –Saracenic architecture at Madras during British Period.

UNIT - III MANUFACTURING TECHNOLOGY [03]

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads –Terracotta beads –Shell beads / bone beats – Archeological evidences – Gem stone types described in Silappathikaram.

UNIT - IV AGRICULTURE AND IRRIGATION TECHNOLOGY [03]

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.

UNIT - V SCIENTIFIC TAMIL & TAMIL COMPUTING [03]

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1 Social Life of Tamils (Dr.K.K.Pillay) A joint Publication of TNTB & ESC and RMRL – (in print)
2 Social Life of the Tamils – The Classical Period (Dr.S.Sigaravelu) (Published by: International Institute of Tamil Studies).

Reference Books :

1 Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukarasu) (Published by : International Institute of Tamil Studies)
2 The Contribution of the Tamils to Indian Culture (Dr.M.Valarmathi)(Puplished by International Institute of Tamil Studies).
3 Keeladi – 'Sangam City Civilzation on the banks of river Vaigai; (Jointly Published by: Department of Archaeology &Tamilnadu Text Book and Educational Services Corporation, Tamilnadu)
4 Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by : The Author)

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20GE052 **Course name : TAMILS AND TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the weaving and ceramic technology of ancient Tamil People nature.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	Comprehend the construction technology, building materials in sangam Period and case studies.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	Infer the metal process, coin and beads manufacturing with relevant archeological evidence	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	Realize the agriculture methods, irrigation technology and pearl diving.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	Apply the knowledge of scientific Tamil and Tamil computing.	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - II

		L	T	P	C
20GE052	**தமிழரும் தொழில் நுட்பமும்** (**அனைத்து துறைகளுக்கும் பொதுவானது**)	1	0	0	1

முன் கூட்டிய துறைசார் அறிவு : தேவை இல்லை

	பாடம் கற்றத்தின் விளைவுகள் : பாடத்தை வெற்றிகரகமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள்	அறிவாற்றல் நிலை
CO1:	*சங்ககாலத் தமிழிர்களின் நெசவு மற்றும் பானைவனைதல் தொழில் நுட்பம் குறித்து கற்றுணர்தல்*	*புரிதல்*
CO2:	*சங்ககாலத் தமிழிர்களின் கட்டிட தொழில் நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளகும் தளங்கள் குறித்து அறிவு*	*புரிதல்*
CO3:	*சங்ககாலத் தமிழிர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு*	*புரிதல்*
CO4:	*சங்ககாலத் தமிழிர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு*	*புரிதல்*
CO5:	*நவீன அறிவியல் தமிழ் மற்றும் கன்னி தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்தலும்*	*பகுப்பாய்வு*

அலகு – I நெசவு மற்றும் பானைத் தொழில்நுட்பம் **[03]**

சங்ககாலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் கருப்பு சிவப்பு பாண்டங்கள்–பாண்டகளில் கீறல் குறியீடுகள்

அலகு – II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் **[03]**

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும்–சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்–மாமல்லபுரச் சிற்பங்களும், கோவில்களும்–சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள்–நாயக்கர் காலக்கோயில்கள்–மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன்ஆலயம் மற்றும் திருமலைநாயக்கர்மஹால் – செட்டிநாட்டுவீடுகள்–பிரிட்டிஷ்காலத்தில் சென்னை இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு – III உற்பத்தித் தொழில்நுட்பம் **[03]**

கப்பல் கட்டும் கலை–உலோகவியல்–இரும்புத்தொழிற்சாலை–இரும்பை உருக்குதல், எஃகு–வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள்–நாணயங்கள் அச்சடித்தல்–மணி உருவாக்கும் தொழிற்சாலைகள்–கல் மணிகள்–கண்ணாடி மணிகள்–சுடு மண்மணிகள்–சங்குமணிகள்–எலும்புத்துண்டுகள்–தொல்லியல் சான்றுகள்–சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு – IV வேளாண்மை மற்றும் நீர்ப் பாசனத் தொழில்நுட்பம் **[03]**

அணை,ஏரி,குளங்கள்,மதகு–சோழர்காலகுமிழித்தூம்பின் முக்கியத்துவம்–கால்நடை பராமரிப்பு–கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்–வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள்–கடல்சார் அறிவு – மீன் வளம்–முத்து மற்றும் முத்துக் குளித்தல்–பெருங்கடல் குறித்த பண்டைய அறிவு–அறிவுசார் சமூகம்.

அலகு – V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் **[03]**

அறிவியல் தமிழின் வளர்ச்சி– கணினித்தமிழ் வளர்ச்சி–தமிழ் நூல்களை மின்பதிப்பு செய்தல்–தமிழ் மென் பொருட்கள் உருவாக்கம்–தமிழ் இணையக்கல்விக் கழகம்–தமிழ் மின்நூலகம்–இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்.

Total (L= 15, T = 0) = 15 Periods

Text Books :

1 தமிழகவரலாறு- மக்களும் பண்பாடும்- கேகேபிள்ளை (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியில் பணிகள் கழகம்)

2 கணினித்தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

Reference Books :

1 கீழடி- வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம்.(தொல்லியல் துறை வெளியீடு)

2 பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

3 Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by : The Author)

4 Porunai Civilization (Jointly Published by: Department of Archaeology &Tamilnadu Textbook and Educational Services Corporation, Tamilnadu)

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : II **Regulation : R2020**
Course code : 20GE052 **Course name : தமிழரும் தொழில் நுட்பமும்**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*சங்ககாலத் தமிழிர்களின் நெசவு மற்றும் பானைவனைதல் தொழில்நுட்பம் குறித்து கற்றுணர்தல்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	*சங்ககாலத் தமிழிர்களின் கட்டிட தொழில்நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளகும் தளங்கள் குறித்து அறிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	*சங்ககாலத் தமிழிர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	*சங்ககாலத் தமிழிர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	*நவீன அறிவியல் தமிழ் மற்றும் கன்னி தமிழ் குறித்த புரிந்து கொள்ளலும் மற்றும் பயன்படுத்தலும்*	-	-	-	-	-	-	3	3	-	2	-	3	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**3**	**-**	**-**

1. சிறிது (குறைந்த) 2. மிதமான (நடுத்தர) 3. கணிசமான (உயர்)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20MA341	**STATISTICS AND NUMERICAL METHODS** (COMMON TO B.E. AU, ME & SF)	3	1	0	4

Prerequisite: -

Course Outcomes : On *successful* completion of this course, the student will be able to		**Cognitive Level**
CO1:	Develop their skills in testing the samples by using various testing of hypothesis methods.	*Remember*
CO2:	Analyze and infer the data using design of experiments.	*Apply*
CO3:	Apply the numerical techniques for solving algebraic, transcendental and simultaneous equations.	*Apply*
CO4:	Evaluate the functions by using the concepts of numerical differentiation and integration.	*Evaluate*
CO5:	Solve the ordinary differential equations with initial conditions numerically.	*Understand*

UNIT – I TESTING HYPOTHESIS [12]

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-Square- test – Independence of attributes.

UNIT – II DESIGN OF EXPERIMENTS [12]

One way and two way classifications - Completely Randomized Design - Randomized Block Design - Latin Square Design.

UNIT – III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS [12]

Solution to algebraic and transcendental equations - Newton-Raphson method, Regula-falsi method - Solutions to simultaneous linear equations - Gauss Elimination method - Gauss-Seidel method - Eigen value of a matrix by Power method.

UNIT – IV NUMERICAL DIFFERENTIATION AND INTEGRATION [12]

Numerical differentiation using Newton's forward and backward interpolation methods - Numerical integration by Trapezoidal and Simpson's 1/3rd rule - Double integrals using trapezoidal rule and Simpson's rule.

UNIT – V INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS [12]

Solving first order Ordinary Differential Equations - Euler's and Modified Euler's Method - Fourth order Runge-Kutta Method - Milne's predictor and corrector method - Finite difference solution of second order ordinary differential equation.

Total (L: 45 T:15) = 60 Periods

Text Book :

1 Grewal. B.S. and Grewal. J.S., Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi, Tenth Edition, 2015.

2 S.P. Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi, Fortyth edition, 2014

Reference Books :

1 Burden, R.L and Faires, J.D, Numerical Analysis, Cengage Learning,New Delhi, Nineth Edition, 2016.

2 Devore. J.L., Probability and Statistics for Engineering and the Sciences, Cengage Learning, New Delhi, Eighth Edition, 2016.

3 P. Kandasamy, K. Thilagavathy, K. Gunavathy Numerical Methods, S. Chand Company, New Delhi, Fifth edition, 2016.

4 S.R.K. Iyengar, R.K.Jain,Numerical Methods, New Age International Publishers,New Delhi, First edition, 2015.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : III **Regulation : R2020**
Course code : 20MA341 **Course name : STATISTICS AND NUMERICAL METHODS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Develop their skills in testing the samples by using various testing of hypothesis methods	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Analyze and infer the data using design of experiments.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Apply the numerical techniques for solving algebraic, transcendental and simultaneous equations.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Evaluate the functions by using the concepts of numerical differentiation and integration.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Solve the ordinary differential equations with initial conditions numerically.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – III

20AU312	FLUID MECHANICS AND HYDRAULIC MACHINES	L	T	P	C
		3	0	0	3

Prerequisite: *-*

Course Outcomes : On successful completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Apply mathematical knowledge to predict the properties and flow characteristics of a fluid.*	*Apply*
CO2:	*Analyze the boundary layer concepts and major and minor losses associated with pipe flow.*	*Apply*
CO3:	*Interpret the results of dimensional and model analysis.*	*Understand*
CO4:	*Illustrate the operation and performance of various hydraulic turbines.*	*Understand*
CO5:	*Evaluate the performance and operation of hydraulic pumps.*	*Understand*

UNIT – I FLUID PROPERTIES AND FLOW CHARACTERISTICS [09]

Classification of fluids – Fluid properties – Pressure Measurements – Flow characteristics – Concept of control volume and system – Continuity equation, energy equation and momentum equation – Applications.

UNIT – II FLOW THROUGH PIPES [09]

Laminar flow through the circular pipes – Darcy Weisbach equation – Friction factor – Moody diagram – Minor losses – Hydraulic and energy gradient – Flow through pipes in series and parallel – Boundary layer concepts – Types of boundary layer thickness.

UNIT – III DIMENSIONAL AND MODEL ANALYSIS [09]

Dimensional analysis: Dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models.

UNIT– IV HYDRAULIC TURBINES [09]

Impact of jets – Velocity triangles – Theory of roto-dynamics machines – Classification of turbines – Pelton wheel, Francis turbine and Kaplan turbine – Working principles – Work done by water on the runner – Efficiencies – Draft tube – Specific speed – Performance curves for turbines – Governing of turbines.

UNIT – V HYDRAULIC PUMPS [09]

Classification of pumps – Centrifugal pumps – Working principle – Heads and efficiencies – Velocity triangles – Work done by the impeller – Performance curves – Reciprocating pump – Working principle – Indicator diagrams – Work saved by air vessels. Rotary pumps – Classification. Working principle.

Total = 45 Periods

Text Books :

1. Bansal R.K, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, Tenth Edition, 2018.
2. Rajput R.K, A Textbook of Fluid Mechanics and Hydraulic Machines, S.Chand & Company Ltd., New Delhi, Sixth Edition, 2016.

Reference Books :

1. Modi.P.N. and Seth.S.M, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, Twenty-first Edition, 2017.
2. Kumar. K.L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., New Delhi, Seventh Edition, 2016.
3. V.L. Streeter and Wylie E.B., Fluid Mechanics, Tata McGraw-Hill Education, New Delhi, Ninth Edition, 2017.
4. Rathakrishnan. E, Fluid Mechanics: An Introduction, Prentice Hall India Learning Private Limited, New Delhi, Third Edition, 2007.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : III **Regulation : R2020**

Course code : 20AU312 **Course name : FLUID MECHANICS AND HYDRAULIC MACHINES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply mathematical knowledge to predict the properties and flow characteristics of a fluid.	3	3	2	-	-	-	-	-	-	-	-	2	3	-
CO2	Analyze the boundary layer concepts and major and minor losses associated with pipe flow.	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO3	Interpret the results of dimensional and model analysis.	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO4	Illustrate the operation and performance of various hydraulic turbines.	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO5	Evaluate the performance and operation of hydraulic pumps.	3	3	2	-	-	-	-	-	-	-	-	2	2	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – III

		L	T	P	C
20AU313	**MECHANICS OF MATERIALS**	3	1	0	4

Prerequisite: *Fundamentals of Engineering Mechanics*

Course Outcomes : On successful completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.*	*Understand*
CO2:	*Identify the load transmitting mechanism in beams and stress distribution due to shearing force and bending moment.*	*Apply*
CO3:	*Analyze the slope and deflection in beams and columns using different methods.*	*Analyze*
CO4:	*Apply basic equation of simple torsion in designing of shafts and springs.*	*Apply*
CO5:	*Design and analyze thin and thick shells for the applied internal and external pressures.*	*Apply*

UNIT – I STRESS STRAIN DEFORMATION OF SOLIDS [12]

Mechanical properties of metals – Rigid and deformable bodies – Strength, stiffness and stability – Stresses; Tensile, compressive and shear – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads – Deformation of simple and compound bars under axial load – Thermal stress and strain.

UNIT – II BEAMS – LOADS AND STRESSES [12]

Types of beams: Supports and loads – Shear force and bending moment in beams – Cantilever, simply supported and overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Shear stresses in beams.

UNIT – III BEAM DEFLECTION AND COLUMNS [12]

Elastic curve of neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay method, and Moment-area method – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns.

UNIT– IV TORSION – SHAFT AND SPRINGS [12]

Analysis of torsion of circular bars – Shear stress distribution – Bars of solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads.

UNIT – V ANALYSIS OF STRESSES IN TWO DIMENSIONS [12]

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress – Strain energy in bending and torsion.

Total (L: 45 T:15) = 60 Periods

Text Books :

1 Bansal R.K., A Textbook of Strength of Materials, Laxmi Publications (P) ltd, New Delhi, Sixth Edition, 2018.

2 Rajput R.K, Strength of materials (Mechanics of Solids) SI Units , S.Chand & Company Ltd, New Delhi, Seventh Edition, 2018.

Reference Books :

1 Beer F. P. and Johnston E, Mechanics of Materials, Tata McGraw-Hill Education, New Delhi, Seventh Edition, 2014.

2 Popov E.P, Engineering Mechanics of Solids, Prentice-Hall of India, New Delhi, Second Edition, 2012.

3 Subramanian R, Strength of Materials, Oxford University Press, New Delhi, Third Edition, 2016.

4 Hibbeler, R.C, Mechanics of Materials, Pearson Education, New Delhi, Ninth Edition, 2018.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : III **Regulation : R2020**
Course code : 20AU313 **Course name : MECHANICS OF MATERIALS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO2	Identify the load transmitting mechanism in beams and stress distribution due to shearing force and bending moment.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO3	Analyze the slope and deflection in beams and columns using different methods.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO4	Apply basic equation of simple torsion in designing of shafts and springs.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
CO5	Design and analyze thin and thick shells for the applied internal and external pressures.	3	3	2	2	-	-	-	-	-	-	-	-	2	-
	Average	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – III

20AU314	AUTOMOTIVE MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	0	3

Prerequisite: *-*

Course Outcomes : On successful completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Outline the various moulding and special casting processes and identify the defects that occur during the process.*	*Understand*
CO2:	*Identify the welding processes used for components manufacturing.*	*Understand*
CO3:	*Demonstrate the various machining processes to enhance the productivity.*	*Understand*
CO4:	*Discuss various fabrication techniques for manufacturing components.*	*Understand*
CO5:	*Familiarize the metal forming and power metallurgy process for making components.*	*Understand*

UNIT – I CASTING [09]

Casting types, procedure to make sand mould, types of core making, moulding tolls, machine moulding, special moulding processes – CO_2 moulding; shell moulding, investment moulding, permanent mould casting, pressure die casting, centrifugal casting, continuous casting, casting defects, Application of castings in Automobile.

UNIT – II WELDING [09]

Soldering, brazing and welding – Fusion welding, gas welding – Flame types – Process of arc welding – Electrode – Filler material – Flux – Edge preparation – Joints – Position – Welding symbol – GMAW – GTAW – Resistance welding – Spot, seam, butt and projection – Stud welding – Friction welding – Submerged arc welding – Electro slag welding.

UNIT – III MACHINING [09]

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe – shaper – planer – horizontal milling machine – universal drilling machine – cylindrical grinding machine – Capstan and turret lathe.

General principles and applications of the following processes: Abrasive jet machining – ultrasonic machining – electric discharge machining – electro chemical machining – plasma arc machining – electron beam machining and laser beam machining.

UNIT– IV FORMING AND SHAPING OF PLASTICS [09]

Types of plastics – Characteristics of the forming and shaping processes – Moulding of thermoplastics – Working principles and typical applications of – Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion – Typical industrial applications – Thermoforming – Processing of thermosets – Working principles and typical applications – Compression moulding – Transfer moulding – Bonding of thermoplastics – Fusion and solvent methods – Induction and ultrasonic methods.

UNIT – V METAL FORMING AND POWDER METALLURGY [09]

Hot and cold forming – Forging – Rolling – Extrusion – Spinning – Wire drawing, powder metallurgy – Steps – Sintering – Merits – demerits and applications. Types of dies – Progressive and combination die.

Total = 45 Periods

Text Books :

1. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2008.
2. Sharma P.C., A Text Book of Production Technology: Manufacturing processes, S.Chand & Company Ltd, New Delhi, Eighth Revised Edition, 2014.

Reference Books :

1. Jain. R.K and Gupta. S.C., Production Technology, Khanna Publishers, New Delhi, Sixth Edition, 2001.
2. H.M.T. Production Technology – Handbook, Tata McGraw-Hill Education, New Delhi, 2001.
3. Roy. A. Linberg, Process and Materials of Manufacture, Prentice Hall India Learning Private Limited, New Delhi, 2000.
4. Adithan. M and A.B. Gupta, Manufacturing Technology, New Age International (P) Ltd, New Delhi, Fifth Edition, 2012.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**: III**	**Regulation**	**:**	**R2020**	
Course code	**: 20AU314**	**Course name**	**:**	**AUTOMOTIVE TECHNOLOGY**	**MANUFACTURING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline the various moulding and special casting processes and identify the defects that occur during the process.	2	2	3	-	-	-	2	-	3	-	-	-	-	-
CO2	Identify the welding processes used for manufacturing components.	2	2	3	-	-	-	2	-	3	-	-	-	-	-
CO3	Demonstrate the various machining processes to enhance the productivity.	2	2	3	-	-	-	2	-	3	-	-	-	-	-
CO4	Discuss various fabrication techniques for manufacturing components.	2	2	3	-	-	-	2	-	3	-	-	-	-	-
CO5	Familiarize the metal forming and power metallurgy process for making components.	2	2	3	-	-	-	2	-	3	-	-	-	-	-
	Average	**2**	**2**	**3**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – III

		L	T	P	C
20AU315	**AUTOMOTIVE CHASSIS**	3	0	0	3

Prerequisite: *-*

Course Outcomes : On successful completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Outline the construction details of various automotive chassis frame layouts.*	*Understand*
CO2:	*Explain the function of steering system and steering gear box used in automotive.*	*Understand*
CO3:	*Comprehend the construction and functions of transmission systems.*	*Understand*
CO4:	*Identify the suspension systems.*	*Understand*
CO5:	*Distinguish various types of braking systems.*	*Understand*

UNIT – I CHASSIS AND FRAMES [09]

Types of chassis layout with reference to power plant locations and drives, vehicle frames, various types of frames, constructional details, materials, testing of vehicle frames, unitized frame body construction. Types of front axles, construction details, materials.

UNIT – II STEERING SYSTEM [09]

Steering geometry: castor, camber, king pin inclination, toe-in. conditions for true rolling motion of wheels during steering, steering geometry, Ackermann and Davis steering system, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, power assisted steering.

UNIT – III PROPELLER SHAFT AND FINAL DRIVE [09]

Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non-slip differential, differential locks, differential housings, construction of rear axles, types of loads acting on rear axles, fully floating, three quarter floating and semi floating rear axles, rear axle housing, construction of different types of axle housings, multi axle vehicles.

UNIT– IV SUSPENSION SYSTEM [09]

Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs, independent suspension, dependent suspension, rubber suspension, pneumatic suspension, shock absorbers.

UNIT – V BRAKING SYSTEM [09]

Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, mechanical, hydraulic system, vacuum assisted system, air brake system, antilock braking, EBD, combi braking system, retarded engine brakes, eddy retarders.

Total = 45 Periods

Text Books :

1 Heldt. P.M, Automotive Chassis, Chilton Co., New York, First Edition, 1990

2 K.K.Ramalingam, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

Reference Books :

1 Newton K, Steeds W and Garret T.K, Motor Vehicles, Butterworth-Heinemann, London, Thirteenth Edition, 2000.

2 Heinz Hazler, Advanced Vehicle Technology, Butterworth-Heinemann, London, Second Edition, 2005.

3 Crouse W.H, Automotive Chassis and Body, Tata McGraw-Hill Inc, New York, Fifth Edition, 1976

4 Giri. N.K., Automotive Mechanics, Khanna Publishers, New Delhi, Eighth Edition, 2008.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : III **Regulation : R2020**
Course code : 20AU315 **Course name : AUTOMOTIVE CHASSIS**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	*Outline the construction details of various automotive chassis frame layouts.*	2	2	2	-	-	2	-	2	2	-	-	-	-	3
CO2	*Explain the function of steering system and steering gear box used in automotive.*	3	3	3	-	-	-	-	2	2	-	-	-	-	3
CO3	*Comprehend the construction and functions of transmission systems.*	3	3	3	-	-	-	2	2	2	-	-	-	-	3
CO4	*Identify the suspension systems.*	2	2	2	-	-	2	3	3	2	-	-	-	-	3
CO5	*Distinguish various types of braking systems.*	2	2	2	-	-	2	3	3	2	-	-	-	-	3
	Average	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – III

20MC052	**ENVIRONMENTAL SCIENCE AND ENGINEERING** (Common to All Branches)	L	T	P	C
		3	0	0	0

Prerequisite: *-*

	Course Outcomes: On successful completion of this course , the student will be able to	***Cognitive level***
CO1:	*Interpret the importance in conservation of resources for future generation.*	*Understand*
CO2:	*Relate the importance of ecosystem and biodiversity.*	*Remember*
CO3:	*Analyze the impact of pollution and hazardous waste in a global and societal context.*	*Understand*
CO4:	*Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.*	*Understand*
CO5:	*Predict the concept of Sustainability and Green Chemistry.*	*Understand*

UNIT – I **INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES** **[09]**

Environment – definition – scope and importance – need for public awareness; Forest resources – use – over exploitation – deforestation; Water resources – over–utilization of surface and ground water; Mineral resources – environmental effects of extracting and using mineral resources; Food resources – overgrazing – effects of modern agriculture – fertilizer–pesticide problems – water logging – salinity; Role of an individual in conservation of natural resources. **Activity:** Slogan making event on conserving natural resources or plantation of trees.

UNIT – II **ECOSYSTEM AND BIODIVERSITY** **[09]**

Concept of an ecosystem – structure and function of an ecosystem – producers – consumers and decomposers – Food chain – food web – energy flow in the ecosystem – ecological pyramids – Ecological succession; Forest ecosystem and Aquatic ecosystems (Estuary and marine ecosystem); Biodiversity – introduction – definition – Values of biodiversity; Hot-spots of biodiversity; Endangered and Endemic Species of India. **Activity:** Arrange a trip to visit different varieties of plants.

UNIT– III **ENVIRONMENTAL POLLUTION** **[09]**

Pollution – introduction and different types of pollution; Causes – effects and control measures of air pollution and water pollution – water quality parameters – hardness – definition – types; Alkalinity – definition – types; BOD and COD (definition and significance); Noise pollution – solid waste management – hazardous waste – medical and e-wastes; Role of an individual in prevention of pollution. **Activity:** Drive for segregation of waste or cleanliness drive.

UNIT– IV **SOCIAL ISSUES AND ENVIRONMENT** **[09]**

Water conservation – rain water harvesting and watershed management; Environmental ethics – Issues and possible solutions; Climate change – global warming and its effects on flora and fauna – acid rain – ozone layer depletion; Disaster Management – earth quake – cyclone – tsunami – disaster preparedness – response and recovery from disaster. **Activity:** Poster making event on water management or Climate change.

UNIT– V **SUSTAINABILITY AND GREEN CHEMISTRY** **[09]**

Sustainable development – from unsustainable to sustainable development – Environmental Impact Assessment (EIA); Human rights; Value education; HIV/AIDS; Role of information technology in environment and human health; 12 Principles of Green Chemistry. **Activity:** Group discussion on Sustainability or Lecture from an expert on Green chemistry.

Total = 45 Periods

Text Books :

1 Dr. T. Arun Luiz, Environmental Science and Engineering, S. Chand & Company Private Limited, New Delhi, First Edition, 2016.

2 Anubha Kaushik and C. P. Kaushik, Environmental Science and Engineering, New Age International Publishers, Chennai, Fifth Edition, 2016.

Reference Books :

1 G. Tyler Miller and Scott E. Spoolman, Environmental Science, Cengage Learning India Private Limited, New Delhi, Fourteenth Edition, 2014.

2 Dr. A. Ravikrishnan, Environmental Science and Engineering, Sri krishna Hi-tech Publishing Company Private Limited, Chennai, Tenth Edition, 2014.

3 Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill Education Private Limited, Fourth Edition, 2012.

4 S S. Dara, A Text book of Environmental Chemistry and pollution control, S. Chand & Company Limited, New Delhi, Tenth Edition, 2005.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**III**	**Regulation**	**:**	**R2020**
Course code	**:**	**20MC052**	**Course name**	**:**	**ENVIRONMENTAL SCIENCE AND ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Interpret the importance in conservation of resources for future generation.	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO2	Relate the importance of ecosystem and biodiversity.	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO3	Analyze the impact of pollution and hazardous waste in a global and societal context.	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO4	Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.	3	2	2	-	-	3	3	2	-	-	-	1	-	-
CO5	Predict the concept of Sustainability and Green Chemistry.	3	2	2	-	-	3	3	2	-	-	-	1	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20AU321	**FLUID MECHANICS AND MECHANICS OF MATERIALS LABORATORY**	0	0	3	1

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Evaluate the coefficient of discharge of orifice meter, venturi meter and friction factor of pipes.*	*Understand*
CO2:	*Analyze the performance of reciprocating pump and gear pump.*	*Understand*
CO3:	*Examine the performance of centrifugal pump and pelton wheel.*	*Understand*
CO4:	*Evaluate the properties of materials using tension test, torsion test and find deflection of different section of beams at different loading conditions.*	*Understand*
CO5:	*Analyze the mechanical behaviour of materials using hardness test, impact test and calculate the compressive stress on helical spring using spring testing machine.*	*Understand*

List of Experiments:

1. Fluid Mechanics and Machinery

1. Determination of the coefficient of discharge of given Orifice meter / Venturi meter.
2. Determination of friction factor for a given set of pipes.
3. Performance study on reciprocating pump.
4. Performance study on gear pump.
5. Performance study on centrifugal pump.
6. Performance study on Pelton wheel.

2. Mechanics of Materials

1. Tension test on a mild steel rod.
2. Torsion test on a mild steel and aluminum rods.
3. Deflection test on beams.
4. Hardness test on metals – Brinell and Rockwell tests
5. Impact test on metal specimen – Izod test
6. Compression test on helical springs.

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**III**	**Regulation**	**:**	**R2020**
Course code	**:**	**20AU321**	**Course name**	**:**	**FLUID MECHANICS AND MECHANICS OF MATERIALS LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Evaluate the coefficient of discharge of orifice meter, venturi meter and friction factor of pipes.	3	2	2	-	-	-	-	-	2	-	-	2	-	-
CO2	Analyze the performance of reciprocating pump and gear pump.	3	2	2	-	-	-	-	-	2	-	-	2	-	-
CO3	Examine the performance of centrifugal pump and pelton wheel.	3	2	2	-	-	-	-	-	2	-	-	-	-	-
CO4	Evaluate the properties of materials using tension test, torsion test and find deflection of different section of beams at different loading conditions.	2	2	2	-	-	-	-	-	2	-	-	-	-	-
CO5	Analyze the mechanical behaviour of materials using hardness test, impact test and calculate the compressive stress on helical spring using spring testing machine	2	2	2	-	-	-	-	-	2	-	-	-	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20AU322	**AUTOMOTIVE MANUFACTURING TECHNOLOGY LABORATORY**	0	0	3	1

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Perform the various machining process such as facing, plain turning, step turning, taper turning, knurling, boring, internal and external thread cutting.*	*Understand*
CO2:	*Apply the appropriate method and machine tools for shaping cube and V-block.*	*Understand*
CO3:	*Identify the appropriate operations like drilling, reaming and tapping to make the basic parts.*	*Understand*
CO4:	*Examine the appropriate method and machine tools for performing milling operations.*	*Understand*
CO5:	*Demonstrate the appropriate method and machine tools for performing grinding operations and slotting operations.*	*Understand*

List of Experiments:

1. Facing, plain turning, step turning and taper turning on circular parts using lathe machine.
2. Knurling, boring, internal and external thread cutting on circular parts using lathe machine.
3. Machining a Cube using shaper.
4. Machining a V-Block using shaper.
5. Drilling multiple holes at a given circle on a plate using vertical drilling machine.
6. Drilling, reaming and tapping using vertical drilling machine.
7. Plain milling operation using milling machine.
8. Milling of spur gear using milling machine.
9. Machining an internal and external key-way using slotting machine.
10. Grinding components using cylindrical grinding machine.

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**III**	**Regulation**	**:**	**R2020**
Course code	**:**	**20AU322**	**Course name**	**:**	**AUTOMOTIVE MANUFACTURING TECHNOLOGY LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Perform the various machining process such as facing, plain turning, step turning, taper turning, knurling, boring, internal and external thread cutting.	3	2	2	-	-	-	-	-	2	-	-	2	-	-
CO2	Apply the appropriate method and machine tools for shaping cube and V-block.	3	2	2	-	-	-	-	-	2	-	-	2	-	-
CO3	Identify the appropriate operations like drilling, reaming and tapping to make the basic parts.	3	2	2	-	-	-	-	-	2	-	-	-	-	-
CO4	Examine the appropriate method and machine tools for performing milling operations.	2	2	2	-	-	-	-	-	2	-	-	-	-	-
CO5	Demonstrate the appropriate method and machine tools for performing grinding operations and slotting operations.	2	2	2	-	-	-	-	-	2	-	-	-	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - III

		L	T	P	C
20HR351	**CAREER DEVELOPMENT SKILLS – I** (Common to All Branches)	0	2	0	0

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Have competent knowledge on grammar with an understanding of its basic rules.*	*Understand*
CO2:	*Communicate effectively and enhance interpersonal skills with renewed self – confidence.*	*Apply*
CO3:	*Construct sentence in English and make correction.*	*Apply*
CO4:	*Perform oral communication in any formal situation.*	*Create*
CO5:	*Develop their LSRW skills.*	*Understand*

UNIT - I EFFECTIVE ENGLISH – SPOKEN ENGLISH [06]

Basic Rules of Grammar – Parts of Speech – Tenses – Verbs – Sentences construction - Vocabulary – idioms & phrases – Synonyms – Antonyms – Dialogues and conversation – Exercise(Speaking).

UNIT - II ESSENTIAL COMMUNICATION [06]

Verbal communication – Effective communication – Active Listening – Paraphrasing – Feedback, Non Verbal Communication – Body language of self and Others, Important of feelings in communication – Dealing with feelings in communication practice – Exercise.

UNIT - III WRITTEN COMMUNICATION – PART 1 [06]

Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition – Change of Voice – Change of Speech – One word Substitution – Using the same word as different parts of speech – Odd Man Out – Spelling & Punctuation (Editing).

UNIT - IV WRITTEN COMMUNICATION – PART – 2 [06]

Analogies – Sentences Formation – Sentence Completion – Sentence Correction – idioms & Phrases – Jumbled Sentences, Letter Drafting (Formal Letters) – Reading Comprehension (Level 1) – Contextual Usage – Foreign Languages Words used in English – Exercise.

UNIT - V ORAL COMMUNICATION – PART – 1 [06]

Self-introduction – Situational Dialogues / Role Play (Telephonic Skills) – Oral Presentations – Prepared –'Just A Minute' Sessions (JAM) – Presentation Skills – Exercise.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan. Hyderabad, 2011.

2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015.

Reference Books :

1 Raj N Bakshmi, English Grammar Practice, Orient Black Swan, Hyderabad, First Edition, 2009.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 Thakur K B Sinha, Enrich Your English, Vijay Nicole, Chennai, First Edition, 2005.

4 Norman Lewis. W.R., "Word Power Made Easy", Goyal Publications.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : III **Regulation : R2020**
Course code : 20HR351 **Course name : CAREER DEVELOPMENT SKILLS – I**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Have competent knowledge on grammar with an understanding of its basic rules.	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO2	Communicate effectively and enhance interpersonal skills with renewed self – confidence.	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO3	Construct sentence in English and make correction.	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO4	Perform oral communication in any formal situation.	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO5	Develop their LSRW skills.	-	-	-	-	1	-	-	-	3	3	-	3	-	-
	Average	-	-	-	-	1	-	-	-	**3**	**3**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU411	**ENGINEERING THERMODYNAMICS AND HEAT TRANSFER** (Use of Standard and approved Steam Tables, Mollier Chart and Refrigeration Tables, Heat and Mass Transfer data book is permitted)	3	1	0	4

Prerequisite: *Engineering Physics, Engineering Chemistry*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Apply the first law of thermodynamics for simple open and closed systems under steady state conditions.*	*Remember*
CO2:	*Evaluate the second law of thermodynamics to open and closed systems, calculate entropy and establish relations between ideal and real gases.*	*Understand*
CO3:	*Analyse the thermodynamic concepts to different air standard cycles and solve problems using refrigerant table.*	*Apply*
CO4:	*Identify the mechanisms of heat transfer under steady state conditions.*	*Understand*
CO5:	*Interpret and analyze the convective and radiation heat transfer.*	*Understand*

UNIT - I FIRST LAW OF THERMODYNAMICS [12]

System, thermodynamic equilibrium, state, property, process, cycle, Zeroth law of thermodynamics, energy, work, heat, first law of thermodynamics, PMM1, ideal gases, application of first law of thermodynamics to closed and open systems, Steady flow process and application of steady flow energy equation.

UNIT - II SECOND LAW OF THERMODYNAMICS [12]

Statements of second law of thermodynamics, PMM2, Clausius inequality, heat engine, heat pump, refrigerator, Carnot cycle, Carnot theorem, entropy, temperature – entropy diagram and entropy changes for a closed system. Properties of pure substances.

UNIT - III GAS POWER CYCLES AND VAPOUR POWER CYCLES [12]

Air standard cycles – Otto, Diesel, Dual – work output, Efficiency and MEP calculations, Standard Rankine cycle, Reheat and Regenerative cycle.

Fundamentals of refrigeration, C.O.P, simple vapour compression refrigeration system, simple vapour absorption refrigeration system and desirable properties of an ideal refrigerant.

UNIT - IV CONDUCTION [12]

Basic concepts – Mechanism of heat transfer – Conduction, Convection and Radiation – General differential equation of heat conduction – Fourier law of conduction – One dimensional steady state heat conduction – Conduction through plane wall, cylinders – Composite systems – Extended surfaces – Simple problems.

UNIT - V CONVECTION AND RADIATION [12]

Basic concepts – Types of convection – Forced convection – External flow – Flow over plates, cylinders – Free convection – Flow over vertical plate, horizontal plate, cylinders.

Basic concepts, Laws of radiation – Stefan Boltzman law, Kirchoff law – Black body radiation – Grey body radiation – Radiation shields.

Total (L= 45, T = 15) = 60 Periods

Text Books :

1 Nag P.K, Engineering Thermodynamics, Tata McGraw-Hill Education, New Delhi, Sixth Edition, 2017.

2 Holman J.P, Heat and Mass Transfer, Tata McGraw Hill Education, New Delhi, Tenth Edition, 2017.

Reference Books :

1 Yunus A. Cengel and Michael A. Boles, Thermodynamics, Tata McGraw-Hill Education, New Delhi, Eighth Edition, 2015.

2 Rajput R.K, A Text Book of Engineering Thermodynamics, Laxmi Publications (P) Ltd, New Delhi, Fifth Edition, 2016.

3 Sachdeva R.C, Fundamentals of Engineering Heat and Mass Transfer, Fifth Edition, New Age International Pvt. Ltd., New Delhi, India 2017.

4 Kothandaraman.C.P, Fundamentals of Heat and Mass Transfer, New Age International Pvt. Ltd, New Delhi, Fourth Edition, 2012.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**

Course code : 20AU411 **Course name : ENGINEERING THERMODYNAMICS AND HEAT TRANSFER**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply the first law of thermodynamics for simple open and closed systems under steady state conditions.	3	3	2	1	1	-	-	-	-	-	-	2	3	-
CO2	Evaluate the second law of thermodynamics to open and closed systems, calculate entropy and establish relations between ideal and real gases.	3	3	2	1	1	-	-	-	-	-	-	2	-	2
CO3	Analyse the thermodynamic concepts to different air standard cycles and solve problems using refrigerant table.	3	2	3	2	1	-	-	-	-	-	-	2	-	-
CO4	Identify the mechanisms of heat transfer under steady state conditions.	3	3	2	1	1	-	-	-	-	-	-	2	2	-
CO5	Interpret and analyze the convective and radiation heat transfer.	*3*	3	3	1	1	-	-	-	-	-	-	2	-	-
	Average	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU412	**AUTOMOTIVE ENGINES**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the construction and working principle of SI and CI engines.*	*Understand*
CO2:	*Outline the fuel supply and injection system used in SI and CI engines.*	*Understand*
CO3:	*Examine the cooling and lubrication systems used in IC engines.*	*Understand*
CO4:	*Describe the concepts of supercharging, turbo charging and engine testing.*	*Understand*
CO5:	*Identify the combustion processes and combustion chambers to improve the performance of IC engines.*	*Understand*

UNIT - I ENGINE FUNDAMENTALS [09]

Engine types and their operation- classifications – Terminology- Four stroke and two stroke cycle- Engine components, working principle and materials - Engine operating parameters- Engine cycles- Air Standard cycles- Otto cycle- Fuel –air and actual cycle analysis – Engine emissions – Two stroke engine terminology – types – Merits and Demerits.

UNIT - II INDUCTION AND IGNITION SYSTEM [09]

Carburettors- requirements - working principles, types, different circuits – compensation and maximum power devices– Requirements and objective of injection system – types of injection - Jerk and distributor type pumps, Unit injector, common rail direct injection -. Electronic fuel injection – Study on injection pressure waves, Injection timing, Injection lag. Types of injection nozzle, Nozzle tests. Spray characteristics. Split and Multiple injection. Mechanical and pneumatic governors. Ignition system- function and types- Ignition control mechanism for speed and load- Electronic ignition system

UNIT - III COMBUSTION OF FUELS [09]

Combustion stoichiometry - Combustion reactions- chemical equilibrium – Combustion in SI engine - Stages of combustion- Flame Propagation- Rate of pressure rise- Abnormal combustion- combustion chambers – design objectives and types Engine Knock Thermodynamic analysis of SI engine combustion- Burned and Unburned mixture states – combustion process characterization- Flame structure and Speed- Cyclic variations in combustion - CI Engine - Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Stages of combustion. Delay period – factors affecting delay period. Knock formation in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers for diesel combustion.

UNIT - IV ENGINE COOLING, LUBRICATING SYSTEMS AND SUPERCHARGING, TURBOCHARGING [09]

Cooling system – Function- types - Frictional work- Definitions – Measuring methods – Engine friction components- Lubricating system- Function- types - Lubricant Requirements Necessity and limitation of supercharging. Thermodynamic cycle with super charging. Types of supercharger and turbocharger. Intercooler. Matching of turbocharger. Modification of an engine for supercharging. Effect of supercharging on engine performance. Variable geometry and variable nozzle turbocharger. E-Turbocharger.

UNIT - V ENGINE TESTING AND RECENT DEVELOPMENTS [09]

Indicated and brake MEP, operating variables that affects SI engine performance, efficiency and emission – Factors that control combustion and performance – Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – Variables affecting engine performance – Heat balance – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, HCCI and RCCI engines.

Total = 45 Periods

Text Books :

1 Ganesan. V, Internal Combustion Engines, Tata McGraw Hill Education, New Delhi, Fourth Edition, 2012.

2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, 2014.

Reference Books :

1 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, 2011.

2 John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education, New Delhi, 1998.

3 Gupta H.N, Fundamentals of Internal Combustion Engines, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

4 Obert, E.F., Internal Combustion Engineering and Air Pollution, Intext Education Publishers, New York, 1988.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**
Course code : 20AU412 **Course name : AUTOMOTIVE ENGINES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the construction and working principle of SI and CI engines.	3	-	3	-	-	3	3	2	-	-	-	-	-	3
CO2	Outline the fuel supply and injection system used in SI and CI engines.	3	-	3	-	-	2	-	2	-	-	-	-	-	2
CO3	Examine the cooling and lubrication systems used in IC engines.	3	-	3	-	-	3	3	3	2	-	-	-	-	3
CO4	Describe the concepts of supercharging, turbo charging and engine testing.	3	-	3	-	-	3	2	2	-	-	-	-	2	-
CO5	Identify the combustion processes and combustion chambers to improve the performance of IC engines.	3	-	3	-	-	2	-	2	-	-	-	-	-	2
	Average	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU413	**MATERIAL SCIENCE AND METALLURGY**	3	0	0	3

Prerequisite: *Engineering Physics, Engineering Chemistry*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain alloys and phase diagram, iron-iron carbide diagram and steel classification.*	*Remember*
CO2:	*Describe isothermal transformation, continuous cooling diagrams and different heat treatment processes.*	*Understand*
CO3:	*Identify the different polymer, ceramics and composites and their uses in engineering field.*	*Understand*
CO4:	*Recognize and select the suitable materials for various automotive components.*	*Understand*
CO5:	*Summarize the mechanism of plastic deformation and testing mechanical properties.*	*Understand*

UNIT - I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS [09]

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast iron microstructure, properties and applications.

UNIT - II HEAT TREATMENT [09]

Full annealing, stress relief, recrystallization, spheroidizing, normalizing and tempering. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, Critical Cooling Rate - Hardenability, Jominy end quench test – Austempering and martempering. Case hardening - carburizing, nitriding, cyaniding, carbonitriding, flame and induction hardening.

UNIT - III NON-METALLIC MATERIALS [09]

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS,PEEK, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics –Introduction to Fibre reinforced plastics.

UNIT - IV MATERIALS FOR AUTOMOTIVE COMPONENTS [09]

Criteria of selecting materials for automotive components viz cylinder block, cylinder head, piston and piston ring. Gudgeon pin, connecting rod, crank shaft, crank case, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel and brake lining.

UNIT - V MECHANICAL PROPERTIES AND TESTING [09]

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test – Izod and Charpy, Fatigue and creep tests.

Introduction to nondestructive testing of materials – basic principles and testing method for Radiographic testing, Ultrasonic testing, Magnetic particle inspection and Liquid penetrant inspections.

Total = 45 Periods

Text Books :

1 Kenneth G. Budinski and Michael K.Budinski, Engineering Materials Prentice-Hall of India Private Limited, 4th Indian Reprint 2010.

2 Khanna.O.P, A text book of Materials Science and Metallurgy, Khanna Publishers, 2003

Reference Books :

1 Raghavan.V, Materials Science and Engineering, Prentice Hall of India Pvt., Ltd., 2015.

2 Sydney H.Avner, Introduction to Physical Metallurgy, Tata McGraw Hill Book Company, 2007.

3 Dieter. G.E., Mechanical Metallurgy, Tata McGraw-Hill , Third Edition, 2017

4 Williams D Callister, Material Science and Engineering, Wiley India Pvt Ltd, Revised Indian Edition 2014.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**
Course code : 20AU413 **Course name : MATERIAL SCIENCE AND METALLURGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain alloys and phase diagram, iron-iron carbide diagram and steel classification.	3	3	2	-	-	-	-	-	2	-	-	-	3	-
CO2	Describe isothermal transformation, continuous cooling diagrams and different heat treatment processes.	3	3	2	-	-	-	-	-	2	-	-	-	2	-
CO3	Identify the different polymer, ceramics and composites and their uses in engineering field.	2	2	-	-	-	-	-	-	2	-	-	-	2	-
CO4	Recognize and select the suitable materials for various automotive components.	3	2	-	-	-	-	-	-	2	-	-	-	-	2
CO5	Summarize the mechanism of plastic deformation and testing mechanical properties.	2	2	-	-	-	-	-	-	2	-	-	-	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU414	**MECHANICS OF MACHINES**	3	1	0	4

Prerequisite: *Fundamentals of Engineering Mechanics*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the concepts of mechanisms and determine velocities and accelerations of various planar mechanisms.*	*Understand*
CO2:	*Analyze and evaluate the amount of friction involved in various moving components.*	*Apply*
CO3:	*Comprehend profile, geometry and nomenclature of gear and cam, construct various gear trains and cams for different types of motions.*	*Understand*
CO4:	*Apply the concept of balancing in rotating and reciprocating masses under various operating conditions.*	*Apply*
CO5:	*Acquire knowledge on vibrations in different systems and apply different damping methods to minimize vibrations.*	*Understand*

UNIT - I MECHANISMS [12]

Machine structure – Kinematic link, pair and chain – Gruebler's, Kutch Bach criteria – Constrained motion – Degrees of freedom – Inversions of four bar, slider crank and crank rocker mechanisms – Applications –Kinematic analysis of simple mechanisms – Determination of velocity and acceleration – slider crank mechanism – four bar mechanism.

UNIT - II FRICTIONAL DRIVES [12]

Friction in screw and nut – Pivot and collar –Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

UNIT - III GEARING AND CAMS [12]

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains, involute gear trains, cycloid gear trains and epicylic gear trains – Determination of speed and torque – Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions.

UNIT - IV BALANCING [12]

Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses - Primary balancing and concepts of secondary balancing – Single and multi-cylinder engines (Inline and outline).

UNIT - V VIBRATION [12]

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi-rotor systems – Geared shafts – Critical speed of shaft– Resonance.

Total (L= 45, T = 15) = 60 Periods

Text Books :

1 Rattan.S.S, Theory of Machines, Tata McGraw–Hill Publishing Co., New Delhi, Fourth Edition, 2014.

2 Shigley, J.E. and Uicker, J.J., Theory of Machines and Mechanisms, Tata McGraw-Hill Education, New Delhi, Fourth Edition, 2014.

Reference Books :

1 Ambekar A.G., Mechanism and Machine Theory, Prentice Hall of India, New Delhi, 2007.

2 Rao.S.S., Mechanical Vibrations, Pearson India Education Services Pvt. Ltd., New Delhi, Sixth Edition, 2016.

3 Gosh, A. and Mallick, A.K., Theory of Machines and Mechanisms, Affiliated East West Press, India, Third Edition, 2008.

4 Burton Paul, Kinematics and Dynamic of Planer Machinery, Prentice Hall of India, New Delhi, 1979.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**
Course code : 20AU414 **Course name : MECHANICS OF MACHINES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify the concepts of mechanisms and determine velocities and accelerations of various planar mechanisms.	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	Analyze and evaluate the amount of friction involved in various moving components.	3	3	2	-	-	-	-	2	-	-	-	3	2	-
CO3	Comprehend profile, geometry and nomenclature of gear and cam, construct various gear trains and cams for different types of motions.	3	3	3	2	-	-	-	-	-	-	-	-	2	-
CO4	Apply the concept of balancing in rotating and reciprocating masses under various operating conditions.	3	3	2	-	-	-	-	2	-	-	-	-	2	-
CO5	Acquire knowledge on vibrations in different systems and apply different damping methods to minimize vibrations.	3	3	3	2	-	-	-	2	-	-	-	-	3	-
	Average	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**2**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU415	**AUTOMOTIVE ELECTRICAL ENGINEERING**	3	0	0	3

Prerequisite: *Basics of Electrical and Electronics Engineering*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Apply the fundamental of AC and DC circuits to real time applications.*	*Apply*
CO2:	*Classify the different types of motors and generators based on different parameters.*	*Understand*
CO3:	*Distinguish the various basic electrical and electronics systems of an automobile.*	*Understand*
CO4:	*Outline the working of different batteries available and select them based on the application.*	*Understand*
CO5:	*Recognize and build wiring diagrams used in vehicles.*	*Understand*

UNIT - I AC AND DC CIRCUITS [09]

Ohm's law - Ideal voltage and current sources-Independent sources -dependent sources-circuit elements - Kirchhoff's law - voltage and current division in series and parallel circuits-Node and Mesh analysis – Introduction to AC Circuits, Sinusoidal voltage and current-RMS and average value of periodic waves - Form factor - Phase and Phase difference – Simple RC.RL and RLC circuits - power and power factor.

UNIT - II ELECTRICAL MACHINES [09]

DC Machines: Construction and working principle of dc machines, Basic Equations and Applications, types of dc machines, speed - torque characteristics of dc motors, speed control of dc motors, braking of dc motors, Ac Machines: Construction and working principle of ac machines, Basic Equations and Applications, types of ac motors - Induction motors, Synchronous motors, speed - torque characteristics of Induction motors, speed control of ac motors, braking of induction motors. Transformer - single phase and three phase transformers

UNIT - III STARTING SYSTEM AND CHARGING SYSTEM [09]

Requirement of a starting System, Starter motor Construction and Working, Starter Drive Mechanism –Bendix drive and Folo-thru drive, Over Running Clutch and Solenoid Mechanism. Starter Motor Fault Diagnosis, New Developments in Starting System. Alternator - Construction and working of alternators, advantages of alternators over D.C Generator, Alternator Charging Circuits and Rectification of AC to DC, Alternator Testing Methods, Mechanical and Electronic Voltage regulator, charging circuits

UNIT - IV BATTERIES [09]

Batteries – Construction and working Principle of Lead acid battery, Nickel Cadmium Battery, Nickel Metal Hydride Battery, Sodium Sulphur Battery and Aluminum air Battery, Lithium ion batteries, Battery Rating, selection of batteries, Lead Acid battery - Charging methods, Testing Methods and Fault Diagnosis, New Developments in Battery Technologies

UNIT - V WIRING SYSTEM [09]

Automotive electrical wiring, terminals and switching, multiplexed wiring system, electromagnetic compatibility(EMC), Lighting system – basic lighting system, Head Lamp and Indicator Lamps, Anti–Dazzling and Dipper system, Wiper system, Signaling and Warning system, Earthing - positive earthing and negative earthing,

Total = 45 Periods

Text Books :

1 Tom Denton, Automotive Electrical and Electronic Systems, Routledge, India, Fifth Edition, 2017.

2 Mahmood Nahvi and Joseph Edminister, Electric Circuits, Schaum's outline series, Tata Mc graw Hill company Ltd., New York, Seventh Edition, 2017.

Reference Books :

1 Robert Bosch Gmbh, Bosch Automotive Electric and Electronics, Springer Fachmedien, Wiesbaden, Fifth Edition, 2014.

2 Kholi .P.L., Automotive Electrical Equipment, Tata McGraw-Hill co ltd, New Delhi, First Edition, 2004.

3 Fitzgerald, A.E., Charles Kingsley, Stephen D.Umans, Electric Machinery, Tata McGraw Hill Book Company, India, Sixth Edition, 2017.

4 Crouse W.H., Automobile Electrical Equipment, Tata McGraw Hill Education, NewYork, 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**
Course code : 20AU415 **Course name : AUTOMOTIVE ELECTRICAL ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply the fundamental of AC and DC circuits to real time applications.	3	-	-	-	-	-	-	-	2	-	2	-	-	2
CO2	Classify the different types of motors and generators based on different parameters.	-	3	2	-	-	-	-	-	-	-	-	-	-	2
CO3	Distinguish the various basic electrical and electronics systems of an automobile.	3	3	2	2	-	-	-	-	-	-	-	-	-	2
CO4	Outline the working of different batteries available and select them based on the application	3	-	-	2	-	2	-	-	-	-	-	-	-	3
CO5	Recognize and build wiring diagrams used in vehicles.	-	-	3	3	-	-	-	-	2	-	2	-	-	2
	Average	**3**	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU416	**AUTOMOTIVE FUELS AND LUBRICANTS**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the manufacturing processes of fuels and lubricants.*	*Remember*
CO2:	*Evaluate the properties and testing of fuels.*	*Understand*
CO3:	*Identify the fuels and alternative fuels for engines with their performance and emission characteristics.*	*Understand*
CO4:	*Discuss the engine friction and various types of lubrication mechanism.*	*Understand*
CO5:	*Examine the need of lubricants, factors influencing the lubricants and testing of lubricants.*	*Understand*

UNIT - I REFINERY OF FUELS AND LUBRICANTS [09]

Introduction to Structure of petroleum, refining Process-Distillation, cracking processes, Catalytic reforming, alkylation, isomerisation and polymerization, finishing process- blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT - II PROPERTIES AND TESTING OF FUELS [09]

Properties and testing of fuels- density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion.

UNIT - III FUELS FOR I.C. ENGINES [09]

Types of fuels, liquid and gaseous fuels, desirable characteristics of SI engine fuels, knocking, octane rating, fuel requirements. CI engine fuels, desirable characteristics, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of additive, fuel additives – specifications of fuels.

UNIT - IV THEORY OF LUBRICATION [09]

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT - V LUBRICANTS [09]

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

Total = 45 Periods

Text Books :

1 Ganesan. V, Internal Combustion Engines, Tata McGraw Hill Education, New Delhi, Fourth Edition, 2012.

2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, 2014.

Reference Books :

1 Roger F. Haycock and John E. Hiller, Automotive Lubricants Reference Book, SAE International, 2004.

2 Brame J.S.S. and King J.G, Fuels Solids, Liquids, Gaseous, Edward Arnold, London, 1961.

3 Lansdown A.R, Lubrication: A practical guide to lubricant selection, Pergamon press, Oxford, 1982, ISBN: 9780080267272

4 Paul Richards, Automotive fuels reference book, SAE International, New York, Third Edition, 2014.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**
Course code : 20AU416 **Course name : AUTOMOTIVE FUELS AND LUBRICANTS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the manufacturing processes of fuels and lubricants.	2	2	1	-	-	2	2	-	-	-	-	2	-	2
CO2	Evaluate the properties and testing of fuels.	2	2	1	-	-	2	2	-	-	-	-	2	-	2
CO3	Identify the fuels and alternative fuels for engines with their performance and emission characteristics.	-	2	-	-	-	2	2	-	-	-	-	2	-	2
CO4	Discuss the engine friction and various types of lubrication mechanism.	2	-	-	-	-	1	1	-	-	-	-	2	-	-
CO5	Examine the need of lubricants, factors influencing the lubricants and testing of lubricants.	-	2	1	-	-	2	2	-	-	-	-	2	-	-
	Average	**2**	**2**	**1**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU421	**AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY**	0	0	3	1

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Acquire knowledge in the area of testing of fuels and lubricants using flash and fire point, cloud and pour point apparatus.*	*Understand*
CO2:	*Evaluate the viscosity, viscosity index of lubricants and fuels using Redwood viscometer, Saybolt viscometer.*	*Understand*
CO3:	*Recognize the procedures for evaluating the calorific value and ASTM distillation test of fuels.*	*Understand*
CO4:	*Examine the aniline point and Reid vapour pressure tests of fuels.*	*Understand*
CO5:	*Demonstrate the copper strip corrosion test of fuels and compare hardness of the grease through drop point and penetration test.*	*Understand*

List of Experiments:

1. Determination of flash and fire point test of fuels.
2. Determination of cloud and pour point of fuels.
3. Determination of viscosity of lubricants and fuels by Redwood viscometer.
4. Determination of viscosity index of lubricants and fuels by Saybolt viscometer.
5. ASTM distillation test of liquid fuels.
6. Determination of calorific value of liquid / gaseous fuel.
7. Determination of aniline point test of diesel.
8. Determinations of Reid vapour pressure of fuels.
9. Copper strip corrosion test.
10. Determination of drop point of grease and mechanical penetration in grease.

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**IV**	**Regulation**	**:**	**R2020**
Course code	**:**	**20AU421**	**Course name**	**:**	**AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Acquire knowledge in the area of testing of fuels and lubricants using flash and fire point, cloud and pour point apparatus.	3	3	-	-	2	2	2	-	2	-	-	2	2	-
CO2	Evaluate the viscosity, viscosity index of lubricants and fuels using Redwood viscometer, Saybolt viscometer.	2	2	1	-	-	2	2	-	-	-	-	2	-	2
CO3	Recognize the procedures for evaluating the calorific value and ASTM distillation test of fuels.	2	2	1	-	-	2	2	-	-	-	-	2	-	2
CO4	Examine the aniline point and Reid vapour pressure tests of fuels.	2	2	1	-	-	2	2	-	-	-	-	2	-	2
CO5	Demonstrate the copper strip corrosion test of fuels and compare hardness of the grease through drop point and penetration test.	-	2	1	-	-	2	2	-	-	-	-	2	-	-
	Average	**2**	**2**	**1**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**	**2**	**2**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20AU422	**AUTOMOTIVE COMPONENTS LABORATORY**	0	0	3	1

Prerequisite: *-*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Dismantle and assemble the SI and CI engines.*	*Understand*
CO2:	*Recognize the different fuel feed systems, vehicle frames of light and heavy vehicles.*	*Understand*
CO3:	*Acquire the knowledge of two and three wheelers and chassis layouts.*	*Understand*
CO4:	*Examine the working of differential, clutch and drive shaft.*	*Understand*
CO5:	*Describe the working principle of steering system and gear boxes of automotive systems.*	*Understand*

List of Experiments:

1. Dismantling and assembling of multi-cylinder petrol engine.
2. Dismantling and assembling of multi-cylinder diesel engine.
3. Study of petrol and diesel engine fuel feed systems.
4. Study and measurement of light and heavy commercial vehicle frame.
5. Study of different components of two and three wheeler.
6. Study of different chassis layouts.
7. Study, dismantling and assembling of front and rear axles.
8. Study, dismantling and assembling of differential and clutch, drive shaft.
9. Study, dismantling and assembling of gear boxes.
10. Study of steering system.

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**
Course code : 20AU422 **Course name : AUTOMOTIVE COMPONENTS LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Dismantle and assemble the SI and CI engines.	3	-	3	-	-	3	3	2	-	-	-	-	-	3
CO2	Recognize the different fuel feed systems, vehicle frames of light and heavy vehicles.	3	-	3	-	-	2	-	2	-	-	-	-	-	2
CO3	Acquire the knowledge of two and three wheelers and chassis layouts.	3	-	3	-	-	3	3	3	2	-	-	-	-	3
CO4	Examine the working of differential, clutch and drive shaft.	3	-	3	-	-	3	2	2	-	-	-	-	2	-
CO5	Describe the working principle of steering system and gear boxes of automotive systems.	3	-	3	-	-	2	-	2	-	-	-	-	-	2
	Average	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - IV

		L	T	P	C
20HR412	**CAREER DEVELOPMENT SKILLS - II**	0	2	0	0

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Speak and write appropriately by understanding verbal and logical reasoning*	*Apply*
CO2:	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions*	*Apply*
CO3:	*Enhance their skills on quantitative aptitude*	*Understand*
CO4:	*Speak and write appropriately by understanding and applying the basic grammatical rules*	*Create*
CO5:	*Critically evaluate problems related to quantitative aptitude*	*Apply*

UNIT - I **VERBAL AND LOGICAL REASONING – PART 1** **[06]**

Alphabet Test – Synonyms & Antonyms – Idioms & Phrases – Analogies - Theme Detection – Odd Words – Statement & Conclusions - Family Tree – Blood Relations – Coding & Decoding – Syllogism – Odd Man Out.

UNIT - II **QUANTITATIVE APTITUDE – PART 1** **[06]**

Numbers: Number system - Squaring of Numbers – Square Roots – Cube Roots – Divisibility – HCF, LCM – Decimals.

UNIT - III **QUANTITATIVE APTITUDE – PART 2** **[06]**

Percentages – Averages – Ratio & Proportion – Mixtures and Allegations – logarithms.

UNIT - IV **READING COMPREHENSION&WRITTEN COMMUNICATION –PART 3** **[06]**

READING SKILLS : Importance of Reading – Definition of Reading – Levels of Reading – Requirements of Reading – Types of Reading – Techniques of Reading - Academic Reading Tips.

UNIT - V **QUANTITATIVE APTITUDE – PART 3** **[06]**

Profit and Loss – Simple Interest & Compound Interest – Problem on Ages – Calendar.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan. Hyderabad, 2011.

2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi,Third Edition,2009

Reference Books :

1 Agarwal. R.S, A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, Second Edition, 2012.

4 Norman Lewis. W.R., “Word Power Made Easy”, Goyal Publications

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : IV **Regulation : R2020**
Course code : 20HR412 **Course name : CAREER DEVELOPMENT SKILLS - II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Speak and write appropriately by understanding verbal and logical reasoning	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO2	Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO3	Enhance their skills on quantitative aptitude	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO4	Speak and write appropriately by understanding and applying the basic grammatical rules	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO5	Critically evaluate problems related to quantitative aptitude	-	-	-	-	-	-	-	-	2	3	-	3	2	2
	Average	-	-	-	-	-	-	-	-	**2**	**3**	**-**	**3**	**2**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20HS051	**UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY** (Common To All Branches)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the basic concepts of value education.*	*Understand*
CO2:	*Distinguish between the self and the body, implement the meaning of harmony in the Co–existence of Self and the Body.*	*Understand*
CO3:	*Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.*	*Understand*
CO4:	*Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.*	*Understand*
CO5:	*Explain the ethical and unethical practices in work environment.*	*Understand*

UNIT - I INTRODUCTION TO VALUE EDUCATION [09]

Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.

UNIT - II HARMONY IN THE HUMAN BEING [09]

Human Begin and Body – Understanding Myself as Co–existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I) – Understanding Myself – Harmony with Body.

UNIT - III HARMONY IN THE FAMILY AND SOCIETY [09]

Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.

UNIT - IV HARMONY IN NATURE AND EXISTENCE [09]

Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co–existence of units of Space – Limited and unlimited – Active and No–activity – Existence is Co–existence.

UNIT - V PROFESSIONAL ETHICS [09]

Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Gaur R.R., Sangal, R., Bagaria, G.P., A Foundation Course in Human Values and Professional Ethics, Excell Books Pvt. Ltd., New Delhi, First Edition, 2016.

2 Tripaty, A.N., Human Values, New Age International Publishers, 2003.

Reference Books :

1 Ivan Illich, Energy & Equity, The Trinity Press, USA, 1974.

2 Schumacher E.F., Small is Beautiful: a study of economics as if people mattered, Britain, 1973.

3 Seebauer, E.G., Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.

4 Banerjee, B.P., Foundations of Ethics and Management, Excel Book, 2005.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : V **Regulation : R2020**

Course code : 20HS051 **Course name : UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the basic concepts of value education.	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO2	Distinguish between the self and the body, implement the meaning of Harmony in the Co– existence of Self and the Body.	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO3	Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO4	Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO5	Explain the ethical and unethical practices in work environment.	-	-	-	-	-	1	1	3	3	-	1	3	-	-
	Round off Average	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**3**	**3**	**-**	**1**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20AU512	**AUTOMOTIVE TRANSMISSION**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the constructional and working principle of various types of clutch.*	*Understand*
CO2:	*Outline the constructional and working principle of various types of gearbox.*	*Understand*
CO3:	*Illustrate the working principle of fluid coupling and torque converter and its performance characteristics.*	*Understand*
CO4:	*Demonstrate the working principle of various types of hydrostatic and electric drives.*	*Understand*
CO5:	*Explain the various types of automatic transmission used in automobile vehicles.*	*Understand*

UNIT - I CLUTCH [09]

Requirement of transmission system, Different types of clutches, principle & construction of single plate coil spring and diaphragm spring clutches, multi-plate clutch, Centrifugal Clutch, Electromagnetic Clutch and dual clutch. Friction lining materials.

UNIT - II GEAR BOXES [09]

Need and objectives of gear box. Construction and operation of sliding mesh, constant mesh and synchromesh gear boxes. Transfer box. Principle and operations of planetary gear box. Power and economy modes in gear box, Gear box maintenance.

UNIT - III HYDRODYNAMIC DRIVE [09]

Fluid coupling – Principle of operation, constructional details, torque capacity, performance characteristics and reduction of drag torque. Hydrodynamic torque converter – Principle of operation, constructional details and performance characteristics. Multistage torque converters and poly phase torque converters.

UNIT - IV HYDROSTATIC AND ELECTRIC DRIVE [09]

Hydrostatic drive, Various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitation. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drive – types – Electric Drive Train Topologies, Principle of early and modified Ward Leonard Control system – Advantages and limitations.

UNIT - V AUTOMATIC TRANSMISSION APPLICATIONS [09]

Need for manual, Intelligent manual, automatic, automated manual transmission, principle of operation. Hydraulic control system for automatic transmission. Turboglide transmission, Continuously variable transmission (CVT) – Types – Operations.

Total = 45 Periods

Text Books :

1 Kirpal Singh, “Automotive Engineering, Vol. I”, Standard Publishers and Distributors pvt. Ltd, New Dlehi, Thirteenth Edition, 2012.

2 Harald Naunheimer , Bernd Bertsche ,Joachim Ryborz , Wolfgang Novak, Automotive Transmissions, Springer, Berlin, Heidelberg, Second Edition, 2011

Reference Books :

1 Crouse W.H., Anglin D.L, Automotive Transmission and Power Trains Construction, Tata McGraw Hill Education US, 1976.

2 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd., Chennai, Second Edition, 2011.

3 Heinz Heisler, Advance Vehicle Technology, Butterworth-Heinemann, London, Second Edition, 2002.

4 Garrett. T.K., Newton. K, Steeds. W, Motor Vehicle, Butterworth-Heinemann, London, Thirteenth Edition, 2000.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : V **Regulation : R2020**
Course code : 20AU512 **Course name : AUTOMOTIVE TRANSMISSION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the constructional and working principle of various types of clutch.	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO2	Outline the constructional and working principle of various types of gearbox.	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO3	Illustrate the working principle of fluid coupling and torque converter and its performance characteristics.	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO4	Demonstrate the working principle of various types of hydrostatic and electric drives.	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO5	Explain the various types of automatic transmission used in automobile vehicles.	3	-	-	3	3	-	-	-	-	2	2	-	2	3
	Average	**3**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20AU513	**DESIGN OF MACHINE ELEMENTS**				
	(Use of Standard and approved Design Data Book is permitted)	3	1	0	4

Prerequisite: *Mechanics of Materials*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Examine the influence of steady and variable stresses in machine components.*	*Understand*
CO2:	*Select the suitable shaft and coupling for a particular application.*	*Apply*
CO3:	*Identify the basic design concepts of temporary and permanent joints.*	*Analyze*
CO4:	*Find and identify suitable springs and understand the design concepts of flywheels.*	*Apply*
CO5:	*Select the suitable bearings for engineering applications.*	*Apply*

UNIT - I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS [12]

Introduction to the design process – Four C's of design - factor influencing machine design, selection of materials based on mechanical properties – Preferred numbers, limits, fits and tolerances – Direct, Bending and Torsional stress equations – Calculation of principal stresses for various load combinations – eccentric loading - Factor of safety - Theories of failure – Stress concentration – Design for variable loading – Soderberg, Goodman and Gerber relations.

UNIT - II DESIGN OF SHAFTS AND COUPLINGS [12]

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways – Design of rigid flange and flexible couplings – Muff, clamp and rigid flange and bushed – pin flexible couplings.

UNIT - III DESIGN OF TEMPORARY AND PERMANENT JOINTS [12]

Threaded fasteners – Design of bolted joints including eccentric loading – Design of welded joints – Axially loaded unsymmetrical welded joints – Eccentric load in the plane of welds – Welded joints subjected to bending and twisting moment – Design of riveted joints.

UNIT - IV DESIGN OF SPRINGS AND FLYWHEEL [12]

Design of helical, multi- leaf and torsional springs under constant loads and varying loads – End conditions and length of springs - Stresses in Helical springs of circular wire – Wahl's stress factor – Concentric torsion springs – Design of flywheels involving stresses in rim and arm.

UNIT - V DESIGN OF BEARINGS [12]

Design of bearings – Sliding contact and rolling contact types – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – Calculation of bearing dimensions – Fundamentals of fracture mechanics.

Total (L= 45, T = 15) = 60 Periods

Text Books :

1 Bhandari.V, Design of Machine Elements, Tata McGraw–Hill Publishing Co., New Delhi, Fourth Edition, 2016.

2 Shigley, J.E., Mischke. C.R., Mechanical Engineering Design, Tata McGraw-Hill Education, New York, Tenth Edition, 2015.

Reference Books :

1 Sundararajamoorthy T.V., Shanmugam. N, Machine Design, Anuradha Publications, Chennai, Fourth Edition, 2018.

2 Gope. P.C., Machine Design - Fundamental and Application, PHI learning Pvt. Ltd., New Delhi, First Edition, 2012.

3 Juvinall. R.C., Marshek. K.M., Fundamentals of Machine Component Design, John Wiley & Sons, New Delhi, Seventh Edition, 2019.

4 Faculty of Mechanical Engineering, PSG College of Technology, Design Data Book, M/s. Kalaikathir Achchagam, Coimbatore, 2019.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : V **Regulation : R2020**
Course code : 20AU513 **Course name : DESIGN OF MACHINE ELEMENTS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Examine the influence of steady and variable stresses in machine components.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO2	Select the suitable shaft and coupling for a particular application.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO3	Identify the basic design concepts of temporary and permanent joints.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO4	Find and identify suitable springs and understand the design concepts of flywheels.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO5	Select the suitable bearings for engineering applications.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
	Average	**3**	**3**	**3**	**3**	-	-	-	-	**-**	**-**	**-**	**3**	**2**	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20AU514	**VEHICLE BODY ENGINEERING**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Compare and familiar with different aspects of car body and its types.*	*Understand*
CO2:	*Examine the role of various aerodynamic forces and moments and its measuring instruments*	*Understand*
CO3:	*Demonstrate the vehicle body regulations to build the bus body.*	*Understand*
CO4:	*Discuss the some new commercial vehicle body and ergonomics designs.*	*Understand*
CO5:	*Identify the various body materials, trim items and mechanisms.*	*Understand*

UNIT - I CAR BODY DETAILS [09]

Car body terminology – Types: Hatch back, Sedan, Estate, SUV, MPV, Limousine, convertibles, Racing and Sports car – Visibility: driver‘s visibility, test for visibility, Methods of improving visibility and space in cars – Driver seat design – Car Body Construction - Various panels in car bodies. Safety: Safety design, safety equipment for cars.

UNIT - II VEHICLE AERODYNAMICS [09]

Aerodynamics – concept, objectives, Forces and Moments – types and effects on vehicle body, Body optimization techniques for minimum drag and lift. Wind tunnel testing – concept – types - test setup - testing process - Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel balance.

UNIT - III BUS BODY DETAILS [09]

Types: Based on distance travelled: mini bus, town, mofussil, luxury coach. Based on capacity of the bus: single deck, double deck, Split level and articulated bus. Constructional details: Frame, integral and double skin construction- Bus body terminology, Bus Body Lay Out: Floor height, engine location, entrance and exit location, seating dimensions - Types of metal section used- Safety aspect of bus body

UNIT - IV COMMERCIAL VEHICLE DETAILS [09]

Different types of commercial vehicle bodies - Light commercial vehicle body types- Construction details of flat platform body, Tipper body and Tanker body - Dimensions of driver‘s seat in relation to controls - driver‘s cabin design.

UNIT - V BODY MATERIALS, TRIM AND MECHANISMS [09]

Steel sheet, timber, plastics, FRP (Fibre-reinforced plastics), properties of materials – Corrosion - Anticorrosion methods - Selection of paint - Modern painting process in details - Body trim items - Body mechanisms.

Total = 45 Periods

Text Books :

1 Powloski, J., Vehicle Body Engineering, Business Books Ltd., London, Second Edition, 1998.

2 John Fenton, Handbook of Automotive Construction and Design Analysis, John Wiley & Sons, New york, Fourth Edition, 2014.

Reference Books :

1 Giles. G.J., Body construction and design, Iliffe Books Butterworth & Co., London, Second Edition, 1991

2 John Fenton, Vehicle Body layout and analysis, Mechanical Engg Publication Ltd., London, First Edition, 1992

3 Dieler Anselm., The passenger car body, SAE International, USA, Fourth Edition, 2000.

4 James E Duffy, Body Repair Technology for 4-Wheelers, Cengage Learning, India, First Edition, 2009

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : V **Regulation : R2020**
Course code : 20AU514 **Course name : VEHICLE BODY ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Compare and familiar with different aspects of car body and its types.	3	2	-	-	-	2	-	-	-	-	-	2	2	-
CO2	Examine the role of various aerodynamic forces and moments and its measuring instruments	3	3	3	2	-	-	2	2	2	-	-	-	3	-
CO3	Demonstrate the vehicle body regulations to build the bus body.	2	-	3	-	-	3	-	2	2	-	-	-	2	-
CO4	Discuss the some new commercial vehicle body and ergonomics designs.	2	-	-	-	-	3	-	2	-	-	-	-	2	-
CO5	Identify the various body materials, trim items and mechanisms.	3	2	2	-	-	2	2	2	-	-	-	2	2	-
	Average	**3**	**3**	**3**	**2**	**-**	**3**	**2**	**2**	**2**	**-**	**-**	**3**	**2**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20AU515	**AUTOMOTIVE ELECTRONICS**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recall the fundamentals of electronic components.*	*Remember*
CO2:	*Illustrate the design of regulated power supply for the given specification*	*Understand*
CO3:	*Construct the digital circuit using logic gates for the given logical operation.*	*Understand*
CO4:	*Demonstrate the electronic component functions involved in automotive electronic circuits*	*Understand*
CO5:	*Explain the working principle of application specific Electronic control unit.*	*Understand*

UNIT - I ELECTRONIC COMPONENTS IN THE VEHICLE [09]

Basic principle of semiconductor technology, Passive Linear Components – Resistor, Types of Resistors, Practical Application of Variable Resistors, Capacitors - Types of Capacitors, Inductors, semiconductor Non Linear Components – Diodes, Types of Diodes, Switches, semiconductor resistor – NTC resistor and PTC resistor, Active Electronic Components – Transistors, Types of Transistor - Integrated Circuit, Manufacture of semiconductor components and circuits.

UNIT - II DESIGN OF REGULATED POWER SUPPLY [09]

Introduction to regulated power supply, Basic Circuit Configuration, Types of rectifier- Bridge rectifier, Types of voltage regulator - Voltage regulator applications, Regulator Circuit Design using IC7805, IC7812 and IC7905, IC7912, IC LM317, Zener diode1N4728A applications, Designing of power supplies.

UNIT - III INTRODUCTION TO DIGITAL ELECTRONICS [09]

Basic difference between analog and digital signal, Concept of negative and positive logic, Binary and hexadecimal number system, conversion from decimal and hexadecimal to binary and vice versa, Definition, symbols and truth tables of NOT, AND, OR, NAND,EXOR Gates, NAND and NOR as universal gates, application of digital electronics.

UNIT - IV AUTOMOTIVE ELECTRONIC CIRCUITS [09]

Single Pushbutton Latching Relay Engine Start Circuit, Adaptive Lighting System for Automobiles, 555 Ignition Coil Driver, Car Interior Light Dimmer, 12V Car Battery Monitor, Engine Running Detector, Load Switch, Anti-theft Car Alarm Circuit, keyless entry circuit, Automotive Wash Wiper Timer, DC motor speed control using electronic components.

UNIT - V AUTOMOTIVE ECU APPLICATIONS [09]

Introduction to ECU - Development of electronic system, task of an electronic system, ECU architecture - Input signals to ECU - Discrete, Frequency, and Analog, Embedded controller, Output signals from ECU - Switch output, PWM output, and Frequency output, Types of ECU - Engine Control Module (ECM), Electronic Brake Control Module (EBCM), Powertrain Control Module (PCM), Vehicle Control Module (VCM), Body Control Module (BCM), Battery management system (BMS).

Total = 45 Periods

Text Books :

1 Denton. T, Automobile Electrical and Electronic Systems, Elsevier Jordan Hill, Oxford, Second Edition, 2010.

2 Babu. A.K., Automotive Electricals & Electronics, Khanna Publishing House, New Delhi, First Edition, 2018.

Reference Books :

1 Robert Bosch gmbh, Bosch Automotive Electrics and Automotive Electronics: Systems and Components, Fifth Edition, 2014.

2 Ronald. K.J, Automotive Electronics Handbook, Tata McGraw Hill Publications, Columbus, First Edition, 2009.

3 Nicholas Navit, Automotive Embedded System Handbook, CRC Press Publications, New Delhi, First Edition, 2009.

4 The 2018-2023 World Outlook for Automotive Electronic Control Unit (ECU) Safety Systems by Icon Group International

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : V **Regulation : R2020**
Course code : 20AU515 **Course name : AUTOMOTIVE ELECTRONICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recall the fundamentals of electronic components.	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	Illustrate the design of regulated power supply for the given specification	2	-	3	-	3	-	-	-	-	-	-	-	-	3
CO3	Construct the digital circuit using logic gates for the given logical operation.	2	-	2	-	2	-	-	-	-	-	-	-	-	-
CO4	Familiarize with electronic component functions involved in automotive electronic circuits	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	Explain the working principle of application specific Electronic control unit.	2	-	-	-	-	-	-	-	-	-	-	-	-	-
	Average	**2**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20AU521	**AUTOMOTIVE COMPONENTS DESIGN AND MODELING LABORATORY**	0	0	3	1

Prerequisite: *Computer Aided Drawing Laboratory*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate the modeling of piston, connecting rod and its components.*	*Understand*
CO2:	*Recognize the modeling of crankshaft and flywheel.*	*Understand*
CO3:	*Construct the model of valve assembly and cylinder block.*	*Understand*
CO4:	*Develop the model of camshaft and clutch assembly using modeling software.*	*Understand*
CO5:	*Create the model of propeller shaft and final drive using modeling software.*	*Understand*

List of Experiments:

1. Modeling of piston, piston pin and piston rings.
2. Modeling of connecting rod small end and big end, Shank, big end cap, bolts.
3. Modeling of centre and side crank shaft.
4. Modeling of flywheel.
5. Modeling of the inlet and exhaust valve assembly.
6. Modeling of cylinder block.
7. Modeling of cam shaft assembly.
8. Modeling of clutch plate assembly.
9. Modeling of propeller shaft assembly.
10. Modeling of final drive.

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**V**	**Regulation**	**:**	**R2020**
Course code	**:**	**20AU521**	**Course name**	**:**	**AUTOMOTIVE COMPONENTS DESIGN AND MODELING LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate the modeling of piston, connecting rod and its components.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO2	Recognize the modeling of crankshaft and flywheel.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO3	Construct the model of valve assembly and cylinder block.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO4	Develop the model of camshaft and clutch assembly using modeling software.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO5	Create the model of propeller shaft and final drive using modeling software.	3	3	3	3	-	-	-	-	-	-	-	3	2	-
	Average	**3**	**3**	**3**	**3**	**-**	-	-	-	-	**-**	**-**	**3**	**2**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20AU522	**AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY**	0	0	3	1

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Comprehend the working and troubleshooting of battery, starting motor and alternator*	*Understand*
CO2:	*Demonstrate and diagnose the ignition system, electrical wiring and regulator, solenoids, horn and wiper mechanism.*	*Understand*
CO3:	*Explain the principle and characteristics of logic gates, SCR, half adder and full adder.*	*Understand*
CO4:	*Interface the DAC for control application and A/D converter for simple data acquisition.*	*Understand*
CO5:	*Describe the working principle of stepper motor and basic microprocessor arithmetic programming.*	*Understand*

List of Experiments:

ELECTRICAL

1. Testing of batteries and battery maintenance.
2. Testing of starting motors and alternator
3. Diagnosis of ignition system faults
4. Study of automobile electrical wiring.
5. Study of voltage regulator, solenoids, horn and wiper mechanism.

ELECTRONICS

1. Study of logic gates (Basic gates) and SCR.
2. Half adder and Full adder.
3. Interfacing DAC for control application
4. Interfacing A/D converter for simple data acquisition
5. Stepping motor interfacing.
6. Basic microprocessor arithmetic programming

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : V **Regulation : R2020**

Course code : 20AU522 **Course name : AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Comprehend the working and troubleshooting of battery, starting motor and alternator.	2	3	3	3	2	1	-	-	1	-	-	-	3	3
CO2	Demonstrate and diagnose the ignition system, electrical wiring and regulator, solenoids, horn and wiper mechanism.	2	3	3	3	2	1	-	-	1	-	-	-	3	3
CO3	Explain the principle and characteristics of logic gates, SCR, half adder and full adder.	2	3	3	3	2	1	-	-	1	-	-	-	3	3
CO4	Interface the DAC for control application and A/D converter for simple data acquisition.	2	3	3	3	2	1	-	-	1	-	-	-	3	3
CO5	Describe the working principle of stepper motor and basic microprocessor arithmetic programming.	2	3	3	3	2	1	-	-	1	-	-	-	3	3
	Average	**2**	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - V

		L	T	P	C
20HR513	**CAREER DEVELOPMENT SKILLS - III**	2	0	0	0

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the nearness of leading various texts.*	*Apply*
CO2:	*Perform well in verbal and logical reasoning.*	*Apply*
CO3:	*Understand and develop the etiquette necessary to present oneself in a professional setting.*	*Understand*
CO4:	*Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.*	*Create*
CO5:	*Enhance the comprehension Skills in core subjects.*	*Apply*

UNIT – I **WRITTEN AND ORAL COMMUNICATION – PART 1** **[06]**

Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate- Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions Practices: Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Interpretation of Pictorial Representations – Editing.

UNIT – II **VERBAL & LOGICAL REASONING – PART 2** **[06]**

Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences - identifying Strong Arguments and Weak Arguments - Statements and Conclusions- Cause and Effect - Deriving Conclusions from Passages - Seating Arrangements Practices: Analogies - Blood Relations - Statement & Conclusions.

UNIT – III **QUANTITATIVE APTITUDE – PART 3** **[06]**

Probability - Calendar- Clocks - Logarithms - Permutations and Combinations.

UNIT – IV **QUANTITATIVE APTITUDE – PART 4** **[06]**

Algebra - Linear Equations - Quadratic Equations – Polynomials – Problem on Numbers – Ages – Train – Time and Work – Sudoku – Puzzles.

UNIT – V **DOMAIN PROFICIENCY** **[06]**

Fluid Mechanics and Hydraulic Machines, Engineering Thermodynamics and Heat Transfer, Automotive chassis and engines, Material Science and Metallurgy, Mechanics of Machines, Manufacturing Technology, Automotive Fuels and Lubricants.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan, Hyderabad, 2011.

2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi,Third Edition,2009

Reference Books :

1 Agarwal. R.S, A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand& Co Ltd., New Delhi.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, second edition, 2012.

4 Norman Lewis. W.R., "Word Power Made Easy", Goyal Publications

5 Jain R.K., Mechanical Engineering for Competitions, Khanna Publishers, New Delhi, Seventh Edition, 2015.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : V **Regulation : R2020**
Course code : 20HR513 **Course name : CAREER DEVELOPMENT SKILLS - III**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the nearness of leading various texts.	-	-	-	-	-	-	-	1	3	3	-	-	1	1
CO2	Perform well in verbal and logical reasoning.	-	-	-	-	-	-	-	1	3	3	-	2	1	1
CO3	Understand and develop the etiquette necessary to present oneself in a professional setting.	-	-	-	-	-	-	-	1	3	3	-	1	1	1
CO4	Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.	-	-	-	-	-	-	-	1	3	3	-	2	1	1
CO5	Enhance the comprehension Skills in core subjects.	-	-	-	-	-	-	-	1	3	3	-	-	1	1
	Average	-	-	-	-	-	-	-	1	**3**	**3**	**-**	**2**	**1**	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20AU611	**AUTOMOTIVE ENGINE COMPONENTS DESIGN**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the selection of engineering materials and types of tolerances and fits.*	*Understand*
CO2:	*Apply the design concepts for cylinder and piston.*	*Apply*
CO3:	*Identify the optimal design solutions of connecting rod.*	*Apply*
CO4:	*Relate the design concepts for crank shaft and cam shaft.*	*Apply*
CO5:	*Carryout the design procedure of valves and flywheel of an automobile.*	*Apply*

UNIT - I INTRODUCTION [09]

Engineering material and their properties applied to design, selection of materials, factor of safety, endurance limit, notch sensitivity, principles of design optimization and computer aided drafting - Definitions, types of tolerances and fits, design considerations for fits, surface finish and surface roughness.

UNIT - II DESIGN OF CYLINDER AND PISTON [09]

Choice of material for cylinder and piston - Piston friction, piston slap, piston failures, lubrication of piston assembly - Design of cylinder and piston, piston pin and piston rings.

UNIT - III DESIGN OF CONNECTING ROD [09]

Material for connecting rod, determination of minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts and connecting rod failures.

UNIT - IV DESIGN OF CRANKSHAFT AND CAM SHAFT [09]

Significance of firing order, material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations, cam shaft and cam design.

UNIT - V DESIGN OF VALVES AND FLYWHEEL [09]

Design aspects of intake and exhaust manifolds, inlet and exhaust valves, valve springs, tappets and valve train - Materials and design of flywheel.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Shigley, J.E., Mischke. C.R., Mechanical Engineering Design, Tata McGraw-Hill Education, India, Eleventh Edition, 2020.
2. Jain, R. K., Machine Design, Khanna Publishers, New Delhi, Ninth edition, 2005.

Reference Books :

1. Sundararajamoorthy T.V., Shanmugam. N., Machine Design, Anuradha Publications, Chennai, 2018.
2. Faculty of Mechanical Engineering, PSG College of Technology, Design Data Book, M/s. Kalaikathir Achchagam, Coimbatore, 2019.
3. Hall Allen, S. & Others, Machine Design, Schaum's series, Tata McGraw–Hill Publishing Co., New Delhi, 2012.
4. Bhandari. V, Design of Machine Elements, Tata McGraw–Hill Publishing Co., New Delhi, Fifth Edition, 2020.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**: VI**	**Regulation**	**:**	**R2020**	
Course code	**: 20AU611**	**Course name**	**:**	**AUTOMOTIVE ENGINE COMPONENTS DESIGN**	

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the selection of engineering materials and types of tolerances and fits.	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO2	Apply the design concepts for cylinder and piston design.	3	-	3	2	-	-	-	-	-	-	-	-	2	-
CO3	Identify the optimal design solutions of connecting rod.	3	-	3	2	-	-	-	-	-	-	-	--	2	-
CO4	Relate the design concepts for crank shaft and cam shaft.	3	-	3	2	-	-	-	-	-	-	-	-	2	-
CO5	Carryout the design procedure of valves and flywheel of an automobile.	3	-	3	2	-	-	-	-	-	-	-	-	2	-
	Average	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20AU612	**AUTOMOTIVE POLLUTION AND CONTROL**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the effects of automobile emissions on environment and human beings.*	*Understand*
CO2:	*Describe the formation of major pollutants in SI engine and study pollutant control techniques.*	*Understand*
CO3:	*Depict the formation of emission in CI engine and learn emission control techniques.*	*Understand*
CO4:	*Recognize sources of noise pollution from automobiles and its reduction method.*	*Apply*
CO5:	*Establish test procedures and emission measurements in automobile.*	*Apply*

UNIT - I EMISSION FROM AUTOMOBILES [09]

Sources of pollution. Various emissions from automobiles – Pollutants Formation and its effects on environment and human beings. Emission control techniques – Emission standards.

UNIT - II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL [09]

Pollutants formation in SI Engines – Carbon monoxide, Unburned hydrocarbon, NOx, Smoke – Effects of design and operating variables on emission formation – controlling of pollutants, Catalytic converters – Charcoal Canister – Positive Crank case ventilation system, Secondary air injection, thermal reactor and Laser Assisted Combustion.

UNIT - III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL [09]

Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay – Significance Effect of Operating variables on Emission formation – Fumigation, EGR, HCCI, Particulate Traps, SCR – Cetane number Effect.

UNIT - IV NOISE POLLUTION FROM AUTOMOBILES [09]

Sources of Noise – Engine Noise, Transmission Noise, Vehicle structural Noise, aerodynamics noise and Exhaust Noise. Noise reduction in Automobiles – Encapsulation technique for noise reduction – Silencer Design.

UNIT - V TEST PROCEDURES AND EMISSION MEASUREMENTS [09]

Constant Volume Sampling I & III Systems - Sampling Procedures – Chassis dyno, Seven mode and thirteen mode cycles for Emission Sampling – Sampling problems – Emission analysers– NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test and Sound level meters.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. B P Pundir, Engine Emissions, Narosa publications, New Delhi, Second Edition, 2017.
2. D J Patterson and N A Henin, Emission from Combustion Engine and their control, Anna Arbor Science Publication, Washington, 1985.

Reference Books :

1. Crouse and Anglin, Automotive Emission Control, Tata McGraw Hill company, New York, 1993.
2. C Duerson, Noise Abatment, Butterworths ltd., London, 1990.
3. Ganesan V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.
4. L Lberanek, Noise Reduction, Mcgrawhill Company, New York, 1993.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VI **Regulation : R2020**
Course code : 20AU612 **Course name : AUTOMOTIVE POLLUTION AND CONTROL**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the effects of automobile emissions on environment and human beings.	3	-	-	-	-	2	3	-	-	-	-	2	-	-
CO2	Describe the formation of major pollutants in SI engine and study pollutant control techniques.	3	-	-	-	-	2	3	-	-	-	-	2	-	-
CO3	Depict the formation of emission in CI engine and learn emission control techniques.	3	-	-	-	-	2	3	-	-	-	-	2	-	-
CO4	Recognize sources of noise pollution from automobiles and its reduction method.	3	-	-	-	-	2	3	-	-	-	-	2	-	-
CO5	Establish test procedures and emission measurements in automobile.	3	-	-	-	-	2	3	-	-	-	-	2	-	-
	Average	**3**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20AU613	**FINITE ELEMENT ANALYSIS**	3	1	0	4

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the* basic concepts of the finite element method.	*Understand*
CO2:	*Solve one dimensional problem using the concepts of Finite Element Analysis.*	*Apply*
CO3:	*Employ the concepts of FEA to solve two dimensional problems.*	*Apply*
CO4:	*Apply the FEA techniques to solve structural and heat transfer problems.*	*Apply*
CO5:	*Analyze the dynamic problems using Isoparametric formulations.*	*Analysis*

UNIT - I INTRODUCTION [12]

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems – Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT - II ONE-DIMENSIONAL PROBLEMS [12]

Finite element modeling – Coordinates and shape functions – Potential energy approach – Element matrices and vectors – Assembly for global equations – Boundary conditions – Shapes functions – Applications to axial loadings of rods – Extension to plane trusses – Bending of beams – Finite element formulation of stiffness matrix and load vectors – Assembly to global equations – Boundary conditions – Solutions and post processing – Example problems.

UNIT - III TWO DIMENSIONAL PROBLEMS [12]

Finite element modeling – CST element – Element equations, Load vectors and boundary conditions – Assembly – Plane stress, Plane strain and axisymmetric problems.

UNIT - IV APPLICATIONS OF FEA [12]

Eigen value problems – Application to one dimensional bar elements – lumped mass method – Application to engine cylinder heat transfer analysis (Conduction and Convection)

UNIT - V ISOPARAMETRIC FORMULATION [12]

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques – Solutions techniques to dynamic problems – Introduction to analysis software.

Total (L= 45, T = 15) = 60 Periods

Text Books :

1. Rao, S.S., The Finite Element Method in Engineering, Butterworth-Heinemann, Oxford, Sixth Edition, 2018.
2. Reddy, J.N. Introduction to the Finite Element Method, Tata McGraw Hill Co., New Delhi, Fourth Edition, 2018.

Reference Books :

1. Dhanaraj. R and Prabhakaran Nair. K, ―Finite Element Analysisǁ, Oxford Publications, Chennai, 2015.
2. Tirupathi R. Chandrupatla and Ashok D. Belegundu, Introduction to Finite Elements in Engineering, Pearson Education Limited, New Delhi, International Edition, 2014.
3. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Co., New Delhi, 2005
4. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill Co., New Delhi, 2000.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VI **Regulation : R2020**
Course code : 20AU613 **Course name : FINITE ELEMENT ANALYSIS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the basic concepts of the finite element method.	3	3	3	2	2	-	-	-	-	-	-	2	3	-
CO2	Solve one dimensional problem using the concepts of Finite Element Analysis.	3	3	3	2	2	-	-	-	-	-	-	2	3	-
CO3	Employ the concepts of FEA to solve two dimensional problems.	3	3	3	2	2	-	-	-	-	-	-	2	3	-
CO4	Apply the FEA techniques to solve structural and heat transfer problems.	3	3	3	2	2	-	-	-	-	-	-	2	3	-
CO5	Analyze the dynamic problems using Isoparametric formulations.	3	3	3	2	2	-	-	-	-	-	-	2	3	-
	Average	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20AU621	**VEHICLE COMPONENTS DESIGN AND ANALYSIS LABORATORY**	0	0	3	1

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Carryout structural analysis of chassis frame and connecting rod.*	*Analyze*
CO2:	*Conduct thermal analysis of piston and modal analysis of aerofoil profile housing.*	*Analyze*
CO3:	*Perform stress analysis of leaf spring and composite structure.*	*Analyze*
CO4:	*Simulate four bar mechanism and cam and follower.*	*Analyze*
CO5:	*Accomplish couple field analysis of brake disc and crash test analysis.*	*Analyze*

List of Experiments

1. Static structure analysis of chassis frame.
2. Transient analysis of connecting rod.
3. Thermal analysis of piston.
4. Modal analysis of aero foil profile housing.
5. Stress analysis of leaf spring.
6. Stress analysis of composite structure.
7. Simulation of four bar mechanism.
8. Simulation of cam and follower.
9. Couple field analysis of brake disc.
10. Model crash test analysis.

Total: 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**:**	**VI**	**Regulation**	**:**	**R2020**
Course code	**:**	**20AU621**	**Course name**	**:**	**VEHICLE COMPONENTS DESIGN AND ANALYSIS LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Carryout structural analysis of chassis frame and connecting rod.	3	3	3	3	3	-	-	-	3	2	-	-	3	-
CO2	Conduct thermal analysis of piston and modal analysis of aerofoil profile housing.	3	3	3	3	3	-	-	-	3	2	-	-	3	-
CO3	Perform stress analysis of leaf spring and composite structure.	3	3	3	3	3	-	-	-	3	2	-	-	3	-
CO4	Simulate four bar mechanism and cam and follower.	3	3	3	3	3	-	-	-	3	2	-	-	3	-
CO5	Accomplish couple field analysis of brake disc and crash test analysis.	3	3	3	3	3	-	-	-	3	2	-	-	3	-
	Average	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20AU622	**ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY**	0	0	3	1

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Acquire the basic knowledge of dynamometers and emission analysis of IC engines.*	*Understand*
CO2:	*Study valve timing and port timing diagrams, and conduct performance and emission test on two wheeler SI engine.*	*Understand*
CO3:	*Conduct performance and emission test on automotive multi-cylinder SI / CI engine.*	*Apply*
CO4:	*Carry out the retardation test on IC engines and conduct the heat balance test on multi-cylinder SI / CI engines.*	*Apply*
CO5:	*Perform morse test on multi-cylinder SI Engine and construct the P-θ & P-V diagrams for IC engine.*	*Analyze*

List of Experiments

1. Study of hydraulic, electrical and eddy current dynamometers.
2. Study of emission analysis of IC Engines.
3. Construct the Valve timing and port timing diagrams.
4. Performance and emission test on two-wheeler SI engine.
5. Performance test on automotive multi-cylinder SI / CI engine.
6. Emission test on automotive multi-cylinder SI / CI engine.
7. Retardation test on I.C. Engines.
8. Heat balance test on automotive multi-cylinder SI / CI engine.
9. Morse test on multi-cylinder SI engine.
10. Engine cylinder pressure measurement, P-θ and P-V diagrams for IC engine with piezo-electric pick up, charge amplifier, angle encoder and data acquisition system.

Total = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester	**: VI**	**Regulation**	**:**	**R2020**	
Course code	**: 20AU622**	**Course name**	**:**	**ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY**	

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Acquire the basic knowledge of dynamometers and emission analysis of IC engines.	3	3	-	-	-	-	3	-	3	2	-	-	-	-
CO2	Study valve timing and port timing diagrams, and conduct performance and emission test on two wheeler SI engine.	3	3	-	-	-	-	3	-	3	2	-	-	-	-
CO3	Conduct performance and emission test on automotive multi-cylinder SI / CI engine.	3	3	-	-	-	-	3	-	3	2	-	-	-	-
CO4	Carry out the retardation test on IC engines and conduct the heat balance test on multi-cylinder SI / CI engines.	3	3	-	-	-	-	-	-	3	2	-	-	-	-
CO5	Perform morse test on multi-cylinder SI Engine and construct the P-θ & P-V diagrams for IC engine.	3	3	-	-	-	-	-	-	3	2	-	-	-	-
	Average	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VI

		L	T	P	C
20HR614	**CAREER DEVELOPMENT SKILLS - IV**	0	2	0	0

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Employ critical thinking in personal interviews type situations.*	*Apply*
CO2:	*Understand the Quantitative Aptitude problems in geometry.*	*Understand*
CO3:	*Understand the data interpretation and analysis by using various graphs.*	*Understand*
CO4:	*Enhance the skills in resume writing and presentation.*	*Create*
CO5:	*Enhance the comprehension Skills in core subjects.*	*Apply*

UNIT - I WRITTEN AND ORAL COMMUNICATION – PART 2 **[06]**

Self-Introduction – GD – Personal Interview Skills Practices on Reading Comprehension Level 2 – Paragraph Writing – Newspaper and Book Review Writing – Skimming and Scanning – Interpretation of Pictorial Representations – Sentence Completion – Sentence Correction – Jumbled Sentences – Synonyms& Antonyms – Using the Same Word as Different Parts of Speech – Editing.

UNIT - II QUANTITATIVE APTITUDE **[06]**

Geometry – Straight Line – Triangles – Quadrilaterals – Circles – Co-ordinate Geometry – Cube – Cone – Sphere.

UNIT - III DATA INTERPRETATION AND ANALYSIS **[06]**

Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs Column Graphs, Bar Graphs, Line Charts, Pie Chart, Graphs representing Area, Venn Diagram & Flow Charts.

UNIT - IV RESUME WRITING & PRESENTATION SKILLS **[06]**

An Introduction to the Resume – Types of Resumes – Common Resume Errors – Anatomy of a Resume – What is a Cover Letter? – Types of Cover Letters – Enhancing the Language and Style of Your Resume and Cover Letter – Assessment.

Presentation Skills: Oral presentation and public speaking skills; business presentations. – Understand the Situation – Know Your Tools – Know Yourself – Organize it, Write the Script – Practice – Delivering a Presentation.

UNIT - V DOMAIN PROFICIENCY **[06]**

Competitive exam training: Automotive Transmission – Automotive Engine and Chassis Design – Automotive Electrical and Electronics – Alternate Fuels – Automotive Pollution and Control.

Total (L= 0, T = 30) = 30 Periods

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan, Hyderabad, 2011.

2 Abhijit Guha, Quantitative Aptitude, TMH, New Delhi, Third Edition,2009

Reference Books :

1 Agarwal. R.S, A Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.

2 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, New Delhi, second edition, 2012.

4 V.K. Mehta & Rohit Mehta, Objective Electrical Technology, S Chand publications, First Edition, 2012.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VI **Regulation : R2020**
Course code : 20HR614 **Course name : CAREER DEVELOPMENT SKILLS - IV**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Employ critical thinking in personal interviews type situations.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO2	Understand the Quantitative Aptitude problems in geometry.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO3	Understand the data interpretation and analysis by using various graphs.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO4	Enhance the skills in resume writing and presentation.	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO5	Enhance the comprehension Skills in core subjects.	3	-	-	-	2	-	-	-	1	3	-	2	-	-
	Average	1	-	-	-	2	-	-	-	**1**	**3**	**-**	**2**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20AU711	**VEHICLE DYNAMICS**	3	0	0	3

Prerequisite: Engineering Mechanics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Categorize vibration system according to the DOF.*	*Understand*
CO2:	*Discern the performance of vehicle due to acceleration and braking.*	*Understand*
CO3:	*Make use of vibration concepts to examine the vehicle response due to suspension system.*	*Apply*
CO4:	*Relate the tyre response according to the steering input.*	*Understand*
CO5:	*Criticize the stability of the vehicle on different drive conditions.*	*Evaluate*

UNIT - I CONCEPT OF VIBRATION [09]

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration – Response Analysis of Single, Two and Multi DOF - Magnification Factor, Transmissibility – Torsional Vibration, Critical Speed.

UNIT - II LONGITUDINAL DYNAMICS [09]

Aerodynamic Forces and Moments, Equation of Motion, Acceleration, Gradability – Calculation of Maximum Acceleration, Tractive Effort and Reaction Forces for Different Drive Vehicles, Power Limited Acceleration and Traction Limited Acceleration - Braking and Driving Torque – Brake Force Distribution, Braking Efficiency and Braking Distance.

UNIT - III VERTICAL DYNAMICS [09]

Sources of Vibration, Vibration Absorber – Design and Analysis of Passive, Active and Semi Active Suspension using Quarter Car, Bicycle Model, Half and Full Car Model – Influence of Suspension Stiffness, Suspension Damping and Tyre Stiffness – Air Suspension System and its Properties.

UNIT - IV LATERAL DYNAMICS [09]

Tyre Forces and Moments, Longitudinal and Lateral Forces at various Slip Angles, Rolling Resistance – Steady State Handling Characteristics, Yaw Velocity Gain, Lateral Acceleration Gain – Steering Dynamics, Direction Control of Vehicles, Roll Center, Roll Axis - Effects of Suspension on Cornering.

UNIT - V VEHICLE STABILITY [09]

Load Distribution, Calculation of Equivalent Weight, Determination of Centre of Gravity Location and Gyroscopic Effect - Stability of a Vehicle on a Slope, on a Curve and on Banked Road – Transient response Characteristics – Mimuro Plot for Lateral Transient Response.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014.
2. J. Y. Wong, "Theory of Ground Vehicles", Fourth Edition, Wiley-Interscience, 2008.

Reference Books :

1. R. NakhaieJazar, "Vehicle Dynamics: Theory and Application", 2nd edition, Springer, 2013
2. Dean Karnopp, "Vehicle Dynamics, Stability, and Control", 2nd Edition, CRC Press, 2013
3. Singiresu S. Rao, "Mechanical Vibrations," 5th Edition, Prentice Hall, 2010
4. Rajesh Rajamani, "Vehicle Dynamics and Control," 2nd edition, Springer, 2012

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VII **Regulation : R2020**
Course code : 20AU711 **Course name : VEHICLE DYNAMICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Categorize vibration system according to the DOF.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Discern the performance of vehicle due to acceleration and braking.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Make use of vibration concepts to examine the vehicle response due to suspension system.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Relate the tyre response according to the steering input.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Criticize the stability of the vehicle on different drive conditions.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20AU712	**ELECTRIC AND HYBRID VEHICLES**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the electric and hybrid vehicle operation and architectures.*	*Understand*
CO2:	*Explore the different subsystems of electric and hybrid vehicles.*	*Understand*
CO3:	*Demonstrate the energy requirement for vehicles.*	*Understand*
CO4:	*Select suitable motors and controllers for electric and hybrid vehicles.*	*Understand*
CO5:	*Summarize the vehicle characteristics, operating modes, and performance parameters.*	*Understand*

UNIT - I NEED FOR ALTERNATIVE SYSTEM [09]

Need for hybrid and electric vehicles – Main components and working principles of hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. Case study on specification of electric and hybrid vehicles.

UNIT - II SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES [09]

Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle- Economy of Hybrid Vehicles. Steering and Suspension system. Choice of Tyres.

UNIT - III ENERGY SOURCES [09]

Battery Parameters - Different types of batteries – Lead Acid- Nickel Metal Hydride – Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT - IV MOTORS AND CONTROLLERS [09]

Types of Motors, Characteristics of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT - V DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES [09]

Design requirement for electric vehicles- Range, Maximum velocity, Acceleration, Power requirement, Mass of the vehicle. Various resistance - Transmission efficiency- Electric vehicle chassis and body design, Electric vehicle recharging and refueling systems, Performance of electrical vehicles.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Iqbal Husain, Electric and Hybrid Vehicles-Design Fundamentals, CRC Press, New York, Second Edition, 2010.
2. MehrdadEhsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, Second Edition, 2009.

Reference Books :

1. James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.
2. Lino Guzzella, Vehicle Propulsion System, Springer, Berlin, Heidelberg, 2013
3. Ron HodKinson, Light Weight Electric/ Hybrid Vehicle Design, Butterworth Heinemann Publication,2001
4. Ronald K Jurgen, Electric and Hybrid – Electric Vehicles, SAE International, New York, 2011.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VII **Regulation : R2020**
Course code : 20AU712 **Course name : ELECTRIC AND HYBRID VEHICLES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the electric and hybrid vehicle operation and architectures.	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	Explore the different subsystems of electric and hybrid vehicles.	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO3	Demonstrate the energy requirement for vehicles.	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO4	Select suitable motors and controllers for electric and hybrid vehicles.	3	-	-	-	-	-	-	-	-	-	-	3	2	-
CO5	Summarize the vehicle characteristics, operating modes, and performance parameters.	3	-	-	-	-	-	-	-	-	-	-	3	2	-
	Average	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20AU713	**VEHICLE MAINTENANCE AND TESTING**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the maintenance of records and schedules.*	*Understand*
CO2:	*Inspect, repair and overhaul I.C. Engines.*	*Apply*
CO3:	*Explain the maintenance aspects of fuel, cooling, lubrication systems and vehicle body.*	*Understand*
CO4:	*Diagnose electrical and electronics systems fault of vehicle.*	*Apply*
CO5:	*Acquire knowledge on maintenance and testing of vehicle.*	*Understand*

UNIT - I MAINTENANCE OF RECORDS AND SCHEDULES [09]

Requirements and importance of maintenance, types of maintenance, preparation of check lists, Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance. Motor vehicle acts, insurance acts, traffic rules, motor vehicle driving rules and regulation.

UNIT - II ENGINE MAINTENANCE – REPAIR AND OVERHAULING [09]

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance, overhauling and engine tune up.

UNIT - III MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEM, LUBRICATION SYSTEM AND VEHICLE BODY [09]

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance.

UNIT - IV ELECTRICAL AND ELECTRONICS SYSTEM – SERVICING AND REPAIRS [09]

Testing methods for checking electrical and electronic components, checking battery, starter motor, charging systems, DC generator and alternator, ignition system, lighting system. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments – On board diagnostics tools.

UNIT - V MAINTENANCE AND TESTING OF VEHICLE [09]

Maintenance and servicing of suspension systems and steering systems - Wheel balancing and alignment. Laboratory testing – Testing of clutch, suspension, braking, steering etc. - Vehicle testing using chassis dynamometer - Road and track testing - Initial inspection, running in and durability, extensive driving, maximum speed, acceleration and ride comfort.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. John E. Dolce, Analytical Fleet Maintenance Management, SAE International, 3rd Edition, 2009.
2. James D. Halderman, Advanced Engine Performance Diagnosis, Pearson Education, 6th Edition, 2015.

Reference Books :

1. H.M. Gousha Company and Ken Layne, Engine performance diagnosis and tune-up, Canfield Press, 1978.
2. John Doke, Fleet Management, McGraw-Hill Co, 1984.
3. Service Manuals from different vehicle manufacturers.
4. William H. Crouse and Donald L. Anglin, Automotive Mechanics, Tata McGraw Hill Education Private Limited, 2007.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VII **Regulation : R2020**
Course code : 20AU713 **Course name : VEHICLE MAINTENANCE AND TESTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the maintenance of records and schedules.	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	Inspect, repair and overhaul I.C. Engines.	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO3	Explain the maintenance aspects of fuel, cooling, lubrication systems and vehicle body.	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO4	Diagnose electrical and electronics systems fault of vehicle.	3	-	-	-	-	-	-	-	-	-	-	3	-	3
CO5	Acquire knowledge on maintenance and testing of vehicle.	3	-	-	-	-	-	-	-	-	-	-	3	-	3
	Average	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20AU721	**VEHICLE MAINTENANCE AND RECONDITIONING LABORATORY**	0	0	3	1

Prerequisite:-

Course Outcomes : On successful completion of the course, the student will be able to		**Cognitive Level**
CO1:	*Acquire the basic knowledge on vehicle maintenance shop layout, tools and equipment.*	*Understand*
CO2:	*Become familiar with engine tuning and head light beam alignment.*	*Apply*
CO3:	*Carry out the wheel balancing.*	*Apply*
CO4:	*Perform wheel alignment and calibration of FIP.*	*Apply*
CO5:	*Accomplish seating of valve and cylinder reboring.*	*Apply*

List of Experiments:

Vehicle maintenance laboratory

1. Study the layout of automobile maintenance shop.
2. Study of automobile maintenance tools and instruments.
3. Tuning of diesel and petrol engines.
4. Head light beam alignment.
5. Removal of tyre and tube.
6. Wheel balancing.
7. Wheel alignment.

Re-Conditioning Laboratory

8. Calibration of fuel injection pump
9. Valve grinding, valve lapping and seating of valve in Cylinder head.
10. Cylinder reboring.

LIST OF EQUIPMENTS

Sl.No.	Name of the Equipment	Qty.
1	Cylinder compression pressure gauge	1 No.
2	Vacuum gauge	1 No.
3	Spark plug cleaner and tester	1 No.
4	Cam angle and rpm tester	1 No.
5	Tachometer	1 No.
6	Wheel alignment apparatus	1 No.
7	Tyre remover	1 No.
8	Engine analyzer	1 No.
9	Cylinder reboring machine	1 No.
10	Valve grinding machine	1 No.
11	Valve lapping stick with seat cutter	1 No.
12	Fuel injection calibration test bench with nozzle tester	1 No.
13	Head light beam alignment gauge	1 No.
14	Spanner set, screw driver and tools	1 Set.
15	HRD tester, clamp on meter and hydrometer	1 No. each
16	Wheel Balancer	1 No.

Total : 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VII **Regulation : R2020**

Course code : 20AU721 **Course name : VEHICLE MAINTENANCE AND RECONDITIONING LABORATORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Acquire the basic knowledge on vehicle maintenance shop layout, tools and equipment.	3	3	-	-	-	-	-	-	3	3	-	3	-	3
CO2	Become familiar with engine tuning and head light beam alignment.	3	3	-	-	3	-	-	-	3	3	-	3	**-**	**3**
CO3	Carry out the wheel balancing.	3	3	-	-	3	-	-	-	3	3	-	3	**-**	**3**
CO4	Perform wheel alignment and calibration of FIP.	3	3	-	-	3	-	-	-	3	3	-	3	**-**	**3**
CO5	Accomplish seating of valve and cylinder reboring.	3	3	-	-	3	-	-	-	3	3	-	3	-	3
	Average	**3**	**3**	**-**	**-**	**2.4**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20AU722	**INDUSTRIAL TRAINING AND SEMINAR**	0	0	3	1

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		**Cognitive Level**
CO1:	*Recollect and appreciate the basics of automobile and mechanical engineering concepts by self-learning.*	*Understand*
CO2:	*Gain knowledge about the present industrial scenario.*	*Understand*
CO3:	*Prepare a report and submit in the proper format.*	*Apply*
CO4:	*Present the outcome of the training as a seminar.*	*Apply*
CO5:	*Effectively communicate the content to the target audience and handle questions with confidence.*	*Analyze*

Guidelines:

1. The students have to undergo practical industrial training for two weeks in recognized industrial establishments during their vacation periods.
2. At the end of the training they have to submit a report with following information:
    i. Profile of Industry
    ii. Product range
    iii. Organization structure
    iv. Plant layout
    v. Processes / Machines / Equipment / Devices
    vi. Details of the training undergone
    vii. Learning points
3. The student will prepare a presentation individually about the industrial training for 15 minutes duration.
4. The assessments will be based equally on the report in the prescribed format and viva-voice examination by a committee nominated by the Head of the Department.

Total : 30 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VII **Regulation : R2020**
Course code : 20AU722 **Course name : INDUSTRIAL TRAINING AND SEMINAR**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recollect and appreciate the basics of automobile and mechanical engineering concepts by self-learning.	3	3	-	-	-	2	3	-	3	3	-	3	3	-
CO2	Gain knowledge about the present industrial scenario.	3	3	-	-	-	2	3	-	3	3	-	3	**3**	**-**
CO3	Prepare a report and submit in the proper format.	3	3	-	-	-	2	3	-	3	3	-	3	**3**	**-**
CO4	Present the outcome of the training as a seminar.	3	3	-	-	-	2	-	-	3	3	-	3	**3**	**-**
CO5	Effectively communicate the content to the target audience and handle questions with confidence.	3	3	-	-	-	2	-	-	3	3	-	3	3	-
	Average	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**3**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VII

		L	T	P	C
20AU723	**PROJECT - I**	0	0	6	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate a sound technical knowledge of project.*	*Evaluate*
CO2:	*Undertake problem identification, formulation and solution.*	*Analyze*
CO3:	*Design engineering solutions through a systematic approach.*	*Analyze*
CO4:	*Communicate with peer groups in written and oral forms.*	*Evaluate*
CO5:	*Demonstrate the knowledge, skill and attitude of an engineer.*	*Evaluate*

Guidelines

1. The project work in Phase – I and II may contain a theoretical study and analysis, experimental analysis, design, modeling & simulation, fabrication of a model or a prototype or a combination of the above related to automotive area.
2. The project work may include literature review, modeling, analysis, simulation, fabrication, testing and analysis & correlation of test data etc.
3. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member.
4. The progress of the project is evaluated based on a minimum of three reviews and end semester review.
5. In Phase-I of the project, literature survey, projects task plan and design phases should have been completed
6. A project report is required at the end of the semester.
7. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total (L= 45, T = 0) = 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215

DEPARTMET OF AUTOMOBILE ENGINEERING

CO-PO MAPPING

Semester : VII **Regulation : R2020**
Course code : 20AU723 **Course name : PROJECT - I**

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate a sound technical knowledge of project.	3	3	3	3	3	3	-	-	3	3	3	3	3	3
CO2	Undertake problem identification, formulation and solution.	3	3	3	3	3	3	-	-	3	3	3	3	3	3
CO3	Design engineering solutions through a systematic approach.	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	Communicate with peer groups in written and oral forms.	3	3	3	3	3	3	-	-	3	3	3	3	3	3
CO5	Demonstrate the knowledge, skill and attitude of an engineer.	3	3	3	3	3	3	-	-	3	3	3	3	3	3
	Average	**3**	**3**	**3**	**3**	**3**	**3**	**0.6**	**0.6**	**3**	**3**	**3**	**3**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VIII

		L	T	P	C
20AU811	**TRANSPORT MANAGEMENT**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the concept of personnel management objectives and functions.*	*Understand*
CO2:	*Explain the various transport systems and their advantages.*	*Understand*
CO3:	*Categorize the scheduling and fare structure.*	*Understand*
CO4:	*State the need and requirement of documentation and certification.*	*Understand*
CO5:	*Acquire knowledge on various activities of preventive maintenance system.*	*Understand*

UNIT - I INTRODUCTION [09]

Personnel management, objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure and psychological tests.

UNIT - II TRANSPORT SYSTEMS [09]

Introduction to various transport systems. Advantages of motor transport, principal function of administrative, traffic, secretarial and engineering divisions. Chain of responsibility forms of ownership by state, municipality, public body and private undertakings.

UNIT - III SCHEDULING AND FARE STRUCTURE [09]

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

UNIT - IV MOTOR VEHICLE ACT [09]

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle – tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time and test for competence to drive, Insurance act in motor vehicle, contemporary issues, Smart RC card.

UNIT - V MAINTENANCE [09]

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear, remedies, maintenance procedure for better fuel economy and Design of bus depot layout.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. John E. Dolce, Analytical Fleet Maintenance Management, SAE International, New York, Third Edition, 2009.
2. Kitchin.L.D. Bus Operation, Illiffee and Sons Co., London, Third edition, 1992.

Reference Books :

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.
2. Ejaz Ahemed, The motor vehicle Act 1939, Ashok law house, India, 1989.
3. John Duke., Fleet Management, Tata McGraw Hill Co., New York, 1994.
4. Government Motor Vehicle Act – Eastern Book Company, Lucknow – 1989

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VIII **Regulation : R2020**
Course code : 20AU811 **Course name : TRANSPORT MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline the concept of personnel management objectives and functions.	-	-	3	-	-	3	-	3	3	3	3	-	3	2
CO2	Explain the various transport systems and their advantages.	-	-	3	-	-	3	-	3	3	-	3	-	**3**	2
CO3	Categorize the scheduling and fare structure.	-	-	3	-	-	3	-	3	-	-	3	-	**3**	**-**
CO4	State the need and requirement of documentation and certification.	-	-	3	-	-	3	-	3	-	-	3	-	**3**	**-**
CO5	Acquire knowledge on various activities of preventive maintenance system.	-	-	3	-	-	3	-	3	-	-	3	-	3	-
	Average	**-**	**-**	**3**	**-**	**-**	**3**	**-**	**3**	**1.2**	**0.6**	**3**	**-**	**3**	**0.8**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - VIII

		L	T	P	C
20AU821	**PROJECT – II**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Identify and study the practical problems related to automotive industry.	*Understand*
CO2:	Able to develop a solution for the problem.	*Understand*
CO3:	Recognize the project management techniques.	*Understand*
CO4:	Comprehend the industrial scenarios.	*Apply*
CO5:	Demonstrate their report writing and presentation skills	*Apply*

Guidelines:

- To continue the Phase – I project and executing the same in consultation with the project coordinator and project guide
- A detailed analysis / modeling / simulation / design / problem solving/experiment is a must to complete and an effort leading to paper publication or patenting is desired.
- A working model or prototype is to be submitted for end semester evaluation
- A project report is required to be submitted at the end of the semester in the required format.
- Project work done at Industry should be duly supported by certificate from the Industry.
- The progress of the project is evaluated based on a minimum of three reviews and end semester review.

The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total : 45 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Semester : VIII **Regulation : R2020**
Course code : 20AU821 **Course name : PROJECT – II**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify and study the practical problems related to automotive industry.	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	Able to develop a solution for the problem.	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	Recognize the project management techniques.	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	Comprehend the industrial scenarios.	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	Demonstrate their report writing and presentation skills	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VI (Professional Elective – I)

		L	T	P	C
20AU661	**AUTOMOTIVE AIR CONDITIONING**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the components of automobile air conditioning system and its operation*	*Understand*
CO2:	*Know the control methods of automobile air conditioner and heating system*	*Understand*
CO3:	*Impart knowledge about refrigerants and its handling system*	*Understand*
CO4:	*Familiarize with air routing, temperature control and handling system*	*Understand*
CO5:	*Provide maintenance and service of air conditioning system*	*Apply*

UNIT - I AIR CONDITIONING FUNDAMENTALS [09]

Basic air conditioning system – location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator and evaporator temperature regulator.

UNIT - II AIR CONDITIONER AND HEATING SYSTEM [09]

Manually controlled air conditioner and heater system, Automatically controlled air conditioner and heater systems, Automatic climate control and air conditioner protection.

UNIT - III REFRIGERANT AND HANDLING SYSTEM [09]

Refrigerant – types and properties, containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure and ambient conditions affecting system pressures.

UNIT - IV AIR ROUTING AND TEMPERATURE CONTROL [09]

Objectives, evaporator airflow through the recirculation unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

UNIT - V AIR CONDITIONING SERVICE [09]

Air conditioner maintenance and service, servicing heater system, removing and replacing components, trouble shooting of air controlling system, compressor service.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. William H. Crouse and Donald I. Anglin – “Automotive Air conditioning” – McGraw Hill Inc. – 2019
2. Boyce H.D Wiggins –”Automotive Air Conditioning” – Delmar – 2012

Reference Books :

1. Mitchell information Services, Inc “Mitchell Automatic Heating and Air Conditioning Systems” PHI – 2014
2. Paul Weiser – “Automotive Air Conditioning” – Reston Publishing Co., Inc., - 2019
3. MacDonald, K.I., - “Automotive Air Conditioning” – Theodore Audel series – 2016
4. Goings.L.F. – “Automotive Air Conditioning” – American Technical services -2014

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU661 **Course name : AUTOMOTIVE AIR CONDITIONING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the components of automobile air conditioning system and its operation	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	Know the control methods of automobile air conditioner and heating system	3	-	-	-	-	-	-	-	-	-	-	-	**-**	**3**
CO3	Impart knowledge about refrigerants and its handling system	3	-	-	-	-	-	-	-	3	-	-	-	**-**	**3**
CO4	Familiarize with air routing, temperature control and handling system	3	-	-	-	-	-	-	-	3	-	-	-	**-**	**3**
CO5	Provide maintenance and service of air conditioning system	3	-	-	-	-	-	-	-	3	-	-	-	-	3
	Average	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VI (Professional Elective – I)

		L	T	P	C
20AU622	**ALTERNATIVE FUELS AND ENERGY SYSTEMS**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the possible ways of using alcohols as a fuel in the IC engines.*	*Understand*
CO2:	*Infer the challenges and difficulties in using vegetable oil as an alternative fuel in IC engines.*	*Understand*
CO3:	*Identify the uses of hydrogen as fuel in SI and CI engines.*	*Remember*
CO4:	*Relate the usefulness of biogas, natural gas and LPG as fuels in SI and CI engines.*	*Apply*
CO5:	*Identify the layouts and different configurations of electric, hybrid and fuel cell vehicles.*	*Remember*

UNIT - I ALCOHOLS AS FUELS [09]

Introduction to alternative fuels – Need for alternative fuels – Availability of different alternative fuels for SI and CI engines. Alcohols as fuels - Production methods of alcohols - Properties of alcohols as fuels - Methods of using alcohols in CI and SI engines - Blending, dual fuel operation, surface ignition and oxygenated additives - Performance, emission and combustion characteristics in CI and SI engines

UNIT - II VEGETABLE OILS AS FUELS [09]

Various vegetable oils and their important properties - Different methods of using vegetable oils in IC engines – Blending, preheating, trans-esterification and emulsification of vegetable oils – Performance, emission and combustion characteristics in IC engines.

UNIT - III HYDROGEN AS ENGINE FUEL [09]

Production methods of hydrogen - Combustive properties of hydrogen - Problems associated with hydrogen as fuel and solutions - Different methods of using hydrogen in SI and CI engines - Performance, emission and combustion analysis in engines - Hydrogen storage – Safety aspects of hydrogen.

UNIT - IV BIOGAS, NATURAL GAS AND LPG AS FUELS [09]

Production methods of biogas, natural gas and LPG - Properties studies - CO_2 and H_2S scrubbing in Biogas, Modification required to use in SI and CI Engines – Performance and emission characteristics of biogas, CNG and LPG in SI and CI engines.

UNIT - V ELECTRIC, HYBRID AND FUEL CELL VEHICLES [09]

Layout of electric vehicle and hybrid vehicles – Advantages and drawbacks of electric and hybrid vehicles - System components, electronic control system – Different configurations of hybrid vehicles - Power split device - High energy and power density batteries – Basics of fuel cell vehicles.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Ayhan Demirbas, Biodiesel - A Realistic Fuel Alternative for Diesel Engines, Springer-Verlag London Limited , 2008, ISBN 13: 9781846289941
2. Society of Automotive Engineers Inc, 2014. Society of Automotive Engineers Inc, 2014, ISBN 13: 9780768000528

Reference Books :

1. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS Press Champaign, Illinois, 2005.
2. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
3. Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) on biofuels.
4. Mehrdad Ehsani, YiminGao , Stefano Longo and Kambiz Ebrahimi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, CRC Press; 3rd edition, 2018.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU622 **Course name : ALTERNATIVE FUELS AND ENERGY SYSTEMS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the possible ways of using alcohols as a fuel in the IC engines	3	-	-	-	-	-	3	-	-	-	-	3	-	-
CO2	Infer the challenges and difficulties in using vegetable oil as an alternative fuel in IC engines.	3	-	-	-	-	-	3	-	-	-	-	3	-	-
CO3	Identify the uses of hydrogen as fuel in SI and CI engines as an alternative for fossil fuels.	3	-	-	-	-	--	3	-	-	-	-	3	-	--
CO4	Relate the usefulness of biogas, natural gas and LPG as fuels in SI and CI engines.	3	-	-	-	-	-	3	-	-	-	-	3	-	-
CO5	Identify the layouts and different configurations of electric, hybrid and fuel cell vehicles.	3	-	-	-	-	-	3	-	-	-	-	3	-	-
	Average	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VI (Professional Elective – I)

		L	T	P	C
20AU663	**AUTONOMOUS VEHICLE TECHNOLOGY**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate different autonomous vehicles.*	*Understand*
CO2:	*Explain the function of electronic control systems for autonomous vehicle.*	*Understand*
CO3:	*Compute and predict the navigation of autonomous vehicle.*	*Understand*
CO4:	*Perceive the concepts of localization and perception of autonomous vehicles.*	*Understand*
CO5:	*Explore integration of sensor data to ON Board control systems.*	*Understand*

UNIT - I INTRODUCTION TO AUTONOMOUS VEHICLES [09]

Automated guided vehicles, trucks, drones, or different types of special vehicles, such as mobile robots, autonomous armoured fighting vehicles and automated highway systems.

UNIT - II ELECTRONIC CONTROL SYSTEMS [09]

Basic control system, operation of ECUs, surroundings sensing systems and wireless data networks-autonomous driving technology, motion planning, feedback control, path and trajectory, traffic decider.

UNIT - III AUTONOMOUS VEHICLE NAVIGATION [09]

Path planning algorithms, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP), intelligent motion planner.

UNIT - IV COMPUTER VISION FOR PERCEPTION AND LOCALIZATION [09]

Introduction, building computer vision hardware, computing, calibration target, multiple camera calibration, VSLAM overview, Running stereo datasets, Perception, and localization interface.

UNIT - V ADVANCED DRIVER ASSISTANCE SYSTEMS [09]

Radar Technology and Systems, Lidar Sensor Technology and Systems, Camera Technology, Night Vision Technology Sensor Data Fusion, Integration of Sensor Data to On-Board Control Systems, Troubleshooting and Maintenance.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. James M. Anderson, Autonomous Vehicle Technology, Rand Corporation, Santa Monica, Calif., Revised Edition, 2016.
2. R. Siegwart, I. R. Nourbakhsh, “Introduction to Autonomous Mobile Robots”, The MIT Press, 2011.

Reference Books :

1. Autonomous Vehicle edited by Andrzej Zak September 7th, 2016, DOI: 10.5772/61898.
2. Ronald K Jurgen, Navigation and Intelligent Transportation Systems – Progress in Technology, Automotive Electronics Series, SAE, USA, 1998.
3. LjuboVlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, 2001.
4. H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun, Principles of Robot Motion: Theory, Algorithms and Implementations, PHI Ltd., 2005.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU663 **Course name : AUTONOMOUS VEHICLE TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate different autonomous vehicles.	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	Explain the function of electronic control systems for autonomous vehicle.	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	Compute and predict the navigation of autonomous vehicle.	3	-	-	-	3	-	-	-	-	-	-	3	-	-
CO4	Perceive the concepts of localization and perception of autonomous vehicles.	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	Explore integration of sensor data to ON Board control systems.	3	-	-	-	3	-	-	-	-	-	-	3	-	3
	Average	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VI (Professional Elective – I)

		L	T	P	C
20AU664	**TYRE TECHNOLOGY**	3	0	0	3

Prerequisite: NIL

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the constructional features of tyre.*	*Remember*
CO2:	*Outline the on road performance of tyres.*	*Understand*
CO3:	*Observe the dynamic behaviour of automotive tyres.*	*Understand*
CO4:	*Identify the tyre defects, reconditioning and failure analysis.*	*Understand*
CO5:	*Study the non-destructive tests, recovery and recycling of tyres.*	*Understand*

UNIT - I BASICS OF TYRES [09]

Types of tyres, tyre components and its role, tread patterns, outline of production of tyres, Requirements and function of tyres–Tyre Performance Criteria – Indoor Test and Outdoor Test –Tyre Manufacturing - Compound Preparation– Basic concepts of Tread Extrusion – Effect of viscosity & temperature on extrusion – Die swell & shrinkage phenomenon – Calendering – Tyre Assembly – Curing – Inspection – Quality Control Tests.

UNIT - II TYRE FORCES AND MOMENTS [09]

Forces and Moments – Rolling Resistance – Cornering Properties – Slip Angle and Cornering Force – Performance of tyre on Wet Surface – Ride Properties of tyres – Study of tyre types based on different road conditions and applications.

UNIT - III RUBBER ABRASION AND TYRE WEAR [09]

Sliding Abrasion – Tyre Wear – Influence of Road Surface – Driving Influences – Speed and Load Distributions – Road Wear and Force Distribution.

UNIT - IV TYRE RETREADING, TYRE DURABILITY AND FAILURE ANALYSIS [09]

Defects of tyres – classification of defects – causes and discussions - Examination of: (i) Returned tyres (ii) Tyres for Re-treading - Norm of tyre adjustments for fast wear, poor Re-treading bead / casing failures. Hot and cold process. Service - Maintenance Safety - On Vehicle - In-Service Safety - Fundamentals of tyre durability - Nature of Tyre Durability- Deflection, Heat, Speed, Tyre Structural Failures - Common In-Service Tyre failure Modes - Run low / Flux Break- Tyre tread bead detachment - Rapid air loss - Over Deflection - Intra-Carcass Pressurization- Cuts And Punctures- Improper Repair.

UNIT - V NON-DESTRUCTIVE TESTS AND INSPECTIONS, RECOVERY AND RE-USE [09]

Introduction of Inspection Techniques - X-Ray Examination – Shearography – Ultrasound – Eddy Currents - Recovery and Re-use Reclaiming Technology – Surface Treatment – Grinding and Pulverization technology – Devulcanization Technology Use of Recovered Tyre rubber.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Tom French, Tyre technology, The University of Michigan, 1989.
2. Brendan Rodgers,Tire Engineering: An Introduction,2020

Reference Books :

1. J. Y. Wong, “Theory of Ground Vehicles”, 4th Edition“2008
2. US Department of Transportation., “The Pneumatic Tire”, 2006
3. Bireswar Banerjee, “Tyre Retreading” Smithers Information Ltd., 2015
4. V. L. Shulman, “Tyre Recycling” Rapra Review Reports Volume 15, Number 7, 2004

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU664 **Course name : TYRE TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the constructional features of tyre.	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	Outline the on road performance of tyres.	3	-	-	-	-	-	2	-	-	-	-	3	-	-
CO3	Observe the dynamic behaviour of automotive tyres.	3	-	-	-	-	-	2	-	-	-	-	-	-	3
CO4	Identify the tyre defects, reconditioning and failure analysis.	3	-	-	-	-	-	2	-	-	-	-	-	-	3
CO5	Study the non-destructive tests, recovery and recycling of tyres.	3	-	-	-	-	-	2	-	-	-	-	-	-	3
	Average	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VI (Professional Elective – I)

		L	T	P	C
20AU665	**AUTOMOTIVE AERODYNAMICS**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the basic principles of aerodynamics for automotive vehicle body.*	*Remember*
CO2:	*Summarize the lift and drag forces of cars.*	*Understand*
CO3:	*Demonstrate the basics of shape optimization of cars.*	*Understand*
CO4:	*Identify the characteristics of forces and moments on vehicles.*	*Apply*
CO5:	*Apply the wind tunnel technology for automotive vehicles.*	*Apply*

UNIT - I INTRODUCTION [09]

Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics.

UNIT - II AERODYNAMIC DRAG OF CARS [09]

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

UNIT - III SHAPE OPTIMIZATION OF CARS [09]

Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

UNIT - IV VEHICLE HANDLING [09]

The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

UNIT - V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS [09]

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. "Aerodynamics for Engineers" – Sixth Edition – John J. Bertin, Russell M.Cummings - 2022
2. Hucho.W.H. - "Aerodynamic of Road Vehicles" - Butterworths Co., Ltd., - 1997.

Reference Books :

1. "A Century of Car Aerodynamics" – the science and arts of cars and airflow - Julian Edgar – 2021
2. "Modifying the Aerodynamics of your Road Car" – Julian Edgar - 2019
3. "Race Car Aerodynamics" – The art of faster Techniques – Ronald Milione - 2022
4. "Vehicle Aerodynamics", SP-1145, Society of Automotive Engineers Inc, 1996.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU665 **Course name : AUTOMOTIVE AERODYNAMICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the basic principles of aerodynamics for automotive vehicle body.	3	2	2	-	-	-	-	-	-	-	-	2	2	-
CO2	Summarize the lift and drag forces of cars.	3	2	2	-	-	-	-	-	-	-	-	2	2	-
CO3	Demonstrate the basics of shape optimization of cars.	3	2	2	-	-	-	-	-	-	-	-	2	2	-
CO4	Identify the characteristics of forces and moments on vehicles.	3	2	2	-	-	-	-	-	-	-	-	2	2	-
CO5	Apply the wind tunnel technology for automotive vehicles.	3	2	2	-	-	-	-	-	-	-	-	2	2	-
	Average	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VI (Professional Elective – I)

		L	T	P	C
20AU666	**COMPUTATIONAL FLUID DYNAMICS**	3	0	0	3

Prerequisite: Fluid Mechanics, Applied Thermodynamics and Heat Transfer.

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Know the applications of continuity, momentum and energy equations in CFD.*	*Remember*
CO2:	*Conceive all kinds of derivatives for the solution of fluid flow.*	*Understand*
CO3:	*Perceive finite volume method in heat transfer.*	*Understand*
CO4:	*Discern the convection and diffusion in different dimensions.*	*Understand*
CO5:	*Harness the solution methods for incompressible and compressible flows.*	*Apply*

UNIT - I INTRODUCTION TO CFD AND GOVERNING EQUATIONS [09]

CFD overview - Applications of CFD, Need of CFD as tool, role in R&D. Models of the fluid flow, Substantial derivative, Divergence of the velocity. Governing equations of fluid dynamics – Continuity, Momentum and Energy equations, Physical boundary conditions, Mathematical behaviour of PDEs on CFD - Elliptic, and Parabolic and Hyperbolic equations.

UNIT - II FINITE DIFFERENCE METHOD [09]

Basic aspects of Discretization - Derivation of finite difference equations - Approximation of the first Derivative, Approximation of the second derivative, Approximation of the mixed derivative – Elliptic equations, Parabolic equations - Explicit and Implicit approaches.

UNIT - III FINITE VOLUME METHOD [09]

Derivation from conservation laws, control volumes, surface and volume integrals, fluxes and sources, Computational heat transfer - Steady one & two dimensional heat conduction, Unsteady one-dimensional heat conduction - Nonisothermal flows, turbulent flows, multiphase flows.

UNIT - IV CONVECTION AND DIFFUSION [09]

Steady one-dimensional convection and diffusion - Central difference, upwind, quick, exponential, hybrid and power law schemes - velocity-stream function approach, solution of Navier-Stokes equations.

UNIT - V COMPUTATIONAL FLUID FLOW [09]

Solution methods for incompressible flows – collocated and staggered grid, Pressure correction equations, SIMPLE and SIMPLER Algorithm, Types of Turbulence modeling –Two equation (k-Є) models, Solution methods for compressible flows – Importance of conservation and upwinding, Applications to inviscid compressible flows.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Anderson J. D. – 'Computational Fluid Dynamics: The Basics with applications' – McGraw Hill – 2007.
2. Chung T.J, Computational Fluid Dynamics, Cambridge University Press, 2014.

Reference Books :

1. Versteeg H.K and Malalasekara W, An Introduction to Computational Fluid Dynamics - The Finite Volume Method, 2nd Edition, Pearson, 2010.
2. Muralidhar, K., and Sundararajan, T., Computational Fluid Flow and Heat Transfer, Narosa Publishing House, NewDelhi, 2004.
3. Sengupta T. K. – 'Fundamentals of Computational Fluid Dynamics' – Universities Press – 2004.
4. Ghoshdastidar, Computational fluid dynamics and heat transfer, Cengage learning, 2017.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU666 **Course name : COMPUTATIONAL FLUID DYNAMICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Know the applications of continuity, momentum and energy equations in CFD.	3	2	2	-	2	-	-	-	-	-	-	2	3	-
CO2	Conceive all kinds of derivatives for the solution of fluid flow.	3	1	2	-	3	-	-	-	-	-	-	2	**3**	**-**
CO3	Perceive finite volume method in heat transfer.	3	1	3	-	3	-	-	-	-	-	-	2	**3**	**-**
CO4	Discern the convection and diffusion in different dimensions.	3	1	2	2	-	-	-	-	-	-	-	2	**3**	**-**
CO5	Harness the solution methods for incompressible and compressible flows.	3	2	2	3	3	-	-	-	-	-	-	2	3	-
	Average	**3**	**1**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – II)

		L	T	P	C
20AU761	**ADVANCED THEORY OF I.C. ENGINES**	3	0	0	3

Prerequisite: Engineering Thermodynamics and Heat Transfer

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the basics of combustion reactions and its characteristics.*	*Understand*
CO2:	*Write combustion equation for hydrocarbon fuels.*	*Understand*
CO3:	*Identify the gas exchange processes of I.C. Engines.*	*Understand*
CO4:	*Calculate the combustion and reaction kinetics in IC Engines.*	*Apply*
CO5:	*Demonstrate the advances in combustion engines.*	*Understand*

UNIT – I THEORY OF COMBUSTION [09]

Combustion reactions and stochiometry, heat of reaction, adiabatic flame temperature in constant pressure and constant volume systems, fuels for internal combustion engines and their properties, premixed and diffusion combustion as applicable to SI and CI engines, concepts of burning rate and flame velocity, fuel spray characteristics and combustion in diesel engines

UNIT – II ADIABATIC FLAME TEMPERATURE [09]

Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state. SI Engine simulation with air as working medium, deviation between actual and ideal cycle.

UNIT – III GAS EXCHANGE PROCESSES [09]

Inlet and exhaust process, Volumetric efficiency, Quasi static effects, flow through valves, residual gas fraction, scavenging in two stroke cycle engines, flow through ports, supercharging and turbo charging – turbo lag.

UNIT – IV CHEMICAL KINETICS OF COMBUSTION [09]

Elementary reactions, Pre-ignition kinetics, Ignition delay Nitric Oxide Kinetics, Soot Kinetics, Calculations, – Reaction control effect on Engine performance and emissions.

UNIT – V ADVANCED COMBUSTION ENGINES [09]

Homogeneously charged compressed ignition engines, controlled auto ignition, LHR engines, Surface ignition concept and multi fuel engines, stratified charge and lean burn engines, performance and emission characteristics, merits and demerits.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Ganesan.V, Internal Combustion Engineering, Tata McGraw Hill Publishing Co., New Delhi, Fourth Edition, 2017.
2. B.P. Pundir I.C. Engines Combustion and Emission, Narosa Publishing House, 2010.

Reference Books :

1. J.F. Ferguson, Internal Combustion Engines, John Wiley and Sons, 2004.
2. Robert Bosch, Automotive Hand book, Eighth Edition, 2011.
3. Heywood J.B, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education., New York, 2018.
4. Ashley Campbel, Thermodynamic Analysis of Combustion Engine Processes, Tata McGraw Hill Publishing Co., New Delhi, 2006.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU761 **Course name : ADVANCED THEORY OF I.C. ENGINES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the basics of combustion reactions and its characteristics.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO2	Write combustion equation for hydrocarbon fuels.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Identify the gas exchange processes of I.C. Engines.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO4	Calculate the combustion and reaction kinetics in IC Engines.	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	Demonstrate the advances in combustion engines.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
	Average	**3**	**0.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – II)

		L	T	P	C
20AU762	**AUTOMOTIVE VEHICLE SAFETY**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the safety concepts in relation to the vehicle body*	*Understand*
CO2:	*Elucidate the safety systems available for passenger*	*Understand*
CO3:	*Recognize about the Collision avoiding systems*	*Understand*
CO4:	*Understand the Comfort conditions for a vehicle driver*	*Understand*
CO5:	*Analyze human response inside the vehicle due to barrier impacts.*	*Apply*

UNIT - I SAFETY CONCEPTS [09]

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact

UNIT - II PASSENGER SAFETY [09]

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tilt able steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

UNIT - III COLLISION [09]

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions

UNIT - IV DRIVER COMFORT AND CONVENIENCE SYSTEM [09]

Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system

UNIT - V ERGONOMICS AND HUMAN RESPONSE TO IMPACT [09]

Importance of Ergonomics in Automotive Safety, Locations of Controls, Anthropometry, Human Impact Tolerance - Determination of Injury Thresholds, Severity Index, Study of Comparative Tolerance, Application of Trauma for Analysis of Crash Injuries.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Jullian Happian-Smith ‘An Introduction to Modern Vehicle Design’ SAE, 2002.
2. Johnson, W., and Mamalis, A.G., "Crashworthiness of Vehicles, MEP, London, 1995.

Reference Books :

1. Pantazis. M, Visual instrumentation: Optical design & engineering Principles, McGraw - Hill 1999.
2. Rollover Prevention, Crash Avoidance, Crashworthiness, Ergonomics and Human Factors”, SAE Special Publication, November 2003.
3. Bosch – Automotive - Handbook, edition 5-SAE Publication - 2000.
4. David C. Viano, “Role of the Seat in Rear Crash Safety”.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU762 **Course name : AUTOMOTIVE VEHICLE SAFETY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the safety concepts in relation to the vehicle body	3	-	-	-	-	2	3	-	-	-	-	2	-	2
CO2	Elucidate the safety systems available for passenger	3	-	-	-	-	2	3	-	-	-	-	2	-	2
CO3	Recognize about the Collision avoiding systems	3	-	-	-	-	2	3	-	-	-	-	2	-	2
CO4	Understand the Comfort conditions for a vehicle driver	3	-	-	-	-	2	3	-	-	-	-	2	-	2
CO5	Analyze human response inside the vehicle due to barrier impacts.	3	-	-	-	-	2	3	-	-	-	-	2	-	2
	Average	**3**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – II)

		L	T	P	C
20AU763	**TWO AND THREE WHEELERS**	3	0	0	3

Prerequisite: NIL

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the suitable power unit for two and three wheelers.*	*Remember*
CO2:	*Summarize the chassis and sub-systems of two and three wheelers.*	*Understand*
CO3:	*Select suitable brakes, wheels and tyres for two and three wheelers.*	*Understand*
CO4:	*Explore the major Indian two wheelers.*	*Understand*
CO5:	*Survey the major Indian three wheelers.*	*Understand*

UNIT - I POWER UNIT [09]

Two stroke SI engine, four stroke SI engine – merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes – merits and demerits, scavenging efficiency, scavenging pumps. Rotary valve engine – Fuel system – Lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system, and variable timing ignition system. Starting system – Kick starter system.

UNIT - II CHASSIS AND SUB–SYSTEMS [09]

Mainframe and its types, Chassis. Chain drive and shaft drive, Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

UNIT - III BRAKES, WHEELS AND TYRES [09]

Drum brakes, Disc brakes, front and rear brake links, layouts. Spoked wheel, cast wheel, disc wheel, disc types. Tyres and tubes-types, alloy wheels.

UNIT - IV TWO WHEELERS [09]

Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, Hero, Honda motorcycles, Bajaj scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance

UNIT - V THREE WHEELERS [09]

Case study of Indian models. Front mounted engine and rear mounted engine types. Auto rickshaws, pickup van, delivery van and trailer. Maintenance and Fault tracing.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Irving. P. E., Motor Cycle Engineering, Temple Press Book, London, 1992.
2. The Cycle Motor Manual, Temple Press Limited, London, 1990.

Reference Books :

1. Marshall Cavendish, Encyclopedia of Motor cycling, 20 volumes, New York and London, 1989.
2. Ramalingam. K. K., Two Wheelers, Scitech publications, Chennai, 2009.
3. Raymond Broad Lambretta, A Practical Guide to maintenance and repair, S. Chand & Co., New Delhi, 1987.
4. Brayant R.V, Vespa, Maintenance and Repair Series, S. Chand & Co., New Delhi, 1986.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU763 **Course name : TWO AND THREE WHEELERS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify the suitable power unit for two and three wheelers.	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	Summarize the chassis and sub-systems of two and three wheelers.	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	Select suitable brakes, wheels and tyres for two and three wheelers.	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO4	Explore the major Indian two wheelers.	3	2	-	-	3	-	-	-	2	-	-	3	-	3
CO5	Survey the major Indian three wheelers.	3	2	-	-	3	-	-	-	2	-	-	3	-	3
	Average	**3**	**1.2**	**-**	**-**	**1.2**	**-**	**-**	-	**0.8**	**-**	**-**	**3**	**-**	**1.2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – II)

		L	T	P	C
20AU764	**DESIGN OF CHASSIS COMPONENTS**				
	(Use of Standard and approved Design Data Book is permitted)	3	0	0	3

Prerequisite: Design of Machine Elements

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer the stresses and moments on action of different loads on frames*	*Understand*
CO2:	*Illustrate the loads acting on the front axle and steering*	*Understand*
CO3:	*Construct the clutch type conforming to the need*	*Apply*
CO4:	*Select the appropriate gear box*	*Apply*
CO5:	*Elucidate the design of final drive*	*Understand*

UNIT - I VEHICLE FRAME AND SUSPENSION [09]

Types of Frames, Loads acting on Frames, Moments and Stresses created – Design of Frame for Passenger and Commercial Vehicles – Design of Leaf Springs, Coil Springs and Torsion Bar Springs.

UNIT - II FRONT AXLE AND STEERING SYSTEM [09]

Design of Front Axle Beam – Study of mechanics at different sections of Front Axle – Determination of Bearing Loads at Kingpin Bearing, Wheel Spindle Bearing – Determination of optimum dimensions and proportions of Steering Linkages ensuring minimum error in Steering.

UNIT - III CLUTCH [09]

Design of Single Plate, Multi Plate Clutch and Cone Clutch –Torque Capacity of Clutch – Design of Clutch Components – Design Details of Roller and Sprag type Clutch.

UNIT - IV GEAR BOX [09]

Gear Train Calculation – Layout of Gear Box – Calculation of Bearing Loads and Selection of Bearings – Design of Three, Four and Five Speed Gear boxes.

UNIT - V DRIVE LINE AND REAR AXLE [09]

Design of Propeller Shaft – Design Details of Final Drive Gearing – Design Details of Full Floating, Semi-Floating and Three-Quarter Floating Rear Shafts and Rear Axle Housing.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Giancarlo Genta, Lorenzo Morello, “The Automotive Chassis Volume 1, Components Design”, Springer International Edition.2014.
2. Khurmi. R.S. & Gupta. J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001.

Reference Books :

1. “Design Data Hand Book”, PSG College of Technology, 2013- Coimbatore.
2. Giri, N.K., "Automobile Mechanics", Khanna publishers, New Delhi, 2007.
3. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine component Design”, 6th Edition, Wiley, 2017.
4. Dean Averns, Automobile Chassis Design, Illife Book Co., 2001.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU764 **Course name : DESIGN OF CHASSIS COMPONENTS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Infer the stresses and moments on action of different loads on frames	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO2	Illustrate the loads acting on the front axle and steering	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO3	Construct the clutch type conforming to the need	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO4	Select the appropriate gear box	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO5	Elucidate the design of final drive	3	3	3	-	-	-	-	-	-	-	-	3	3	-
	Average	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – II)

		L	T	P	C
20AU765	**INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the concepts of industrial robots in engineering fields.*	*Understand*
CO2:	*Exemplify the types of robot drive systems and end effectors.*	*Understand*
CO3:	*Apply the sensors and image processing techniques to improve the ability of robots.*	*Apply*
CO4:	*Develop programs for different tasks and analyze the kinematic motions of robot.*	*Analyze*
CO5:	*Identify robots for various industrial sectors and interpolate the economic analysis.*	*Apply*

UNIT - I FUNDAMENTALS OF ROBOT [09]

Robot – Definition – Robot anatomy – Co-ordinate systems, Work envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint notations, Speed of motion, Pay load – Robot parts and their functions – Need for robots – Different applications.

UNIT - II ROBOT DRIVE SYSTEMS AND END EFFECTORS [09]

Design of drive systems, Mechanical, hydraulic, and pneumatic drives, electric drives, motors, designing of end effectors, mechanical, hydraulic, vacuum, and magnetic grippers, Open and close loop control, linear control and PID control schemes of robotic manipulators.

UNIT - III SENSORS AND MACHINE VISION [09]

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors),Wrist Sensors, Compliance Sensors, Slip Sensors Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

UNIT - IV ROBOT KINEMATICS AND ROBOT PROGRAMMING [09]

Forward Kinematics, Inverse Kinematics and Differences – Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – DH matrices – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

UNIT - V IMPLEMENTATION AND ROBOT ECONOMICS [09]

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method and Rate of Return Method.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Fu. K.S, Gonzalez. R.C, Lee. C.S.G, Robotics – Control, Sensing, Vision, and Intelligence, Tata McGraw Hill Co., New Delhi, 2015
2. GrooverMikell .P, Industrial Robotics -Technology Programming and Applications, Tata McGraw Hill Co., New Delhi, 2014.

Reference Books :

1. Craig J.J., Introduction to Robotics Mechanics and Control, Pearson Education, New York, 2009.
2. Deb S.R., Robotics Technology and Flexible Automation, Tata McGraw Hill Book Co., New Delhi, 2013.
3. Maja J Mataric, The Robotics Primer, Universities Press, Hyderabad, 2013.
4. Robin R. Murphy, Introduction to AI Robotics, PHI Learning Private Limited, New Delhi, 2000.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU765 **Course name : INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the concepts of industrial robots in engineering fields.	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO2	Exemplify the types of robot drive systems and end effectors.	3	3	3	-	-	-	-	-	-	-	-	3	3	-
CO3	Apply the sensors and image processing techniques to improve the ability of robots.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	Develop programs for different tasks and analyze the kinematic motions of robot.	3	3	3	3	3	3	-	-	-	-	-	3	3	-
CO5	Identify robots for various industrial sectors and interpolate the economic analysis.	3	3	3	-	3	3	-	-	-	-	3	3	3	-
	Average	**3**	**3**	**3**	**0.6**	**1.8**	**1.2**	**-**	**-**	**-**	**-**	**0.6**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – II)

		L	T	P	C
20AU766	**BATTERY TECHNOLOGY**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Select suitable Li-Ion battery cells for use in electric vehicles.*	*Understand*
CO2:	*Demonstrate the assembly of battery systems for electric vehicles.*	*Understand*
CO3:	*Identify battery management system.*	*Understand*
CO4:	*Summarize the requirements of battery systems for automobile.*	*Understand*
CO5:	*Analyze the cost benefits of battery sub systems and recycling.*	*Apply*

UNIT - I INTRODUCTION OF LI-ION BATTERY [09]

Significance of Li-ion batteries - Classification of Li-ion batteries - Construction of Li-ion batteries - Energy density - Charging and discharging profiles - influence of temperature -life and ageing issues - Safety aspects and thermal runaway.

UNIT - II LI-ION BATTERY SYSTEMS [09]

Battery systems and subsystems - Battery modules - Cells in series and parallel configurations - Battery cooling systems - Battery management systems - Cell balancing -Battery housing - Assembly of battery systems - Production aspects - Regulations on battery systems

UNIT - III BATTERY MANAGEMENT SYSTEM [09]

Battery management systems: functions and architecture, performance parameter measurement, equalization management circuit, data communication, logic and safety control, testing stability..

UNIT - IV BATTERIES FOR AUTOMOTIVES – FUTURE PROSPECTS: [09]

Batteries for Automotives – Future prospects: Degrees of vehicle electrification - Battery size vs. application -USABC and DOE targets for vehicular energy storage systems - Analysis and Simulation of batteries - Equivalent circuit and life modelling – Environmental concerns in battery production – recycling of batteries

UNIT - V TRENDS AND OUTLOOK [09]

Study of battery systems in electric passenger vehicles (Bus, Car and Two Wheeler) - Production and cost analysis - Mass production demands - Cell manufacturing - Demands on cooling systems - Fast charging and charging stations - Second life use for battery packs - Solid state batteries - Ecosystem for electric vehicles.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Reiner Korthauer, ― Lithium-Ion Batteries: Basics and Applications‖, Springer, August2018, ISBN 978-3-662-53069-6.
2. MasatakaWakihara and Osamu Yamamoto, Lithium ion Batteries Fundamental and Performance, Wiley–VCH, Verlag GmbH, 2008, ISBN: 978-3-527-61198-0.

Reference Books :

1. Jiuchun Jiang and Caiping Zhang, ― Fundamentals and Applications of Lithium-IonBatteries in Electric Drive Vehicles‖, John Wiley and Sons, 2015 ISBN 978-1-118-41478-1.
2. John G. Hayes and G. AbasGoodarzi, ― Electric Powertrain‖, First Edition, John Wileyand Sons, 2018, ISBN: 9781119063667.
3. James Larminie and John Lowry, ― Electric Vehicle Technology Explained‖, John Wiley and Sons, 2018, ISBN 978-81-265-5670-8.
4. Sandeep Dhameja, Electric Vehicle Battery Systems, Newnes publication, 2001.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU766 **Course name : BATTERY TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Select suitable Li-Ion battery cells for use in electric vehicles.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO2	Demonstrate the assembly of battery systems for electric vehicles.	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Identify battery management system.	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	Summarize the requirements of battery systems for automobile.	3	3	-	-	-	3	3	3	-	-	-	3	3	-
CO5	Analyze the cost benefits of battery sub systems and recycling.	3	3	-	-	-	3	3	3	-	-	-	3	3	-
	Average	**3**	**2.4**	**-**	**-**	**-**	**1.2**	**1.2**	**1.2**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – III)

		L	T	P	C
20AU767	**COMBUSTION THERMODYNAMICS AND HEAT TRANSFER**	3	0	0	3

Prerequisite: Engineering Thermodynamics and Heat Transfer

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the principle of combustion in thermodynamics*	*Understand*
CO2:	*Identify the kinetics behind the chemical reaction of combustion of fuels.*	*Understand*
CO3:	*Discuss about the properties of flame inside a combustion chamber.*	*Understand*
CO4:	*Realize the principle of conduction, convection and radiation in IC engines.*	*Understand*
CO5:	*Comprehend the concept of combustion.*	*Understand*

UNIT – I THERMODYNAMICS OF COMBUSTION [09]

Premixed and diffusion combustion process in IC engines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT – II CHEMICAL KINETICS OF COMBUSTION [09]

Fundamentals of combustion kinetics, rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for Normal Combustion.

UNIT – III FLAMES [09]

Laminar premixed – flame speed correlations- quenching, flammability, and ignition, flame stabilization, laminar diffusion flames, turbulent premixed flames - Reynolds and Damkohler numbers and their significance.

UNIT – IV HEAT TRANSFER IN IC ENGINES [09]

Engine Heat transfer and heat Balance. Measurement of Instantaneous heat transfer rate. Heat transfer modelling. Heat transfer coefficients, radiative heat transfer.

UNIT – V EXPERIMENTS IN IC ENGINES [09]

Cylinder pressure measurement. Rate of heat release calculation – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Heywood J.B, Internal Combustion Engine Fundamentals, Tata McGraw Hill Publishing Co., New York, 2018.
2. Ashley Campbel, Thermodynamic Analysis of Combustion Engine Processes, Tata McGraw Hill Publishing Co., New Delhi, 2006.

Reference Books :

1. Ganesan, V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.
2. Spalding.D.B, Some fundamental of Combustion, Butterworth Science Publications, London, 1985.
3. Taylor. E.F. The Internal Combustion Engines, International Text Book Co., Pennsylvania, 1982.
4. Irvin Glasman, Combustion, Academic Press, London, 1987, ISBN 0-12-285851- 4.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU767 **Course name : COMBUSTION THERMODYNAMICS AND HEAT TRANSFER**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the principle of combustion in thermodynamics	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO2	Identify the kinetics behind the chemical reaction of combustion of fuels.	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Discuss about the properties of flame inside a combustion chamber.	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	Realize the principle of conduction, convection and radiation in IC engines.	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO5	Comprehend the concept of combustion.	3	3	-	-	3	-	-	-	-	-	-	3	3	-
	Average	**3**	**3**	**-**	**-**	**1.2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – III)

		L	T	P	C
20AU768	**VEHICLE CONTROL SYSTEMS**	3	0	0	3

Prerequisite: Automotive Computer Controlled Systems

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the basics of control system used in automobiles.*	*Understand*
CO2:	*Recognize the electronically controlled system used in driving mechanics.*	*Understand*
CO3:	*Demonstrate the working principle of driver modelling and power train control systems*	*Understand*
CO4:	*Identify the control system used in hybrid and electrical vehicles*	*Understand*
CO5:	*Illustrate the need of automated transport systems*	*Apply*

UNIT - I INTRODUCTION TO VEHICLE CONTROL SYSTEM [09]

Trends, overview and examples of vehicle control system- Sensors, actuators and controller modules-Vehicle communication Network-System Engineering V-diagram- Algorithm Development - Steps in vehicle control system design- Degree of freedom for vehicle control- selection of controlled, manipulated, measured disturbance variables- classification of the variables in various automotive systems like engines, suspension, braking, air conditioning – General types of vehicle controller configurations- Feedback, Inferential, Feed-Forward, Ratio control.

UNIT - II CONTROL SCHEMES, CRUISE AND HEADWAY CONTROL [09]

Feed - Forward control - Cascade control- Design considerations for cascade control, Time delay compensation, Inferential control- Nonlinear control- Adaptive control etc. Cruise control design- Autonomous cruise control- Anti locking brakes- Traction control system- Vehicle stability control linear and non-linear vehicle model- VSC Design Principles – four-wheel steering – Goals of 4WS Algorithms – active suspensions.

UNIT - III DRIVER MODELING AND POWERTRAIN CONTROL SYSTEMS [09]

Driving simulators- percentage of road departure- Driver modeling- Transfer function models- Preview/ Predictive models- longitudinal driver models Control oriented engine modeling- Air intake model- Fuel dynamics model- Air Fuel ratio dynamics- Engine Control Loops- Air Fuel Ratio control- EGR Control- Spark Timing control- Idle speed control- Knock control-Adaptive knock control- Combustion torque estimation- Transmission control.

UNIT - IV CONTROL OF HYBRID AND FUEL CELL VEHICLES [09]

Series-Parallel- Split Hybrid Configurations- Hybrid Vehicle Control Hierarchy- Control Concepts of Series Hybrids- Equivalent Consumption minimization strategy- control concepts for split hybrid modelling of fuel cell systems- fuel stack model- control of fuel cell system.

UNIT - V HUMAN FACTORS AND INTELLIGENT TRANSPORT SYSTEM [09]

Human factors in vehicle automation- cross over model principle- Risk- Homeostatic Theory- Driving simulators- percentage of road departure Advanced traffic management system- Advanced traveller information system- commercial vehicle operation- Advanced vehicle control system- Preventing collisions- Longitudinal motion control and platoons- Site specific information comparison of longitudinal control approaches- String stability- Automated steering and lateral control – Lane sensing- automated lane change and follow control.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. GalipUlsoy, Automotive Control System, Cambridge University Press, 2012.
2. UweKiencke and Lars Nielson, Automotive Control System, SAE Publications, 2006.

Reference Books :

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Benjamin C.Kuo and FaridGolnaraghi, Automatic Control System, John Wiley & Sons, Eight edition, 2003.
3. Katsuhiko Ogata, System Dynamics, Prentice Hall International, Inc. Third Edition, 1998.
4. Richard C.Dorf and Robert H.Bishop, Modern Control Systems, Pearson Prentice Hall, 2008.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU768 **Course name : VEHICLE CONTROL SYSTEMS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the basics of control system used in automobiles.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO2	Recognize the electronically controlled system used in driving mechanics.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO3	Demonstrate the working principle of driver modelling and power train control systems	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	Identify the control system used in hybrid and electrical vehicles	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO5	Illustrate the need of automated transport systems	3	3	3	-	3	-	-	-	-	-	-	3	3	-
	Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – III)

		L	T	P	C
20AU769	**INTELLIGENT VEHICLES TECHNOLOGY**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the systems involved in driver support systems.*	*Understand*
CO2:	*Familiarize with telematics.*	*Apply*
CO3:	*Comprehend the constructional and working features of safety systems and security systems*	*Understand*
CO4:	*Recognize about the various comfort systems.*	*Remember*
CO5:	*Acquire about the various adaptive control systems.*	*Understand*

UNIT - I DRIVER ASSISTANCE SYSTEMS [09]

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, vehicle status monitoring and automated highway systems.

UNIT - II TELEMATICS [09]

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition and application of Internet of Things (IoT) in automotive industry.

UNIT - III SAFETY SYSTEMS &SECURITY SYSTEMS [09]

Airbags, seat belt tightening system, collision avoidance and warning systems, child lock, antilock braking systems, Anti-theft technologies, smart card system and number plate coding.

UNIT - IV COMFORT SYSTEMS [09]

Active suspension systems-requirement and characteristics - types, power steering, collapsible and tiltable steering column, power windows.

UNIT - V ADAPTIVE CONTROL SYSTEMS [09]

Adaptive cruise control, adaptive noise control, anti-spin regulation, traction control systems and cylinder cut off technology and autonomous driving.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. LjuboVlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, 2001.
2. Ronald K Jurgen, Navigation and Intelligent Transportation Systems – Progress in Technology, Automotive Electronics Series, SAE, USA, 1998.

Reference Books :

1. Richard Bishop, Intelligent Vehicle Technology and Trends, Artech House, London, 2005.
2. William B Riddens, Understanding Automotive Electronics, Eighth edition, Butterworth-Heinemann, Woburn, 2017.
3. Robert Bosch, Automotive Handbook, Bently Publishers, Cambridge, Ninth Edition, 2014.
4. Bechhold, Understanding Automotive Electronics, SAE, 1998.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU769 **Course name : INTELLIGENT VEHICLES TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify the various systems involved in driver support systems and their working principle.	3	-	-	-	3	3	-	-	-	-	-	3	3	-
CO2	Familiarize with global positioning systems, geographical information systems and navigation systems.	3	-	-	-	3	3	-	-	-	-	-	3	3	-
CO3	Comprehend the constructional and working features of safety systems and security systems	3	-	-	-	3	3	-	-	-	-	-	3	3	-
CO4	Recognize about the various comfort systems.	3	-	-	-	3	3	-	-	-	-	-	3	3	-
CO5	Acquire about the various adaptive control systems.	3	-	-	-	3	3	-	-	-	-	-	3	3	-
	Average	**3**	**-**	-	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – III)

		L	T	P	C
20AU771	**COMPUTER SIMULATION OF I.C. ENGINE PROCESSES**	3	0	0	3

Prerequisite: Engineering Mechanics - Dynamics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Remember the basics of combustion reactions and its characteristics*	*Understand*
CO2:	*Describe the SI engine simulation and heat release curves.*	*Understand*
CO3:	*Analyze the performance by simulation and combustion models.*	*Analyze*
CO4:	*Simulate the SI engine combustion models.*	*Apply*
CO5:	*Simulate the CI engine combustion models.*	*Apply*

UNIT - I INTRODUCTION [09]

Introduction. Heat of reaction, complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature.

UNIT - II SI ENGINE SIMULATION WITH FUEL-AIR AS WORKING [09]

Deviation between actual and air standard cycles of operation- problems, SI engine simulation with adiabatic constant volume combustion with fuel and air being considered, calculation of temperature drop due to fuel vaporization, calculation of mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions.

UNIT - III ACTUAL CYCLE SIMULATION IN SI ENGINES [09]

Progressive combustion; gas exchange process, heat transfer process, friction. Validation of the computer code with experimental data based on performance parameters and pressure crank angle diagram.

UNIT - IV SIMULATION OF 2-STROKE SI ENGINE [09]

Simulation of the scavenging process, determination of the pressure-crank angle variation, computation of performance parameters.

UNIT - V DIESEL ENGINE SIMULATION [09]

CI engine simulation, differences between ideal and actual cycles, zero dimensional combustion model for diesel engine, heat transfer and gas exchange processes. Performance prediction and comparison of results.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Shley Campbel, Thermodynamic Analysis of Combustion Engine Processes, Tata McGraw Hill Publishing Co., New Delhi, 2006.
2. Ganesan. V. - Computer Simulation of spark ignition engine process, -Universities Press (I) Ltd, Hyderabad – 2013.

Reference Books :

1. Ramadoss.A.L. - Modelling of Internal Combusion Engines Processes - McGraw-Hill Publishing Co., - 1992.
2. Heywood J.B, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education., New York, 2011.
3. Robert Bosch, Automotive Hand book, Eighth Edition, 2011.
4. Gunnar Stiesch, Modeling Engine Spray and Combustion Processes, Springer Berlin, Heidelberg, 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU771 **Course name : COMPUTER SIMULATION OF I.C. ENGINE PROCESSES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Remember the basics of combustion reactions and its characteristics	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO2	Describe the SI engine simulation and heat release curves.	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO3	Analyze the performance by simulation and combustion models.	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	Simulate the SI engine combustion models.	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO5	Simulate the CI engine combustion models.	3	3	3	3	3	-	-	-	-	-	-	3	3	-
	Average	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – III)

		L	T	P	C
20AU772	**PRODUCT LIFE CYCLE MANAGEMENT**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the history, concepts and terminology of PLM.*	*Understand*
CO2:	*Demonstrate the functions and features of PLM/PDM.*	*Understand*
CO3:	*Select PLM/PDM approaches for industrial applications.*	*Apply*
CO4:	*Integrate PLM/PDM with legacy database and ERP systems.*	*Apply*
CO5:	*Identify different modules offered in commercial PLM/PDM tools.*	*Apply*

UNIT - I INTRODUCTION TO PRODUCT LIFE CYCLE MANAGEMENT(PLM) [09]

Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM – Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (cPDm), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM).PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.

UNIT - II PLM/PDM FUNCTIONS AND FEATURES [09]

User Functions – Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management. Utility Functions – Communication and Notification, data transport, data translation, image services, system administration and application integration.

UNIT - III ROLE OF PLM IN INDUSTRIES [09]

Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organization, users, product or service, process performance.

UNIT - IV BASICS ON CUSTOMISATION / INTEGRATION OF PLM / PDM SOFTWARE [09]

PLM Customization, use of EAI technology (Middleware), Integration with legacy database, CAD, SLM and ERP.

UNIT - V DETAILS OF MODULES IN PLM / PDM SOFTWARE [09]

Case studies based on top few commercial PLM/PDM tools.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Grieves Michael, Product Lifecycle Management- Driving the Next Generation of Lean Thinking, McGraw-Hill, 2016.
2. John Stark, “Product Lifecycle Management: 21st Century Paradigm for Product Realisation”, Springer Publisher, 2011 (2nd Edition).

Reference Books :

1. AnttiSaaksvuori, AnselmiImmonen, Product Life Cycle Management - Springer, 1st Edition (Nov.5, 2008).
2. IvicaCrnkovic, Ulf Asklund and Annita Persson Dahlqvist, “Implementing and Integrating Product Data Management and Software Configuration Management”, Artech House Publishers, 2013.
3. International Journal of Product Lifecycle Management, Inderscience Publishers.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU772 **Course name : PRODUCT LIFE CYCLE MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the history, concepts and terminology of PLM.	3	-	2	3	3	-	-	-	-	-	-	3	3	-
CO2	Demonstrate the functions and features of PLM/PDM.	3	2	2	3	3	-	-	-	-	-	-	3	3	-
CO3	Select PLM/PDM approaches for industrial applications.	3	2	2	3	3	-	-	-	-	-	-	3	3	-
CO4	Integrate PLM/PDM with legacy database and ERP systems.	3	2	2	3	3	-	-	-	-	-	-	3	3	-
CO5	Identify different modules offered in commercial PLM/PDM tools.	3	2	2	3	3	-	-	-	-	-	-	3	3	-
	Average	**3**	**1.6**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VII (Professional Elective – III)

		L	T	P	C
20AU773	**ADDITIVE MANUFACTURING**	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the additive manufacturing technologies for engineering applications.*	*Understand*
CO2:	*Apply data processing software for additive manufacturing.*	*Apply*
CO3:	*Comprehend the SLA, FDM and LOM technologies.*	*Understand*
CO4:	*Explore powder based additive manufacturing systems.*	*Apply*
CO5:	*Discover various applications of additive manufacturing in the automotive and aerospace field.*	*Apply*

UNIT - I **INTRODUCTION TO ADDITIVE MANUFACTURING (AM)** **[09]**

Introduction to Additive Manufacturing (AM): Overview – History - Need-Classification -Additive Manufacturing Technology in product development- Materials for Additive Manufacturing Technology, Tooling - Applications. Classification of AM processes: Liquid polymer system, discrete particle system - molten material systems - solid sheet system.

UNIT - II **CAD AND REVERSE ENGINEERING** **[09]**

CAD and Reverse Engineering: Basic Conceptualization, CAD model preparation – conversion to STL - STL file manipulation - Part Orientation and support generation – Model Slicing –Tool path Generation – Transfer to AM - Machine setup, build, removal and clean up, post processing. Data Processing for Additive Manufacturing Technology - Software's for Additive Manufacturing Technology: MIMICS, MAGICS.

UNIT - III **LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS** **[09]**

Liquid Based and Solid Based Additive Manufacturing Systems: Classification – Liquid based system – Stereolithography Apparatus (SLA) - Principle, process, advantages, and applications - Solid based system – Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing.

UNIT - IV **POWDER BASED ADDITIVE MANUFACTURING SYSTEMS** **[09]**

Powder Based Additive Manufacturing Systems: Selective Laser Sintering – Principles of SLS process - Process, advantages and applications, Three-Dimensional Printing - Principle, process, advantages, and applications - Laser Engineered Net Shaping (LENS), Electron Beam Melting.

UNIT - V **APPLICATIONS OF ADDITIVE MANUFACTURING** **[09]**

Various applications of additive manufacturing in the automotive and aerospace industry.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
2. Gibson, Rosen, Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing. Springer, 2009.

Reference Books :

1. Frank W. Liou, Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development, CRC Press, Taylor and Francis Group, 2007.
2. Duc Pham, S.S. Dimov, "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling", Springer-Verlag London, 2001.
3. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003.
4. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
5. Hopkinson, Hague, Dickens, Rapid Manufacturing: An Industrial Revolution for the Digital Age. Wiley, 2005.
6. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU773 **Course name : ADDITIVE MANUFACTURING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the additive manufacturing technologies for engineering applications.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO2	Apply data processing software for additive manufacturing.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO3	Comprehend the SLA, FDM and LOM technologies.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	Explore powder based additive manufacturing systems.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO5	Discover various applications of additive manufacturing in the automotive and aerospace field.	3	3	3	-	3	-	-	-	-	-	-	3	3	-
	Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – IV)

		L	T	P	C
20AU861	**FUEL CELLS AND APPLICATIONS**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the concepts, principle and working of fuel cells.*	*Understand*
CO2:	*Interpretation the various automotive applications of fuel cells.*	*Understand*
CO3:	*Explain the performance of various fuel cell components.*	*Understand*
CO4:	*State the fuel processing techniques for fuel cells.*	*Understand*
CO5:	*Understand the fuel cell analysis and application to fuel cell technologies.*	*Understand*

UNIT - I INTRODUCTION TO FUEL CELLS [09]

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – Thermodynamics and electrochemical kinetics of fuel cells.

UNIT - II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS [09]

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems – on board hydrogen storage –liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system– alkaline fuel cell – road map to market.

UNIT - III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE [09]

Fuel cell performance characteristics – current - voltage - voltage efficiency - power density - ohmic resistance – kineticperformance - mass transfer effects - membrane electrode assembly components - fuel cell stack – bi polar plate - humidifiers - cooling plates.

UNIT - IV FUELING [09]

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – Steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

UNIT - V FUEL CYCLE ANALYSIS [09]

Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fuelled by natural gas and hydrogen and hybrid electric vehicle.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Viswanathan B. and ScibiohAulice M, Fuel Cells: Principles and Applications, Universities Press, Hyderabad,First Edition, 2009.
2. Thring. R.H, Fuel Cells for automotive applications, Professional engineering publishing, London,First Edition, 2004.

Reference Books :

1. Frano Barbir, PEM Fuel Cells: Theory and Practice, Elsevier Academic Press, New York, Second Edition, 2012.
2. Gregor Hoogers, Fuel Cell Technology Handbook, SAE International, CRC Press, New York, First Edition, 2003.
3. MehrdadEhsani, YiminGao, SebastienE.Gay and Ali Emadi, Modern Electric, Hybrid Electric and Fuel cell Vehicles: Fundamentals, Theory and Design, CRS Press, New York, Second Edition, 2010.
4. Ryan O'Hayre, Suk-Won Cha, Whitney Colella, ―Fuel Cell Fundamentalsll, John Wiley & Sons, New York, ThirdEdition, 2016.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU861 **Course name : FUEL CELLS AND APPLICATIONS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the concepts, principle and working of fuel cells.	3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO2	Interpretation the various automotive applications of fuel cells.	3	3	3	-	-	-	-	-	-	-	-	-	**3**	**2**
CO3	Explain the performance of various fuel cell components.	3	3	3	-	-	-	-	-	-	-	-	-	**3**	**2**
CO4	State the fuel processing techniques for fuel cells.	3	3	3	-	-	-	-	-	-	-	-	-	**3**	**2**
CO5	Understand the fuel cell analysis and application to fuel cell technologies.	3	3	3	-	-	-	-	-	-	-	-	-	3	2
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – IV)

		L	T	P	C
20AU862	**SPECIAL PURPOSE VEHICLES**	3	0	0	3

Prerequisite: *Nil*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify about the specification and functions of various types of cranes and compacters.*	*Apply*
CO2:	*Gain knowledge about the various types of excavators and graders.*	*Understand*
CO3:	*Perceive the knowledge about haulage vehicles and lift trucks.*	*Understand*
CO4:	*Identify the various descriptions and functions of towed rooters, scarifiers and scrapers.*	*Understand*
CO5:	*Generalize the functions of special purpose vehicles.*	*Apply*

UNIT - I CRANES AND COMPACTION VEHICLES [09]

General description, specifications and functions, excavator mounted cranes, mobile cranes with strut and cantilever type jibs, tractor towed and tractor mounted cranes. General description, specification and functions, smooth wheeled rollers, pneumatic tired rollers, agricultural Rollers, sheep's foot rollers; vibrating compactors.

UNIT - II EXCAVATORS AND GRADERS [09]

General description, specification and functions, classification based on attachments, face shovel, drag shovel, hoe, drag-line and grab or clam shell, advantages and limitations. Description, specification of tractor towed graders and motor graders, classification and functions of graders, functional details of spreading, mixing, ditching, bank sloping, snow removal, stripping, scarifying, and finishing. Merits and limitations of graders.

UNIT - III HAULAGE VEHICLES AND LIFT TRUCKS [09]

General description, specification and functions, self-propelled and tractor towed haulage vehicles and pneumatic – tires, dumpers – front tipping; trucks – rear tipping, tractor towed semi-trailers and trailers (rear and side tipping, bottom dumping). General description, specification and functions, fork lift trucks, alternative front end equipment (attachments) – jib arm, shovel bucket, squeeze clamp, boom, fork extensions, barrel forks. Scissors lift trucks – applications in industry, advantages and disadvantages.

UNIT - IV ROOTERS AND SCARIFIERS AND SCRAPERS [09]

General description, specification and functions, tractor towed rooters and scarifiers {heavy duty (roller)/ light duty (grader)} back rippers for bull and angle dozers. General description, specification and functions, tractor towed and motorized scrapers, scraper work in cutting, cambering, side hill cutting, spreading on embankments, compaction of fill merits and demerits.

UNIT - V TRACTORS AND OTHER SPECIAL PURPOSE VEHICLES [09]

General description, specification and functions, light, medium and heavy wheeled tractors, crawler tracks mounted / wheeled-bull dozers, tilt dozers and angle dozers, front end loaders, factors affecting efficiency of output of tractors, simple problems, merits and demerits. General description, specification and functions, Ambulance, Oil tankers, surveillance vehicle, Television recording Mobile, Reefer vehicle, Double Decker bus, Vestibule bus and Fire fighting vehicle.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Khanka. S. S, "Entrepreneurial Development" S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, "Entrepreneurships – Theory, Process and Practice", CengageLearning, 2014.

Reference Books :

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, Entrepreneurship theory at cross roads: paradigms and praxis", Dream tech, 2005.
3. Rajeev Roy, 'Entrepreneurship', 2nd Edition, Oxford University Press, 2011.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU862 **Course name : SPECIAL PURPOSE VEHICLES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify about the specification and functions of various types of cranes and compacters.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Gain knowledge about the various types of excavators and graders.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Perceive the knowledge about haulage vehicles and lift trucks.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Identify the various descriptions and functions of towed rooters, scarifiers and scrapers.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Generalize the functions of special purpose vehicles.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – IV)

		L	T	P	C
20AU863	**DESIGN THINKING**	3	0	0	3

Prerequisite: *Nil*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Apply design thinking concepts to give solution for the problems identified.*	*Apply*
CO2:	*Implement Agile software methodology for faster development of quality software.*	*Understand*
CO3:	*Describe how to improve collaboration between development and operations.*	*Understand*
CO4:	*Design innovative products.*	*Apply*
CO5:	*Implement Automated Installations and Deployments.*	*Apply*

UNIT - I **INTRODUCTION TO DESIGN THINKING** **[09]**

Introduction to Design Thinking – Importance of Design Thinking – History of Design Thinking- Design Thinking Framework - Design Thinking Methods - Empathise –Define – Ideate – Conventional Prototype – Test- Software Development Methodology – Waterfall model – V –model -Customer Example.

UNIT - II **INTRODUCTION TO AGILE** **[09]**

History of Agile – Agile principles – Agile Vs Waterfall – Agile Methodology Overview- Agile frameworks – Extreme programming - Rational Unified Process (RUP) - Test Driven Development (TDD) – Feature Drive Development (FDD)- Scrum - Kanban Methodology – Agile and DevOps.

UNIT - III **AGILE SOFTWARE DEVELOPMENT** **[09]**

Software Development- using Extreme Programming – Roles & Rules - Software Development using Scrum Framework – Scrum team – Sprints – Sprints planning – Metrics – Scrum tools - Case Studies.

UNIT - IV **DESIGN THINKING FOR STRATEGIC INNOVATION** **[09]**

Innovation Management-Changing Management Paradigms-Design Thinking related to science and art-Design Thinking in Business-Linking Design Thinking Solution to Business Challenges

UNIT - V **DEVOPS** **[09]**

Introduction to DevOps – DevOpsvs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD &DevOps Tools– Version Control – Build Automation – Configuration Management – Containerization – Continuous Deployment – Continuous Integration – Continuous Testing –Continuous Monitoring.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. MaurícioVianna, YsmarVianna, Brenda Lucena and Beatriz Russo," Design thinking: Business innovation", MJV Technologies and innovation press, 2011.
2. Design Thinking: Integrating Innovation, Customer Experience, and Brand Valueby Thomas Lockwood (Editor) Published February 16th 2010 by Allworth Press.

Reference Books :

1. KalloriVikram, ―Introduction to DevOps, 1st Edition, KalloriVikram Publication, 2016
2. Jaokim Verona, ―Practical DevOps, 2nd Edition, Packt. Publication, 2018.
3. Stephen Fleming, Pravin, ―DevOps Handbook: Introduction of DevOps Resource Management―, 1st Edition, Createspace Independent Pub., 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU863 **Course name : DESIGN THINKING**

CO	Course Outcomes	Programme Outcomes													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	Apply design thinking concepts to give solution for the problems identified.	3	3	3	1	3	3	1	1	1	1	1	3	1	1
CO2	Implement Agile software methodology for faster development of quality software.	3	3	3	1	3	3	1	1	1	1	1	3	1	1
CO3	Describe how to improve collaboration between development and operations.	3	3	3	1	3	3	1	1	1	1	1	3	1	1
CO4	Design innovative products	3	3	3	1	3	3	1	1	1	1	1	3	1	1
CO5	Implement Automated Installations and Deployments.	3	3	3	1	3	3	1	1	1	1	1	3	1	1
	Average	**3**	**3**	**3**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – IV)

		L	T	P	C
20AU864	**NEW PRODUCT DEVELOPMENT**	3	0	0	3

Prerequisite: *Nil*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Introduce the importance of product design.*	*Understand*
CO2:	*Describe the needs of a customer towards a product.*	*Understand*
CO3:	*Initiate the idea of creativeness on product.*	*Understand*
CO4:	*Understand the decision-making concepts.*	*Understand*
CO5:	*Design a product based on cost frame and need of the customer.*	*Analysis*

UNIT - I INTRODUCTION [09]

Need for developing products – the importance of engineering design – types of design –the designprocess – relevance of product lifecycle issues in design –designing to codes and standards-societal considerations in engineering design –generic product development process – variousphases of product development-planning for products –establishing markets- market segments-relevance of market research.

UNIT - II CUSTOMER NEEDS [09]

Identifying customer needs –voice of customer –customer populations- hierarchy of human needsneed gathering methods – affinity diagrams – needs importance- establishing engineeringcharacteristics-competitive benchmarking- quality function deployment- house of quality- productdesign specification-case studies.

UNIT - III CREATIVE THINKING [09]

Creative thinking –creativity and problem solving- creative thinking methods- generating designconcepts-systematic methods for designing –functional decomposition – physical decomposition –functional representation –morphological methods-TRIZ- axiomatic design.

UNIT - IV DECISION MAKING AND PRODUCT ARCHITECTURE [09]

Decision making –decision theory –utility theory –decision trees –concept evaluation methods –Pugh concept selection method-weighted decision matrix –analytic hierarchy process – introductionto embodiment design –product architecture – types of modular architecture –steps in developingproduct architecture.

UNIT - V DESIGN AND COST ANALYSIS [09]

Industrial design – human factors design –user friendly design – design for serviceability –designfor environment – prototyping and testing – cost evaluation –categories of cost – overhead costs –activity-based costing –methods of developing cost estimates – manufacturing cost –value analysisin costing – cost reduction.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development ", 4thEdition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9.
2. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2015, PearsonEducation, ISBN 9788177588217.

Reference Books :

1. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition,John Wiley & Sons, 2009, ISBN 978-0-470-22596-7.
2. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill InternationalEdition, 4th Edition, 2009, ISBN978-007-127189-9.
3. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint,Cengage Learning, 2010, ISBN 0495668141.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU864 **Course name : NEW PRODUCT DEVELOPMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Introduce the importance of product design.	2	2	2	2	-	2	3	1	2	2	2	3	1	2
CO2	Describe the needs of a customer towards a product.	2	2	2	2	-	2	3	1	2	2	2	3	2	2
CO3	Initiate the idea of creativeness on product.	3	3	3	3	-	3	3	1	2	2	3	3	2	3
CO4	Understand the decision-making concepts.	3	3	3	3	-	3	3	1	2	2	3	3	2	3
CO5	Design a product based on cost frame and need of the customer.	3	3	3	3	-	3	3	1	2	2	3	3	2	3
	Average	**2**	**3**	**3**	**3**	**-**	**3**	**3**	**1**	**2**	**2**	**3**	**3**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – IV)

		L	T	P	C
20AU865	**ENTREPRENEURSHIP DEVELOPMENT**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Develop knowledge and skills needed to run a business successfully.*	*Apply*
CO2:	*Interpret the motivational concept in entrepreneurship development.*	*Understand*
CO3:	*To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.*	*Understand*
CO4:	*Summarize the concept of financial and cost accounting.*	*Understand*
CO5:	*Compose the business strategy and skills to develop small scale industries.*	*Apply*

UNIT - I ENTREPRENEURSHIP [09]

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth-Factors Affecting Entrepreneurial Growth.

UNIT - II MOTIVATION [09]

Major Motives Influencing an Entrepreneur – Achievement Motivation Training-Self Rating- Business Games-Thematic Apperception Test – Stress Management-Entrepreneurship Development Programs – Need- Course Objectives.

UNIT - III BUSINESS [09]

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity- Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies

UNIT - IV FINANCING AND ACCOUNTING [09]

Need – Sources of Finance- Term Loans- Capital Structure-Financial Institution-Management of working Capital- Costing-Break Even Analysis-Taxation – Income Tax-Excise Duty – Sales Tax.

UNIT - V SUPPORT TO ENTREPRENEURS [09]

Sickness in small Business – Concept-Magnitude-Causes and Consequences- Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion- Diversification- Joint Venture-Merger and Sub Contracting.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Khanka. S. S, “Entrepreneurial Development” S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, “Entrepreneurships – Theory, Process and Practice”, CengageLearning, 2014.

Reference Books :

1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, Entrepreneurship theory at cross roads: paradigms and praxis”, Dream tech, 2005.
3. Rajeev Roy, ‘Entrepreneurship’, 2nd Edition, Oxford University Press, 2011.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU865 **Course name : ENTREPRENEURSHIP DEVELOPMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Develop knowledge and skills needed to run a business successfully.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Interpret the motivational concept in entrepreneurship development.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Summarize the concept of financial and cost accounting.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Compose the business strategy and skills to develop small scale industries.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – IV)

		L	T	P	C
20AU866	**ENGINEERING ECONOMICS AND FINANCE**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify with economic decision-making problems by using simple economic analysis.*	*Understand*
CO2:	*Recognize a value engineering procedure.*	*Apply*
CO3:	*Know the methods of comparison of alternatives.*	*Understand*
CO4:	*Comprehend the replacement and maintenance analysis.*	*Apply*
CO5:	*Calculate the depreciation and evaluation of public alternatives.*	*Apply*

UNIT - I INTRODUCTION TO ECONOMICS [09]

Introduction to Economics – Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Elements of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Elementary economic Analysis – Material selection for product Design selection for a product and Process planning.

UNIT - II VALUE ENGINEERING [09]

Make or buy decision, Value engineering – Function, aims, and Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor – equal payment series capital recovery factor – Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT - III CASH FLOW [09]

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods).

UNIT - IV REPLACEMENT AND MAINTENANCE ANALYSIS [09]

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT - V DEPRECIATION [09]

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation – Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation – Evaluation of public alternatives – introduction, Examples, Inflation adjusted decisions –procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Donald.G. Newman, Jerome.P.Lavelle, Engineering Economics and analysis, Engg. Press, Texas, 2002.
2. PanneerSelvam, R, Engineering Economics, Prentice Hall of India Ltd, NewDelhi, 2004.

Reference Books :

1. Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, New Delhi, 2002.
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, Engineering Economy, Macmillan, New York, 1984.
3. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, Principles of Engineering Economy, Ronald Press, New York,1976.
4. Smith, G.W., Engineering Economy, Lowa State Press, Iowa, 1973.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU866 **Course name : ENGINEERING ECONOMICS AND FINANCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify with economic decision-making problems by using simple economic analysis.	-	-	-	-	-	1	-	-	-	-	-	-	1	1
CO2	Recognize a value engineering procedure.	2	2	2	-	-	-	-	-	-	-	-	-	1	1
CO3	Know the methods of comparison of alternatives.	2	2	2	-	-	-	-	-	-	-	-	-	1	1
CO4	Comprehend the replacement and maintenance analysis.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO5	Calculate the depreciation and evaluation of public alternatives.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
	Average	**1.6**	**1.6**	**0.8**	**-**	**-**	**0.2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – V)

		L	T	P	C
20AU867	**IoT IN AUTOMOBILES**	3	0	0	3

Prerequisite: *Nil*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Study about Internet of Things technologies and its role in real time applications.*	*Understand*
CO2:	*Introduce the infrastructure required for IoT.*	*Understand*
CO3:	*Provide insight about the embedded processor and sensors required for IoT.*	*Understand*
CO4:	*Familiarize the accessories for automobile application.*	*Understand*
CO5:	*Familiarize the different safety aspects for Automobiles.*	*Understand*

UNIT – I BASICS OF IoT **[09]**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT – IoT Information Security.

UNIT – II IoT DESIGN METHODOLOGY AND PROTOCOLS **[09]**

M2M – M2M Vs IoT – Software Defined Networks – Network function Virtualization – IoT Platform Design Methodologies – Domain Specific IoT-Protocols – IEEE 802.15.4 – BACNet Protocol-ZigbeeArchitecture.

UNIT – III INTERFACING OF ARDUINO WITH DEVICES **[09]**

Digital Sensor – Capacitive Touch Proximity Sensor, Analog Sensor – DC Voltage Sensor, Serial Communication with RFModem, Interfacing of ESP8266 with Analog Sensor, Interfacing of ESP8266 with Digital Sensors.

UNIT – IV IoT IN VEHICLE SAFETY **[09]**

Biometric Car Door Opening System, Accident Monitoring System, Engine Oil and Coolant Level Monitoring System, Thing Speak Server, Fleet and Driver Management System.

UNIT – V IoT IN ROAD SAFETY **[09]**

Smart Road Communication System for Mobile Vehicles, Talking Road Unit at Pin Turn in Hilly Areas, Real-time Car Telematics Tracking System, Connection of Smart Device Using GPRS Modem. -Vehicle-to-Everything (V2X) Communication-Intelligent Transportation Systems (ITS).

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Pearson Education, First Edition, 2017.
2. Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, Technologies & Sensors for the Internet of Things Businesses & Market Trends, First Edition, 2014.

Reference Books :

1. Raghuveer, Chimata, Anita, Gehlot, Rajesh-singh, Internet of Things automotive industries road safety, First Edition, 2022.
2. Rajkamal, Internet of Things: Architecture, Design Principles and Applications, McGraw Hill Education, New York, First Edition, 2017.
3. https://www.tatacommunications.com/wp-content/uploads/2018/02/IOT-IN-THE-AUTOMOTIVE-INDUSTRY.pdf.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU867 **Course name : IoT IN AUTOMOBILES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Study about Internet of Things technologies and its role in real time applications.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Introduce the infrastructure required for IoT.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Provide insight about the embedded processor and sensors required for IoT.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Familiarize the accessories for automobile application.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Familiarize the different safety aspects for Automobiles.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – V)

		L	T	P	C
20AU868	**NOISE, VIBRATION AND HARSHNESS**	3	0	0	3

Prerequisite:

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Realize the noise pollution of automobiles.*	*Understand*
CO2:	*Perceive the sources of transportation noise and vibration.*	*Understand*
CO3:	*Recognize the facilities available for tests and instrumentation.*	*Understand*
CO4:	*Pick out the application design of mufflers and silencers.*	*Understand*
CO5:	*Discern the control strategies of NVH.*	*Understand*

UNIT - I NOISE POLLUTION FROM AUTOMOBILES [09]

Introduction to vibration and noise, Noise pollution from automobiles - Vehicle NVH Fundamentals, Effect of NVH in automobiles - Effect of NVH in HEV & EV's - Human comfort level.

UNIT - II SOURCES OF TRANSPORTATION NOISE AND VIBRATION [09]

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise — Diesel and Gasoline Engines, Tire/Road Noise, Aerodynamic Sound Sources in Vehicles, Transmission and Gearbox Noise and Vibration, Brake Noise. Introduction to Interior Transportation Noise and Vibration Sources.

UNIT - III TEST FACILITIES AND INSTRUMENTATION [09]

Laboratory static test setup and instrumentations, rolling roads (dynamometers) analysis, four post-test rig analysis, semi-anechoic rooms, wind tunnels, etc. - Transducers, signal conditioning and recording systems - sound intensity technique.

UNIT - IV ACOUSTICAL DESIGN OF MUFFLERS AND SILENCERS [09]

Exhaust and Intake Noise in Diesel and Gasoline Engines - Electro-Acoustic Modeling, Transfer Matrix Modeling, Simple Expansion Chamber, Extended Tube Expansion Chamber, Extended Concentric Tube Resonator, Plug Muffler, Multiply Connected Muffler, Absorptive Ducts and Mufflers, Combination Mufflers.

UNIT - V NVH ANALYSIS AND CONTROL STRATEGIES [09]

Noise Control, noise ratings and standards related to NVH, Vibration absorbers and Helmholtz resonators, Active control techniques - Noise reduction in Automobiles - Vehicular noise and control – Noise control through barriers and enclosures and absorbent linings - Sound-absorbing materials

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Norton M P, Fundamental of Noise and Vibration, Cambridge University Press, 1989.
2. M L Munjal "Noise and Vibration Control" IISc Lecture Notes Series, World Scientific Publishing Co.Ltd. 2013.

Reference Books :

1. M L Munjal "Acoustics of Ducts and Mufflers", 2nd Edition, John Wiley & Sons, Chichester, UK, February 2014
2. David A.Bies and Colin H.Hansen "Engineering Noise Control: Theory and Practice "SponPress, London. 2009.
3. Anton FuchsEugeniusNijmanHans-HerwigPriebsch, Automotive NVH Technology, springer, 2016.
4. István L. Vér, Leo L. Beranek, Noise and Vibration Control Engineering: Principles and Applications, John Wiley, 2006.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU868 **Course name : NOISE, VIBRATION AND HARSHNESS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Realize the noise pollution of automobiles.	-	-	-	-	-	-	1	-	-	-	-	-	1	2
CO2	Perceive the sources of transportation noise and vibration.	-	-	-	-	-	-	1	-	-	-	-	-	**1**	**2**
CO3	Recognize the facilities available for tests and instrumentation.	-	-	-	-	-	-	1	-	-	-	-	-	**1**	**2**
CO4	Pick out the application design of mufflers and silencers.	-	-	-	-	-	-	1	-	-	-	-	-	**1**	**2**
CO5	Discern the control strategies of NVH.	-	-	-	-	-	-	1	-	-	-	-	-	1	2
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – V)

		L	T	P	C
20AU869	**VEHICLE DEALERSHIP MANAGEMENT**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Rephrase the basic concepts of dealership and their methods.*	*Understand*
CO2:	*Demonstrate the contemporary showroom management.*	*Understand*
CO3:	*Apply a strategic perspective of the retailing industry.*	*Apply*
CO4:	*Apply the concept of management in parts ordering and servicing.*	*Apply*
CO5:	*Analyze the case study of vehicle dealership, service and showroom management.*	*Analyze*

UNIT - I DEALERSHIP **[09]**

Understanding Dealership Infrastructure requirements-Furnishing Dealership-Preparing dealer manual.

UNIT - II SHOWROOM MANAGEMENT **[09]**

Contemporary show room management-Institutionalizing-structuring and monitoring the sales process-managing the showroom floor and the sales team-Retail developments and industry trends.

UNIT - III SERVICE MANAGEMENT **[09]**

Service management-process and fundamentals- repair order analysis-productivity and Efficiency- scheduling, loading-warranties and service retention.

UNIT - IV PARTS MANAGEMENT **[09]**

Parts management- inventory control- staffing and productivity-ordering parameters-parts marketing- merchandising, retailing and trade activities.

UNIT - V CASE STUDY **[09]**

Applying theory in practice working case study of an actual dealership-sales techniques and strategy- corporate sales deal-group presentations and action planning.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Gibson G.Vedamani (2003), Retail Management, Jaico Publishing House, New Delhi

Reference Books :

1. A.Sivakumar (1997), Retail Management, Excel Books, New Delhi
2. Kapil Sharma (2009), Marketing Management, Global India Publication Pvt.Ltd. New Delhi.
3. KVS Madaan (2009), Fundamentals of Retailing, Tata McGraw Hill, New Delhi

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU869 **Course name : VEHICLE DEALERSHIP MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Rephrase the basic concepts of dealership and their methods.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Demonstrate the contemporary showroom management.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Apply a strategic perspective of the retailing industry.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Apply the concept of management in parts ordering and servicing.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Analyze the case study of vehicle dealership, service and showroom management.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – V)

		L	T	P	C
20AU871	**INDUSTRY 4.0**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Perceive the changes in the Industrial Revolution.*	*Understand*
CO2:	*Recognize the internet services in Industry 4.0.*	*Understand*
CO3:	*Discern the significance of IoT in Industry.*	*Understand*
CO4:	*Pick out the application IoT.*	*Understand*
CO5:	*Make out the opportunities and challenges in Industry 4.0*	*Understand*

UNIT - I INTRODUCTION TO INDUSTRY 4.0 **[09]**

The various Industrial Revolutions, Internet of Things (IoT) & Industrial Internet of Things, Overview on Technologies of Industry 4.0. Comparison of Industry 4.0 Factory and Today's Factory.

UNIT - II ROAD TO INDUSTRY 4.0 **[09]**

Internet of Things (IoT), Internet of Services, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics.

UNIT - III IIoT **[09]**

Fourth Revolution – Sustainability assessment of Manufacturing Industry – Lean Production system – Smart and connected business perspective – smart factories – cyber-physical systems – collaboration platform and PLM.

UNIT - IV APPLICATION **[09]**

Robotic Automation and Collaborative Robots, Support System for Industry 4.0. Inventory Management and Quality Control – Plant security and safety – Facility management.

UNIT - V OPPORTUNITIES AND CHALLENGES **[09]**

Opportunities, Challenges, and skills for workers in the Industry 4.0, Supply Chain Management, Readiness of Industry. Strategies for competing in an Industry 4.0 world.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. The Fourth Industrial RevolutionII by Klaus Schwab, World Economic Forum.
2. Internet of Things: A Hands-On ApproachII by ArsheepBahga and Vijay Madisetti, University Press, 2015.

Reference Books :

1. NOC: Introduction to Industry 4.0 and Industrial Internet of Things.
2. The Fourth Industrial Revolution by Klaus Schwab 2 The Industries of Future by Alec Ross 3. A course on “Industry 4.0: How to Revolutionize your business” on edx.
3. Artificial Intelligence a Modern Approach by Peter Norvig, Rusel. Third Edition.
4. Architecting for the Cloud-AWS Best Practices.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU871 **Course name : INDUSTRY 4.0**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Perceive the changes in the Industrial Revolution.	-	-	-	-	1	-	-	-	1	-	-	1	-	1
CO2	Recognize the internet services in Industry 4.0.	-	-	-	-	1	-	-	-	1	-	-	1	-	1
CO3	Discern the significance of IoT in Industry.	-	-	-	-	1	-	-	-	1	-	-	1	-	1
CO4	Pick out the application IoT.	-	-	-	-	1	-	-	-	1	-	-	1	-	1
CO5	Make out the opportunities and challenges in Industry 4.0	-	-	-	-	1	-	-	-	1	-	-	1	-	1
	Average	-	-	-	-	**1**	-	-	-	**1**	-	-	**1**	-	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – V)

		L	T	P	C
20AU872	**PRODUCTION PLANNING AND CONTROL**	3	0	0	3

Prerequisite: -

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the role of Production Planning and control activities in Manufacturing and Services and perform various forecasting techniques and problems.*	*Understand*
CO2:	*Understand and perform various Inventory Management techniques and summarize various aggregate production planning techniques.*	*Apply*
CO3:	*Evaluate and perform various line balancing and routing concepts.*	*Evaluate*
CO4:	*Demonstrate various Scheduling procedures.*	*Apply*
CO5:	*Solve the dispatching and follow up problems.*	*Apply*

UNIT - I FORECASTING **[09]**

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department. Forecasting – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

UNIT - II INVENTORY MANAGEMENT AND AGGREGATE PLANNING **[09]**

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only. Aggregate planning – Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

UNIT - III LINE BALANCING AND ROUTING **[09]**

Line Balancing: Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method. Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

UNIT - IV SCHEDULING **[09]**

Scheduling –Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling – job shop scheduling, line of balance (LOB) – objectives - steps involved.

UNIT - V DISPATCHING AND FOLLOW UP **[09]**

Dispatching: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching. Follow up: definition – types of follow up – expediting – definition – expediting procedures Applications of computers in planning and control.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. K C Jain and L N Agarwal, Production Planning and Control, 6th edition, Khanna Publishers, 2008.
2. M Mahajan, Production Planning and Control, DhanpatRai& Co., 2010.

Reference Books :

1. James. B. Dilworth, Operations management – Design, Planning and Control for manufacturing and services, Tata Mcgraw Hill, New York, International Edition 1992.
2. MartandTelsang, Industrial Engineering and Production Management, S. Chand and Company, New Delhi, First Edition 2000.
3. R Paneerselvam, Production & Operations Management, 2nd edition, PHI Publications, 2006.
4. E S Baffa and R K Sarin, Modern Production & Operation Managements, 8th edition, Wiley Publications, 2009.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU872 **Course name : PRODUCTION PLANNING AND CONTROL**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the role of Production Planning and control activities in Manufacturing and Services and perform various forecasting techniques and problems.	-	-	-	-	-	1	-	-	-	-	-	-	1	1
CO2	Understand and perform various Inventory Management techniques and summarize various aggregate production planning techniques.	2	2	2	-	-	-	-	-	-	-	-	-	1	1
CO3	Evaluate and perform various line balancing and routing concepts.	2	2	2	-	-	-	-	-	-	-	-	-	1	1
CO4	Demonstrate various Scheduling procedures.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO5	Solve the dispatching and follow up problems.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
	Average	**1.6**	**1.6**	**0.8**	**-**	**-**	**0.2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER – VIII (Professional Elective – V)

		L	T	P	C
20HS002	**TOTAL QUALITY MANAGEMENT (Common to All Branches)**	3	0	0	3

Prerequisites: Nil

Course outcome: On completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Explain the fundamental concepts of total quality management.*	*Understand*
CO2:	*Illustrate the Various TQM principles for continuous process improvement*	*Understand*
CO3:	*Classify the statistical tools to control and improve the quality of the products and services.*	*Understand*
CO4:	*Describe the tools and techniques to improve the quality concept*	*Create*
CO5:	*Explain the quality system in manufacturing and service sectors.*	*Analysis*

UNIT - I INTRODUCTION **[09]**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM implementation steps – Quality Council-Importance of leadership and motivation in TQM - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT - II TQM PRINCIPLES **[09]**

Quality statements - Customer perception of quality – Customer complaints, Customer retention. Employee involvement, Empowerment, Team and Teamwork, Recognition and Reward - Continuous process improvement – Juran trilogy, PDSA cycle, 5s, 8D Methodology - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT - III STATISTICAL PROCESS CONTROL **[09]**

The seven traditional tools of quality – Measurement of central tendency and dispersion, population and sample, normal curve, control chart (X,R,p) for variable and attributes, process capability - Seven new management tools – Six-sigma Concepts.

UNIT - IV TQM TOOLS **[09]**

Bench marking – reason, process – Quality circles concepts - FMEA – stages, types– Quality Function Deployment (QFD) – Taguchi quality loss function –TPM – concepts, improvement needs –Performance measures-criteria – Quality Cost.

UNIT - V QUALITY SYSTEMS **[09]**

Need for ISO 9000 – ISO 9001-2014, ISO 9001-2015, ISO 14000 Quality System – elements, implementation, and documentation. IFDA - Quality auditing – concepts, requirements and benefits, non-conformance report – Case studies of TQM implementation in manufacturing and service sectors.

Total (L: 45 T: 0) = 45 Periods

Text Books:

1. Dale H.Besterfiled, et at., Total Quality Management, Pearson Education Asia, Indian Reprint, New Delhi, Third Edition, 2018.
2. Janakiraman,B and Gopal, R.K, Total Quality Management – Text and Cases,Prentice Hall (India) Pvt. Ltd., New Delhi, Third Edition, 2015.

Reference Books:

1. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India)Pvt. Ltd., New Delhi, Frist Edition, 2014.
2. James R. Evans and William M. Lindsay, The Management and Control of Quality, South-Western (Thomson Learning), New Delhi, Ninety Edition, 2015.
3. Subburaj R, Total Quality Management, Tata McGraw Hill, New Delhi, Frist Edition, 2014.
4. EugenceMckenna and Nic Beach, Total Quality Management, Pearson Education Limited, New Delhi, Second Edition, 2014.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20HS002 **Course name : TOTAL QUALITY MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the fundamental concepts of total quality management.	3	-	-	-	1	-	1	-	-	-	-	1	-	1
CO2	Illustrate the Various TQM principles for continuous process improvement	3	-	-	-	1	-	1	-	-	-	-	1	-	1
CO3	Classify the statistical tools to control and improve the quality of the products and services.	3	-	-	-	1	-	1	-	-	-	-	1	-	1
CO4	Describe the tools and techniques to improve the quality concept	3	-	-	-	1	-		-	-	-	-	1	-	1
CO5	Explain the quality system in manufacturing and service sectors.	3	-	-	-	1	-	1	-	-	-	-	1	-	1
	Average	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 1

		L	T	P	C
20AU873	**RELIABILITY ENGINEERING**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Recognize the concept of reliability.*	*Understand*
CO2:	*Comprehend the concept of various reliability and system models.*	*Apply*
CO3:	*Compare various types of design and analysis of failures.*	*Evaluate*
CO4:	*Explain the reliability testing.*	*Apply*
CO5:	*Remember the reliability analysis.*	*Understand*

UNIT - I CONCEPT OF RELIABILITY [09]

Definition of reliability – reliability Vs quality – reliability function – MTTF – hazard rate function – bathtub curve – Derivation of the reliability function – constant failure rate model – Time dependent failure models – Weibull distribution – Normal distribution- The logarithmic normal distribution. Choosing the best distribution and assessing the results.

UNIT - II RELIABILITY OF SYSTEM AND MODELS [09]

Serial configuration – parallel configuration – combined series parallel systems system structure function, Minimal cuts and Minimal paths – Markov analysis – Load sharing systems, standby system, degraded systems , three state devices – covariate models , static models, dynamic models and physics of failure models.

UNIT - III DESIGN FOR RELIABILITY [09]

Reliability design process – system effectiveness – Economic analysis and life cycle cost – Reliability allocation – ARINC, AGREE- Design methods – parts and material selection, Derating, stress-strength analysis – Failure Analysis – Identification of failure mode – Determine of causes – Assessment of effects – classification of severity computation of critically index – corrective action – System safety and FTA.

UNIT - IV ANALYSIS OF FAILURE DATA AND RELIABILITY TESTING [09]

Data collection – Empirical methods – ungrouped and grouped complete, censored data – static life estimation- test time calculation – Burn in testing, Acceptance, sequential, binomial testing – Accelerated life testing – other acceleration models – Experimental design – Reliability growth process idealized growth curve – various growth models – Identifying failure and repair distributions.

UNIT - V RELIABILITY ANALYSIS OF FMEA [09]

System analysis – Determination of system components and system elements, Classification of system elements, Determination of the reliability structure, Determination of the reliability of system elements, calculation of the system reliability. Failure mode and effects analysis (FMEA) – basic principles and general fundamentals of FMEA methodology, FMEA according to VDA 86 (Form FMEA), Example of a design FMEA according to VDA 86.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Patrick D T o'connor, Andre kleyner, Practical Reliability Engineering, John-Wiley and Sons ltd, New Delhi, Fifth Edition, 2012.
2. David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth, London, Seventh Edition, 2005.

Reference Books :

1. J Bernd Bertsche, Reliability in Automotive and Mechanical Engineering: Determination of Component and System Reliability, Springer, London, 2008.
2. Charles E Ebling, An introduction to Reliability and Maintainability Engineering, Tata McGraw-Hill Education, New Delhi, 2000.
3. Way kuo, Rajendra Prasad V, Frank A and Tillman, Ching-lai Hwang, Optimal reliability design and applications, Cambridge University Press Pvt. Ltd., Cambridge, 2001.
4. L.S.Srinath, “Reliability Engineering”, East West Press, New Delhi, Fourth Edition, 2005.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU873 **Course name : RELIABILITY ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Recognize the concept of reliability.	2	2	-	-	-	1	-	-	-	-	-	-	1	1
CO2	Comprehend the concept of various reliability and system models.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO3	Compare various types of design and analysis of failures.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	Explain the reliability testing.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO5	Remember the reliability analysis.	2	2	-	-	-	-	-	-	-	-	-	-	1	1
	Average	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 1

		L	T	P	C
20AU874	**PREDICTIVE MAINTENANCE**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explain the importance and benefits of sound maintenance.	*Understand*
CO2:	Comprehend the principles of reliability.	*Understand*
CO3:	Realize the concept of misalignment and imbalance.	*Understand*
CO4:	Apply the theory of Ferrography for equipment maintenance.	*Apply*
CO5:	Categorize suitable repair method for maintenance of equipment.	*Apply*

UNIT - I Basic concept of maintenance [09]

Basic concept - purpose and function of maintenance — Importance and benefits of sound Maintenance systems- types of maintenance - Maintenance categories - Comparative merits of each category - Preventive maintenance - TPM .maintenance schedules - repair cycle - Principles and methods of lubrication -Condition Monitoring - Cost comparison with and without CM - Basic Principles of maintenance planning - principles of planned maintenance activity.

UNIT - II Principles of Reliability [09]

Reliability : basic concepts – reliability- maintainability -availability- failure rate-mean time between failures - Reliability and machine availability – MTBF- MTTR -MWT-Bath tub curve - Factors of availability - Maintenance economics- system reliability-reliability of series and parallel systems- reliability estimation using exponential distribution function.

UNIT - III Condition monitoring [09]

Misalignment - unbalance - vibration monitoring and analysis -vibration analysis -proximity analysis - frequency analysis - - real time analysis- vibration limits- vibration severity criteria -vibration severity charts -Methods - instruments for CM - Temperature sensitive tapes - Pistol thermometers - wear-debris analysis - shock pulse analysis - application -condition monitoring of ball - roller bearings - vibration signature analysis transducers for vibration measurement.

UNIT - IV Theory of Ferrography [09]

Ferrography - spectral oil analysis procedure - non-destructive testing - liquid penetrant testing- radio graphic inspection-ultrasonic testing -acoustic emission- corrosion monitoring-resistance techniques technique providing information on plant regarding corrosion monitoring.

UNIT - V Repair methods [09]

Repair methods for beds - slide ways- spindles- gears- lead screws - bearings - Failure analysis - Failures and their development - Logical fault location methods - Sequential fault location. Repair methods for Material handling equipment - Equipment records -Job order systems -Use of computers in maintenance.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981.
2. Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995.

Reference Books :

1. Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 2018.
2. White E.N., "Maintenance Planning", I Documentation, Gower Press, 2016.
3. Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill, 5th Edition, 2015.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU874 **Course name : PREDICTIVE MAINTENANCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the importance and benefits of sound maintenance.	3	3	3	1	1	1	1	1	2	1	1	1	1	1
CO2	Comprehend the principles of reliability.	3	3	3	1	1	1	1	1	2	1	1	1	1	1
CO3	Realize the concept of misalignment and imbalance.	3	3	3	1	1	1	1	1	2	1	1	1	1	1
CO4	Apply the theory of Ferrography for equipment maintenance.	3	3	3	1	1	1	1	1	2	1	1	1	1	1
CO5	Categorize suitable repair method for maintenance of equipment.	3	3	3	1	1	1	1	1	2	1	1	1	1	1
	Average	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 1

		L	T	P	C
20AU875	**CONNECTED CARS AND ADAS**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Perceive the technology applied in connected cars.*	*Understand*
CO2:	*Explore the basics and advancement in automated and intelligent cars.*	*Understand*
CO3:	*Discern the basics related to sensor technology in automated cars.*	*Apply*
CO4:	*Learn the fundaments related to wireless technology in connected cars.*	*Apply*
CO5:	*Perceive recent driver assistance system technology associated with automated cars.*	*Understand*

UNIT - I INTRODUCTION TO CONNECTED CARS [09]

Introduction to Connected, automated and Intelligent cars: Automotive Electronics Overview, Advanced Driver Assistance Electronic Systems.**Connected Car Technology:** Connectivity Fundamentals, Navigation and Other Applications, Connected Car Display Technology.

UNIT - II AUTONOMOUS AND INTELIGENT CARS [09]

Autonomous Vehicle Technology: Basic Control System Theory applied to Automobiles, Overview of the Operation of ECUs, Basic Cyber-Physical System Theory and Autonomous Vehicles,**Autonomous Vehicles:** Driverless Car Technology, Moral, Legal, Roadblock Issues, Technical Issues, Security Issues

UNIT - III SENSOR TECHNOLOGY [09]

Sensor Technology for Advanced Driver Assistance Systems: Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, Lidar Sensor Technology and Systems, Camera Technology, Night Vision Technology, **Impaired Driver Technology:** Driver Impairment Sensor Technology, Sensor Technology for Driver Impairment Detection, Transfer of Control Technology

UNIT - IV WIRELESS TECHNOLOGY [09]

Overview of Wireless Technology: Wireless System Block Diagram and Overview of Components, Transmission Systems – Modulation/Encoding, Receiver System Concepts – Demodulation/Decoding, Signal Propagation Physics, Basic Transmission Line and Antenna Theory, **Wireless System Standards and Standards Organizations:** Wireless Networking and Applications to **Vehicle Autonomy:** Basics of Computer Networking – the Internet of Things, Wireless Networking Fundamentals, Integration of Wireless Networking and On-Board Vehicle Networks

UNIT - V RECENT DRIVER ASSISTANCE SYSTEM AND VEHICLES [09]

Recent Driver Assistance System Technology: Basics of Theory of Operation, Applications – Legacy, Applications – New, Applications – Future, Integration of ADAS Technology into Vehicle Electronics, System Examples, Role of Sensor Data Fusion. Recent Driver Assistance System Technology applied in various automobile companies dealing with Non-Passenger Car.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Dr. Dietmar P.F. Möller, Dr. Roland E. Haas: Guide to Automotive Connectivity and Cyber securityTrends, Technologies, Innovations and Applications, Springer International Publishing, 2019.
2. G. Mullett, Wireless Telecommunications Systems and Networks, Thomson – Delmar Learning, ISNB#1-4018-8659-0, 2006

Reference Books :

1. Mullett, Gary J., Basic Telecommunications: The Physical Layer, Cengage Learning, ISBN#1-4018-4339-5, 2002.
2. Tom Denton, Automobile Electrical and Electronic Systems, ISBN 9780415725774, Routledge, Fifth Edition, 2017.
3. Plato Pathrose, ADAS and Automated Driving: A Practical Approach to Verification and Validation R-525, SAE International, 2022.
4. Lentin Joseph, Amit Kumar Mondal, Autonomous Driving and Advanced Driver-Assistance Systems (ADAS) Applications, Development, Legal Issues, and Testing, CRC Press, First Edition, 2021.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU875 **Course name : CONNECTED CARS AND ADAS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Perceive the technology applied in connected cars.	3	-	3	-	3	-	3	3	-	-	3	3	-	2
CO2	Explore the basics and advancement in automated and intelligent cars.	3	-	3	-	3	-	3	3	-	-	3	3	-	2
CO3	Discern the basics related to sensor technology in automated cars.	3	-	3	-	3	-	3	3	-	-	3	2	-	2
CO4	Learn the fundaments related to wireless technology in connected cars.	3	-	3	-	3	-	3	3	-	-	3	-	-	2
CO5	Perceive recent driver assistance system technology associated with automated cars.	3	-	3	-	3	-	3	3	-	-	3	3	-	2
	Average	**3**	**-**	**3**	**-**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**2.2**	**-**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 2

		L	T	P	C
20AU881	**ELECTRIC TWO AND THREE WHEELERS**	3	0	0	3

Prerequisite: Nil

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Develop knowledge and skills needed to run a business successfully.*	*Apply*
CO2:	*Interpret the motivational concept in entrepreneurship development.*	*Understand*
CO3:	*Impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.*	*Understand*
CO4:	*Summarize the concept of financial and cost accounting.*	*Understand*
CO5:	*Compose the business strategy and skills to develop small scale industries.*	*Apply*

UNIT - I DESIGN CONCEPTS FOR ELECTRIC TWO AND THREE WHEELER [09]

Choosing a Frame and Body-Selecting a Frame-Standard Measurements and Formulas- EVWeight- Aerodynamic Drag Force-Relative Wind Contributes to Aerodynamic Drag- Wheel Well andUnderbody Airflow- Rolling Resistance- Gradability- Horsepower, Torque, and Current Calculations-Energy Comparison in Electric Vehicles-Gear Ratio Calculations.

UNIT - II BATTERIES FOR EV [09]

Range of EV and battery trend. Batteries for Powering Electric Bikes- Battery Selection- - Battery Types, Components, and Performance- Lead-Acid Battery-Its Limits for Electric Bike Propulsion- Nickel-Cadmium Batteries for Electric Bike Propulsion- Lithium Ion Batteries for Electric Bike Propulsion. Battery Charging- Charge Control of Long-Life Bike Batteries- Charging Solutions for Lithium Batteries- Two-Step Charging, Three-Step Charging- Charging with Pulses and Rest Periods.

UNIT - III FUNDAMENTAL PRINCIPLES OF ELECTRIC MOTORS [09]

Brush-and-Commutator Motor- Induction Motors-Permanent Magnet Synchronous Motors- BLDC - Motor Characteristics for Electric Bike Propulsion- Torque-Speed Characteristics- Motor Output Power-**Motor Control-** Different type of Motor Control- Working principle of Motor Control-Testing and Troubleshooting of Motor Control.

UNIT - IV POWER ELECTRONICS INTERFACE [09]

Power electronics interface – basic devices and components-Convertors and invertors-Traction motors-Battery modules and pack-Sizing of battery pack-Mechanical and thermal design of battery pack-Motor Control**-** Different type of Motor Control- Working principle of Motor Control-Testing and Trouble shooting.

UNIT - V ECONOMICS, REGULATIONS AND POLICY [09]

Future projections-Laws and Regulations-EV Standards- Safety of Vehicle and Passengers-Goveming Electric Bikes, Total cost of ownership-Running Cost-Payback period-Indian EV policies-Electricity Requirements-Battery Recycling-Impact on Environment.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Electric Motorcycles 2019: A Guide to the Best Electric Motorcycles and Scooters, Micah Toll, ISBN-10: 0989906728, ISBN-13: 978-0989906722, Atlantic Publishers and Distributors, 10 April 2019.
2. M. Ehsani, Y. Gao, S. Gay and A. Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, CRC Press, 2005.

Reference Books :

1. Jiuchun Jiang and Caiping Zhang, “Fundamentals and applications of Lithium-Ion batteriesin Electric Drive Vehicles”, Wiley, 2015.
2. Haitham Abu-Rub, Mariusz Malinowski and Kamal Al-Haddad “Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications”, John Wiley and sons, 2014.
3. Iqbal Husain, ELECTRIC and HYBRIDVEHICLES, Design Fundamentals, CRC Press, 2003.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU881 **Course name : ELECTRIC TWO AND THREE WHEELERS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Upon completion of the course, students will Develop knowledge and skills needed to run a business Successfully.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Interpret the motivational concept in entrepreneurship development.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Summarize the concept of financial and cost accounting.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Compose the business strategy and skills to develop small scale industries.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 2

		L	T	P	C
20AU882	**MOTORS AND DRIVERS**	3	0	0	3

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Rephrase the basic concepts of electric motor designs.*	*Understand*
CO2:	*Demonstrate the electric vehicle motors and controllers.*	*Understand*
CO3:	*Reveal the construction and principle of operation of a stepper motor.*	*Understand*
CO4:	*Demonstrate the electric vehicle DC motor drives.*	*Understand*
CO5:	*Reveal the AC motor drives used for electric vehicles.*	*Understand*

UNIT - I **DESIGN CONSIDERATIONS** **[09]**

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems, performance of electrical vehicles.

UNIT - II MOTORS AND CONTROLLERS **[09]**

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT - III STEPPER MOTORS **[09]**

Constructional features – Principle of operation – Variable reluctance motor – Permanent Magnet motor – Hybrid motor – Single and multi-stack configurations – Torque equation – Modes of excitation – Characteristics – Drive system and control circuitry – Processor control of stepping motors – Closed loop control.

UNIT - IV DC DRIVES **[09]**

Speed control of DC series and shunt motors — Armature and field control – Ward-Leonard control system – Controlled Rectifiers Fed DC motor Drive – Chopper fed DC motor Drive: Buck, Boost and Buck-Boost – Applications.

UNIT - V AC DRIVES **[09]**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverter and AC Voltage Controller Based Induction Drives – Applications.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Dubey G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2019
2. E.G.Janardanan, Special Electrical Machines, PHI Learning Pvt. ltd., India, Second Edition, 2014.

Reference Books :

1. Krishnan.R, Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application, CRC Press, New York, Second Edition, 2009.
2. Bose.B.K, Modern Power Electronics & AC drives, Pearson Education, India, Second Edition, 2003.
3. VedamSubramaniam, Electric Drives: Concepts and Applications, Tata McGraw Hill Publishing Company, New Delhi, Second Edition, 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU882 **Course name : MOTORS AND DRIVERS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Rephrase the basic concepts of electric motor designs.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Demonstrate the electric vehicle motors and controllers.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Reveal the construction and principle of operation of a stepper motor.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Demonstrate the electric vehicle DC motor drives.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Reveal the AC motor drives used for electric vehicles.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 2

20AU883	**ELECTRIC VEHICLE DYNAMNICS**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Categorize vibration system according to the DOF.*	*Understand*
CO2:	*Discern the performance of electric vehicle due to acceleration and braking.*	*Understand*
CO3:	*Outline the suspension system for electric vehicle.*	*Understand*
CO4:	*Pick out the response of electric vehicle according to the direction change.*	*Understand*
CO5:	*Criticize the stability of the vehicle on different drive conditions.*	*Understand*

UNIT - I CONCEPT OF VIBRATION **[09]**

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration – Response Analysis of Single, Two and Multi DOF - Magnification Factor, Transmissibility – Torsional Vibration, Critical Speed.

UNIT - II LONGITUDINAL DYNAMICS **[09]**

Aerodynamic Forces and Moments acting on electric vehicle, Equation of Motion, Acceleration, Gradability Tractive Effort and Reaction Forces for electric Vehicles, Braking and Driving Torque – Brake Force Distribution, Power regeneration, Braking Efficiency and Braking Distance.

UNIT - III VERTICAL DYNAMICS **[09]**

Sources of Vibration, Vibration Absorber – Design and Analysis of Suspension system for an electric vehicle, Influence of Suspension Stiffness using quarter car model, Suspension Damping.

UNIT - IV LATERAL DYNAMICS **[09]**

Tyre Forces and Moments acting on electric vehicle, Longitudinal and Lateral Forces at various Slip Angles, Rolling Resistance, Yaw Velocity Gain, Lateral Acceleration Gain – Direction Control of Electric Vehicles, Roll Center, Roll Axis.

UNIT - V VEHICLE STABILITY **[09]**

Load Distribution, Calculation of Equivalent Weight, Determination of Centre of Gravity Location and Gyroscopic Effect - Stability of a Vehicle on a Slope, on a Curve and on Banked Road.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Electric and Hybrid Vehicles, Design Fundamentals, Third Edition, Iqbal Husain, CRC Press, 2021.
2. Wie Liu, “Hybrid Electric Vehicle System Modeling and Control”, Second Edition, John Wiley & Sons, 2017, 2nd Edition.

Reference Books :

1. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014.
2. Singiresu S. Rao, "Mechanical Vibrations," 5th Edition, Prentice Hall, 2010.
3. J. Y. Wong, "Theory of Ground Vehicles", Fourth Edition, Wiley-Interscience, 2008.
4. Modem Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory, and Design, MehrdadEhsaniandYiminGao, Power Electronics and application series.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU883 **Course name : ELECTRIC VEHICLE DYNAMNICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Categorize vibration system according to the DOF.	3	-	-	-	-	1	1	-	-	-	-	-	3	3
CO2	Discern the performance of electric vehicle due to acceleration and braking.	3	-	-	-	-	1	1	-	-	-	-	-	**3**	**3**
CO3	Outline the suspension system for electric vehicle.	3	-	-	-	-	1	1	-	-	-	-	-	**3**	**3**
CO4	Pick out the response of electric vehicle according to the direction change.	3	-	-	-	-	1	1	-	-	-	-	-	**3**	**3**
CO5	Criticize the stability of the vehicle on different drive conditions.	3	-	-	-	-	1	1	-	-	-	-	-	3	3
	Average	**3**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 2

		L	T	P	C
20AU884	**ELECTRIC VEHICLE MAINTENANCE**	3	0	0	3

Prerequisite: *Nil*

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Rephrase the introduction and safety to Electric Vehicle Maintenance.*	*Understand*
CO2:	*Understand the Energy Storage System Maintenance.*	*Understand*
CO3:	*Organize the fundamentals Drive train Maintenance.*	*Understand*
CO4:	*Apply the concept of EV Maintenance Servicing and Repairs.*	*Apply*
CO5:	*Perform auxiliary Systems Maintenance activities in time to avoid unnecessary downtime.*	*Apply*

UNIT - I Introduction and safety to Electric Vehicle Maintenance [09]

Maintenance standards and procedures - checklists and schedules - workplace related risks and hazards - 5S guidelines- procedure for storage of tools, equipment and material- waste management. Hand Tools, Testing equipment and spare parts. basic technology - Laws and principles of electricity - Symbols- wiring diagrams and software tools used for identifying bugs.

UNIT - II Energy Storage System Maintenance [09]

Types of Batteries - Testing, gas generation in batteries, leakage path & rates. High discharge rates, Short circuits, charging and discharging. Monitor and check performance of HV rechargeable energy storage system and Battery Management System. Battery temperature Mapping- Configures BMS with software application- Replacement of defective Battery. Environment and Human Health impact of batteries - Recycling of EV batteries.

UNIT - III Drive trainMaintenance [09]

Electric vehicle motor- speed controller. DC/DC converters, Motor cooling system Control system principles, speed and torque control, Advanced charging Systems Management. Test regenerative braking. Test high voltage electric distribution systems speed control of DC Motor Diagnose, repair, and test DC/DC converters. Test the various sensors. Charging techniques.

UNIT - IV EV Maintenance Servicing and Repairs [09]

Trace the High Voltage wiring on the vehicle- HV and LV and the electrical components in the electric vehicle. Testing methods for checking electrical components, checking battery, starter motor, charging systems, Alternator, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instrument- Diagnose troubles and Remedies.

UNIT - V Auxiliary Systems Maintenance [09]

Vehicle Propulsion and Braking Maintenance-Regenerative Braking maintenance- Maintenance of EV/HEV Powertrains Components-Electric Motor maintenance - Battery Performance Characteristics- horn- Wiper and washer - Power window - Power Door lock -Vehicle interior and exterior lighting system Maintenance. Servicing and repairing an air conditioning system of a vehicle.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic T3: Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2006.
2. Judge.A.W.Modern Electrical Equipments of Automobiles, Chapman & Hall, London2004.

Reference Books :

1. Amir Khajepour, SaberFallah and AvestaGoodarzi, “Electric and Hybrid VehiclesTechnologies, Modelling and Control: A Mechatronic Approach”, John Wiley & Sons Ltd, 2014.
2. Crouse.W.H. Automobile Electrical Equipment, McGraw Hill Book CoInc. NewYork, 2005.
3. MehrdadEhsani, YiminGao, Sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell VehiclesFundamentals, Theory and Design”, CRS Press, 2004.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU884 **Course name : ELECTRIC VEHICLE MAINTENANCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Rephrase the introduction and safety to Electric Vehicle Maintenance.	3	2	-	-	3	-	-	-	-	-	-	3	-	-
CO2	Understand the Energy Storage System Maintenance.	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	Organize the fundamentals Drive train Maintenance.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
CO4	Apply the concept of EV Maintenance Servicing and Repairs.	3	-	-	-	3	2	-	-	-	-	-	3	3	-
CO5	Perform auxiliary Systems Maintenance activities in time to avoid unnecessary downtime.	3	2	-	-	3	2	-	-	-	-	-	3	3	-
	Average	**3**	**1.2**	**-**	**-**	**2.4**	**1.2**	**-**	**-**	**-**	**-**	**-**	**3**	**2.4**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

Emerging Area 2

		L	T	P	C
20AU885	**OPERATIONS RESEARCH**	3	0	0	3

Prerequisite:

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Enable to develop the decision making during the uncertain situations by linear programming approach.*	*Understand*
CO2:	*Identify to minimize the Transportation and Assignment cost and maximize the profit in Industries.*	*Understand*
CO3:	*Developing the network techniques in project scheduling.*	*Understand*
CO4:	*Study the importance of stock controlling to maximize the profit.*	*Understand*
CO5:	*Perceive the Replacement and sequencing methods in manufacturing engineering.*	*Understand*

UNIT - I LINEAR PROGRAMMING PROBLEM [09]

Introduction - scope and role of OR - phases of OR - limitations of OR - linear programming problem - formulation of linear programming problem - optimum solution by graphical method - simplex method (using slack variables only).

UNIT - II TRANSPORTATION AND ASSIGNMENT PROBLEM [09]

Transportation Models (Minimizing and Maximizing Cases) - Balanced and unbalanced cases - Initial Basic feasible solution by North West Corner Rule, Least cost and Vogel's approximation methods. Check for optimality by Modified method. Assignment Models (Minimizing and Maximizing Cases) - Balanced and Unbalanced Cases - Solution by Hungarian method

UNIT - III NETWORK MODELS [09]

Network - Fulkerson's rule - construction of a network - critical path method (CPM) - optimistic, pessimistic and most likely time estimates - project scheduling by PERT analysis.

UNIT - IV INVENTORY MODEL [09]

Types of Inventory - Deterministic inventory models - EOQ and EBQ models with and without shortages - Quantity discount model - Price breaks - probabilistic inventory model.

UNIT - V REPLACEMENT MODELS AND SEQUENCING [09]

Replacement of items that deteriorate with time - value of money changing with time - not changing with time - optimum replacement policy - individual and group replacement. Sequencing problem - assumptions - processing of 'n' jobs in 2 machines, 'n' jobs with 'm' machines.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. P.K. Gupta and Man Mohan, Problems in Operations Research, S. Chand and Co, New Delhi, Fourteenth edition, 2016.
2. Wayne. L. Winston, Operations research applications and algorithms, Thomson learning, New Delhi, Tenth edition, 2016.

Reference Books :

1. Hira and Gupta, Problems in Operations Research, S. Chand and Co, NewDelhi, Eighth edition, 2015.
2. Taha H.A, Operation Research, Pearson Education, New Delhi, sixth edition, 2016.
3. J k Sharma, Operation Research, Macmillan India Pvt. Ltd., New Delhi, Seventh edition, 2007.
4. https://en.wikipedia.org/wiki/Resource_management.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AU885 **Course name : OPERATIONS RESEARCH**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Enable to develop the decision making during the uncertain situations by linear programming approach.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Identify to minimize the Transportation and Assignment cost and maximize the profit in Industries.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Developing the network techniques in project scheduling.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Study the importance of stock controlling to maximize the profit	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Perceive the Replacement and sequencing methods in manufacturing engineering.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE901 **ARCHITECTURAL HERITAGE OF INDIA** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate various materials used and construction style of Indus Valley Civilization*	*Understand*
CO2:	*Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture*	*Understand*
CO3:	*Describe the materials used and construction style of Mughal architecture*	*Understand*
CO4:	*Explain the various materials and construction style of British* architecture	*Understand*
CO5:	*Describe various materials and construction style of Portuguese, Dutch, French and Danish*	*Understand*

UNIT - I INDUS VALLEY CIVILIZATION **[09]**

Indus valley civilization – Chronological introduction – Construction style – Materials used – The cities Harappa, lothal and Mohenjo-Daro, The great bath – The granary at Harappa – The assembly hall – Ajanta-Ellora Cave temples – Mahabodhi temple complex

UNIT - II SOUTH INDIAN ARCHITECTURE **[09]**

Chera-Chola-Pandya architecture – Chronological introduction – Construction style – Materials used – Brihadeeswarar Temple – Meenakshi Temple – Kalinga – Chalukya – Pallava architecture – Mahabalipuram stone temples – Khajuraho – Muskin Bhanvi – Konark Sun Temple – Hoysala – Vijayanagara architecture – twin temples Mosale – Virupaksha temple Raya Gopura at Hampi

UNIT - III MUGHAL ARCHITECTURE **[09]**

Mughal architecture – Chronological introduction – Construction style – Materials used – Qutub Minar – Taj Mahal – Humayun's Tomb – Redfort – Fatehpur Sikri – Agra fort – Jama Masjid – Rajput civil architecture – Chronological introduction – Construction style – Materials used – All hill forts of Rajasthan

UNIT - IV BRITISH ARCHITECTURE **[09]**

British colonial architecture – Chronological introduction – Construction style – Materials used – Buildings in Chennai, Mumbai, and Shimla – Churches – Mountain railways of India-bridges.

UNIT - V COLONIAL ARCHITECTURE **[09]**

Other colonial architecture – Portuguese-Dutch-French-Danish – Chronological introduction – Construction style – Materials used – Churches – Churches and Convents of Goa and Cochi – French town of Puducherry – Tranquebar fort – Bungalow on the beach

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Bindia Thapar, Surat Kumar Manto, and Suparna Bhalla., Introduction to Indian Architecture: Arts of Asia, Periplus Editions (HK) ltd, Hong Kong, First Edition, 2005

2 Sandhya Ketkar., The History of Indian Art, Jyotsna Prakashan Publisher, Maharashtra, E – Edition, 2020

Reference Books :

1 Christopher Tadgell., The History of Architecture in India, Phaidon Press Ltd, New York, First Edition, 1990.

2 Mark M. Jarzombek, Vikramaditya Prakash, Francis D. K. Ching., A Global History of Architecture, John Wiley & Sons, Hoboken, Second Edition, 2010

3 https://nptel.ac.in/courses/124106009

4 https://ncert.nic.in/textbook/pdf/kefa106.pdf

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CE901 **Course name : ARCHITECTURAL HERITAGE OF INDIA**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate various materials used and construction style of Indus Valley Civilization	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO2	Demonstrate the materials used and construction style of Chera, Chola and Pandya architecture	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO3	Describe the materials used and construction style of Mughal architecture	3	3	-	1	-	2	2	-	-	-	-	3	-	-
CO4	Explain the various materials and construction style of British architecture	3	3	-	2	-	2	2	-	-	-	-	3	-	-
CO5	Describe various materials and construction style of Portuguese, Dutch, French and Danish	3	3	-	1	-	2	2	-	-	-	-	3	-	-
	Average	**3**	**3**	**-**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	-	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE902	**BUILDING PLANNING AND CONSTRUCTION** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the factors to be considered in planning and construction of buildings*	*Understand*
CO2:	*Infer the different components and Foundations of building in their construction practices.*	*Understand*
CO3:	*Interpret masonry and* alternative *materials of wood, aluminum and glass.*	*Understand*
CO4:	*Discuss different types of floors, roofs and the materials which are commonly used for construction.*	*Understand*
CO5:	*Explain about dampness and fire resistance in buildings*	*Understand*

UNIT - I FUNCTIONAL PLANNING OF BUILDINGS [09]

Types of Buildings, Aspects and Principles of Building Planning, Building By - laws and Regulations, Site Selection criteria, Orientation of Building and its relation to surrounding environment, Sustainability and Green Buildings - Building Bye - laws and Building code of India 2016.

UNIT - II BUILDING COMPONENTS AND FOUNDATIONS [09]

Lintels, arches, different types of floors-concrete, mosaic, terrazzo floors, pitched, flat and curved roofs, lean-to roof, coupled roofs, trussed roofs, king and queen post trusses; RCC roofs, madras terrace/shell roofs. Foundations: Shallow foundations, spread, combined, strap and mat footings.

UNIT - III ALTERNATIVE MATERIALS AND MASONRY [09]

Structure, properties, seasoning of timber; Classification of various types of woods used in buildings, defects in timber; Alternative materials for wood, galvanized iron, fibre-reinforced plastics, steel, aluminium and glass; Types of masonry, English and Flemish bonds, rubble and ashlars masonry, cavity and partition walls - Light weight concrete blocks – merits and demerits.

UNIT - IV FLOORS,ROOFS AND STAIRCASES [09]

Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings. Functional requirements of a good stair, type of stairs, planning a stair case.

UNIT - V DAMP PROOFING AND FIRE PROTECTION [09]

Damp proofing and Fire protection: Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Varghese P. C., Building construction, PHI Learning Pvt. Ltd, New Delhi ,Second Edition, 2016.

2 B. C. Punmia , Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications, New Delhi ,Eleventh Edition,2019.

Reference Books :

1 S. K. Duggal, Building Materials II, New Age International (P) Limited, New Delhi ,Fourth Edition, 2016,

2 Bulding Bye-laws 2019

3 National Building Code of India, 2016.

4 www.nptel.ac.in/courses/105101088/2 home.htm

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CE902 **Course name : BUILDING PLANNING AND CONSTRUCTION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline the factors to be considered in planning and construction of buildings	3	2	1	1	-	3	2	-	-	-	-	2	-	-
CO2	Infer the different components and Foundations of building in their construction practices.	3	2	-	2	-	2	3	-	-	-	-	2	-	-
CO3	Interpret masonry and alternative materials of wood, aluminum and glass.	2	-	-	2	-	3	2	-	-	-	-	2	-	-
CO4	Discuss different types of floors, roofs and the materials which are commonly used for construction.	3	2	-	2	-	3	2	-	-	-	-	2	-	-
CO5	Explain about dampness and fire resistance in buildings	3	2	-	2	-	3	3	-	-	-	-	2	-	-
	Average	**3**	**2**	**1**	**2**	**1**	**3**	**3**	**-**	-	-	**-**	**2**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE903 **ELEMENTARY CIVIL ENGINEERING** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to	***Cognitive Level***
CO1: Provide an overview of civil engineering	*Understand*
CO2: Explain the basics of surveying , modern tools of surveying and mapping	*Understand*
CO3: Summarize the fundamentals of building materials in civil engineering	*Understand*
CO4: Explain the components of building structures.	*Understand*
CO5: Interpret various infrastructures of civil engineering in construction	*Understand*

UNIT - I OVERVIEW OF CIVIL ENGINEERING **[09]**

History of Civil Engineering - Role and Functions of Civil Engineer - Fields of Civil Engineering - Importance of Civil Engineering

UNIT - II BASICS OF SURVEYING **[09]**

Introduction - Basic Definitions (Surveying, leveling, Plans, Maps, Scales) - Introduction to divisions of surveying - Classification of surveying - Fundamental principles of surveying - Measurement in Surveying - Phases of Surveying

MODERN TOOLS OF SURVEYING AND MAPPING:

Introduction to Global Positioning System - Remote Sensing and Geographic Information System

UNIT - III FUNDAMENTALS OF BUILDING MATERIALS **[09]**

Bricks – stones – sand – M-sand - cement – fly ash - silica fume - mortar- concrete – steel – glass - wood –plastics – ceramics

UNIT - IV COMPONENTS OF BUILDING **[09]**

Foundations – stone masonry – brick masonry – beams – columns – lintels – roofing – flooring – plastering- damp proofing weathering course

UNIT - V STRUCTURES **[09]**

Introduction to dams, weirs, barrages and check dams - Role of transportation in national development - Modes of transportation - Introduction to road traffic and traffic control - Introduction to mass transportation system

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Anurag Kandya, Elements of Civil Engineering, Charotar Publishing House Pvt. Ltd, Gujarat, Third Edition, 2017.

2 Palanichamy M.S., Basic Civil Engineering, Tata McGraw-Hill, New Delhi, Fourth Edition, 2011.

Reference Books :

1 Poonam Sharma & Swati Rajput, Sustainable Smart Cities in India – Challenges and Future Perspectives, Springer, First Edition, 2017.

2 Dr.B.C.Punamia, Surveying, Laxmi Publication, New Delhi, Seventh Edition, 2016.

3 https://nptel.ac.in/courses/105102088

4 https://byjusexamprep.com/civil-engineering-exams/building-materials

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20CE903 **Course name : ELEMENTARY CIVIL ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Provide an overview of civil engineering	1	-	-	-	-	1	-	-	-	-	-	1	-	-
CO2	Explain the basics of surveying and modern tools of surveying and mapping	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO3	Summarize the fundamentals of building materials in civil engineering	2	1	-	-	-	2	2	-	-	-	-	1	-	-
CO4	Explain the components of building structures.	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO5	Interpret various infrastructures of civil engineering in construction	3	2	1	-	-	3	2	-	-	-	-	1	-	-
	Average	**3**	**2**	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE904	**ENERGY AND ENVIRONMENT** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the earth's energy, environment and the processes leading to climate change.*	*Understand*
CO2:	*Infer the atmospheric issues related to the chemistry, green house gases*	*Understand*
CO3:	*Summarize the role of the terrestrial energy-environment-climate system*	*Understand*
CO4:	*Interpret the Possible effects of Global Warming and climate change.*	*Understand*
CO5:	*Outline the Natural and Anthropogenic and Green House Gas theory*	*Understand*

UNIT - I INTRODUCTION [09]

Overview on the Earth's energy requirements-Climate Change-Origins of the terrestrial atmosphere-Earth's early atmosphere- Introduction to Climate-Layers of the atmosphere.

UNIT - II GLOBAL ATMOSPHERIC ISSUES [09]

Composition of the present day atmosphere-Introduction to Atmospheric chemistry-Green House Gases, and the O3 - depletion problem-Post Industrial Revolution Scenario

UNIT - III ENERGY BALANCE [09]

Earth Atmosphere System- Solar and Terrestrial Radiation- Absorption of Radiation by gases.-Energy balance- Solar variability and the Earth's Energy Balance.

UNIT - IV ATMOSPHERIC CHEMISTRY AND CLIMATE [09]

The Global Temperature Record.-Possible effects of Global Warming. – Indian Context. Atmospheric Chemistry and Climate Change- Atmospheric Aerosol and Cloud Effects on Climate.

UNIT - V ENVIRONMENTAL VARIABILITY [09]

Natural (volcanoes, forest fires) and Anthropogenic (Antarctic Ozone Hole, Global Warming).-Green House Gas theory.- Effects of urbanization- Landscape changes-Influence of Irrigation-Desertification and Deforestation

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Peter E Hodgson, Energy the Environment and Climate Change, Imperial College Press, London, First Edition, 2010

2. Ahluwalia V K, Energy and Environment, The Energy and Resources Institute, New Delhi, First Edition, 2019

Reference Books :

1 Richard Wolfson, Energy, Environment, and Climate, Publisher: W. W. Norton & Company, New York, Second Edition,2011

2 Saeed Moaveni ,Energy, Environment, and Sustainability with Mind Tap, Cengage India Private Limited ,New Delhi, First Edition,2017

3 Wilbanks, T., Bilello D, Schmalzer D, Scott, Climate Change and Energy Supply and Use: Technical Report for the U.S. Department of Energy in Support of the National Climate Assessment., Island Press,Washington,2013

4 Frank T. Princiotta, Global Climate Change - The Technology Challenge, Springer Publisher, New York, First Edition, 2011

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20CE904 **Course name : ENERGY AND ENVIRONMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline The Earth's Energy, Environment and the processes leading to climate change.	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO2	Infer the Atmospheric issues related to the chemistry, Green House Gases	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO3	Summarize the role of the Terrestrial Energy-Environment-Climate System	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO4	Interpret the Possible effects of Global Warming and climate change.	3	3	-	-	-	2	2	-	-	-	-	2	-	-
CO5	Outline the Natural and Anthropogenic and Green House Gas theory	3	3	-	-	-	2	2	-	-	-	-	2	-	-
	Average	**3**	**3**	**-**	-	**-**	**2**	**2**	**-**	-	-	**-**	**2**	**-**	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CE905	**ENVIRONMENTAL LAWS AND POLICIES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the basic concepts in environmental laws and its judicial activism*	*Understand*
CO2:	*Interpret different water acts and marine laws in India*	*Understand*
CO3:	*Summarize various Environment protection laws and acts in the framework of Mega projects*	*Understand*
CO4:	*Explain the management and handling of various hazardous waste management*	*Understand*
CO5:	*Summarize the International Environmental laws framed at various conferences.*	*Understand*

UNIT - I BASIC CONCEPTS IN ENVIRONMENTAL LAW [09]

An introduction to the legal system – Constitution – Acts – Rules – Regulations - Indian Judiciary - Doctrine of precedents - judicial review - Writ petitions - PIL– liberalization of the rule of locus standi - Judicial activism - Introduction to environmental laws in India - Constitutional provisions - Stockholm conference - Bhopal gas tragedy - Rio conference - General principles in Environmental law - Precautionary principle - Polluter pays principle - Sustainable development- Public trust doctrine - Overview of legislations and basic concepts.

UNIT - II AIR- WATER - MARINE LAWS [09]

National Water Policy and some state policies - Laws relating to prevention of pollution, access and management of water and institutional mechanism - Water Act, 1974 - Water Cess Act, 1977 - EPA, 1986 - Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India - Coastal zone regulations - Legal framework on Air pollution - Air Act,1981 - EPA, 1986

UNIT - III ENVIRONMENT PROTECTION LAWS - LARGE PROJECTS [09]

Legal framework on environment protection - Environment Protection Act as the framework legislation - strength and weaknesses of EIA - National Green tribunal the courts infrastructure projects

UNIT - IV HAZARDOUS SUBSTANCES AND ACTIVITIES [09]

Legal framework - EPA and rules made there under PLI Act, 199 - Principles of strict and absolute liability - Hazardous Wastes (Management, Handling and Transboundary) Rules, 2008 - Biomedical Waste (Management and Handling) Rules, 1998 - Municipal Solid Wastes (Management and Handling) Rules, 2000 - E - Waste (Management and Handling) Rules, 2011 - Batteries (Management & Handling) Rules, 2001

UNIT - V INTERNATIONAL ENVIRONMENTAL LAW [09]

Development of international environmental law, nature and scope of key international environmental law principles and rights (substantive and procedural), Establishment of Environmental Institutions like UNEP, Ozone Protection – Montreal Protocol for the Protection of Ozone Layer, 1987 as amended; U.N. Convention on Climate Change1992, Kyoto Protocol, 1997; Public Participation in Decision-making and Access to Justice in Environmental Matters, 1998 (Aarhus Convention); Johannesburg Conference, 2002.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Divan,S and Rosencranz, A., Environmental Law and Policy in India, Oxford India Paperbacks, New Delhi, Second edition, 2005.
2. Kanchan Chopra., Development and Environmental Policy in India: The Last Few Decades, Springer Publication, New Delhi, First edition, 2017.

Reference Books :

1. Birnie, P Boyle, and Red well's., International Law and the Environment ,Oxford University Press, United Kingdom, Fourth edition,2021.
2. Upadhyay S. and Upadhyay V., Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment; Vols. I, II and III, Lexis Nexis Butterworths, New Delhi, India, First Edition, 2001.
3. Leelakrishnan, P., Environmental Law Case Book, Lexis Nexis, India, Sixth Edition, 2021.
4. Sands, P., Principles of International Environmental Law, and Cambridge University press, United Kingdom, Second Edition, 2002.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CE905 **Course name : ENVIRONMENTAL LAWS AND POLICIES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the basic concepts in Environmental laws and its judicial activism	3	2	2	-	-	2	-	-	-	-	2	3	-	-
CO2	Interpret different water acts and marine laws in India	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO3	Summarize Various Environment protection laws and acts in the framework of Mega projects	3	2	3	-	-	2	-	-	-	-	2	3	-	-
CO4	Explain the management and Handling of various hazardous waste management	3	2	3	1	-	3	1	-	-	-	2	3	-	-
CO5	Summarize the International Environmental laws framed at various conferences.	3	2	3	2	-	3	-	-	-	-	2	3	-	-
	Average	**3**	**2**	**3**	**3**	**-**	**3**	**1**	**-**	**-**	**-**	**2**	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE906	**GLOBAL WARMING AND CLIMATE CHANGE** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the concept of the causes and effects of global warming*	*Understand*
CO2:	*Summarize about physical and chemical characteristics of atmosphere*	*Understand*
CO3:	*Identify the causes and effects of climate change*	*Remember*
CO4:	*Infer the agreements took place among the countries regarding climate change*	*Understand*
CO5:	*Summarize about the concept of mitigation measures against climate change*	*Understand*

UNIT - I EARTH'S CLIMATE SYSTEM [09]

Role of ozone in environment – Ozone layer – Ozone depleting gases – Greenhouse gases and its sources - Green House Effect, Radiative Effects of Greenhouse Gases -The Hydrological Cycle – Green House Gases and Global Warming – Effects and causes of Global Warming, Carbon Cycle.

UNIT - II ATMOSPHERE AND ITS COMPONENTS [09]

Importance of Atmosphere – Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability -Temperature profile of the atmosphere - Lapse rates-Temperature inversion - effects of inversion on pollution dispersion.

UNIT - III IMPACTS OF CLIMATE CHANGE [09]

Causes of Climate change – Change of Temperature in the environment - Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT - IV OBSERVED CHANGES AND ITS CAUSES [09]

Climate change and Carbon credits – CDM- Initiatives in India - Kyoto Protocol - Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT - V CLIMATE CHANGE AND MITIGATION MEASURES [09]

Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding - Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste(MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1 Kandarp Tarkeshprasad Vaishnav., Climate Change Solutions, Global Warming Solutions & Innovative Ideas For Construction of World Development, Notion Press, Chennai, First Edition, 2018

2 Vivian Moritz., Climate Change and Global Warming, Syrawood Publishing House, New York, First Edition, 2017

Reference Books :

1 Marie Antonette and Chloe Marechal., Climate Change Past, Present & Future, Wiley-Blackwell, New Jersey, First Edition, 2015.

2 Empereur Raymond., Global Warming and Climate Change, Litfire Publishing, Atlanta, First Edition, 2017.

3 Agarwal S.K., Global Warming and Climate Change Past, Present & Future, Ashish Publishing House, New Delhi, First Edition, 2004.

4 https://onlinecourses.swayam2.ac.in/arp19_ap55/preview

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20CE906 **Course name : GLOBAL WARMING AND CLIMATE CHANGE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline the concept of the causes and effects of global warming	3	2	2	-		3	2	-	-	-	-	2	-	-
CO2	Summarize about physical and chemical characteristics of atmosphere	3	2	-	-	-	3	3	-	-	-	2	2	-	-
CO3	Interpret knowledge about the causes and effects of climate change	3	-	-	2	-	3	2	-	-	-	2	3	-	-
CO4	Infer the agreements took place among the countries regarding climate change	3	2	-	2	-	3	2	-	2	-	-	2	-	-
CO5	Summarize skills about the concept of mitigation measures against climate change	3	2	-	-	-	3	3	-	3	-	2	3	-	-
	Average	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**-**	**3**	-	**2**	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE907	**INTRODUTION TO DISASTER MANAGEMENT AND MITIGATION** (Open Elective)	3	0	0	3

Prerequisite: Nil

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the concepts of disaster and its effect in Indian scenario.*	*Understand*
CO2:	*Elaborate the difference between natural and manmade disasters.*	*Understand*
CO3:	*Outline the disaster management cycle and its operation.*	*Understand*
CO4:	*Outline the disaster management in India and its profile.*	*Understand*
CO5:	*Propose the application of geo-informatics for disaster management and mitigation.*	*Apply*

UNIT - I INTRODUCTION TO DISASTER [09]

Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.

UNIT - II NATURAL DISASTER AND MANMADE DISASTERS [09]

Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion.

Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

UNIT - III DISASTER MANAGEMENT CYCLE AND FRAMEWORK [09]

Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action.

UNIT - IV DISASTER MANAGEMENT IN INDIA DISASTER PROFILE OF INDIA [09]

Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

UNIT - V APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT & MITIGATION [09]

Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. R B Singh., Disaster Management and Mitigation, World focus Publisher, New Delhi, First Edition, 2016.
2. Satish Modh, Introduction to disaster management, Macmillan publishers India ltd, New Delhi, Second Edition, 2019.

Reference Books :

1. R B Singh. Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi, Reprint Edition, 2006.
2. Pardeep Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, Fourth Edition, 2018.
3. M. Saravanakumar, Disaster Management, Himalaya Publishing House, Bangalore, First Edition, 2017
4. Singh, Disaster Management: Future Challenges, IK International, New Delhi, First Edition, 2017.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CE907 **Course name : INTRODUTION TO DISASTER MANAGEMENT AND MITIGATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the concepts of disaster and its effect in Indian scenario.	3	3	1	-	-	2	-	-	-	-	-	3	-	-
CO2	Elaborate the difference between natural and manmade disasters.	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO3	Outline the disaster management cycle and its operation	3	3		-	-	2	-	-	-	-	-	3	-	-
CO4	Outline the disaster management in India and its profile	3	3	1	-	-	3	-	-	-	-	-	3	-	-
CO5	Propose the application of geo-informatics for disaster management and mitigation.	3	3	3	-	2	3	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**1**	-	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	-

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE908	**INTRODUCTION TO EARTHQUAKE ENGINEERING** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the causes and effects of earthquake.*	*Understand*
CO2:	*Explain the basic concepts in seismology and correlate to earthquake engineering.*	*Understand*
CO3:	*Summarize the theory of vibrations.*	*Understand*
CO4:	*Outline the design process for earthquake resisting structures*	*Understand*
CO5:	*Predict the performance of building and structures under the earthquake.*	*Understand*

UNIT - I CAUSES AND EFFECTS OF EARTHQUAKE [09]

Causes of earthquake by natural sources and manmade sources - Earthquake effects on building structure - Liquefaction of soils, effects of liquefaction, methods to reduce liquefaction - Land and rock slides - tsunamis.

UNIT - II ELEMENTS OF ENGINEERING SEISMOLOGY [09]

Plate tectonics, Elastic rebound, seismic zoning map of India , Focus, epicenter, seismic waves, magnitude, intensity, intensity scale and its correlation with ground acceleration, characteristics of strong ground motions.

UNIT - III THEORY OF VIBRATIONS [09]

Basic concepts of vibration - Difference between static loading and dynamic loading - Types of vibration - Vibration measuring instruments - Degrees of freedom -Types of Damping.

UNIT - IV DESIGN METHODOLOGY [09]

Design methodology - Architectural consideration - Geotechnical consideration - Structural design consideration, earthquake design philosophy, importance of ductility - Capacity design - Techniques of aseismic design - Design spectrum.

UNIT - V PERFORMANCE OF BUILDING AND STRUCTURES [09]

Lessons learnt from the past earthquakes - Shear wall, types of shear wall, function of shear wall - Concepts of seismic base isolation technique - Base isolation devices - Seismic dampers - Seismic active control.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Duggal,S .K., Earthquake Resistant Design of Structures, Oxford University Press, London, Second Edition, 2013.

2 Damodarasamy, S.R. and Kavitha, S., Basics of structural dynamics and Aseismic design, PHI Learning Pvt. Ltd, New Delhi, Fifth Edition, 2006.

Reference Books :

1 Pankaj Agarwal. and Manish Shrikhande., Earthquake Resistant Design of Structures, Prentice Hall of India, New Delhi, Third Edition, 2009.

2 Chopra, Anil. K., Dynamics of Structures -Theory and Applications to Earthquake Engineering, Prentice Hall of India (P), New Delhi, Fifth Edition, 2020.

3 Murty C.V.R .Earthquake tips, IITK, Building material and technology promotion council, New Delhi, First Edition, 2005.

4 http://nptel.ac.in/syllabus/105101004/

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CE908 **Course name : INTRODUCTION TO EARTHQUAKE ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate the causes and effects of earthquake.	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO2	Explain the basic concepts in seismology and correlate to earthquake engineering.	3	2	2	-	-	-	2	-	-	-	-	3	-	-
CO3	Summarize the theory of vibrations.	3	2	3	-	-	-	2	-	-	-		3	-	-
CO4	Outline the design process for earthquake resisting structures	3	2	3	2	-	-	2	-	-	-		3	-	-
CO5	Predict the performance of building and structures under the earthquake.	3	2	3	2	-	-	2	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**		**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE909	**SOLID WASTE MANAGEMENT** (Open Elective)	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Overview the concept of Solid waste and management.*	*Understand*
CO2:	*Summarize about on-site storage and processing of solid waste.*	*Understand*
CO3:	*Summarize about collection and transportation of waste.*	*Understand*
CO4:	*Summarize about off-Site Processing of solid waste.*	*Understand*
CO5:	*Interpret about safe disposal of solid waste.*	*Understand*

UNIT - I Solid Waste and its Perspectives **[09]**

Sources – Types – Composition – Properties – Characteristics – Quantities – Generation rates – Types of Sampling – Functional elements – Legislative measures – 3R concept – Participatory waste management.

UNIT - II On-Site Storage and Processing **[09]**

On-site storage methods - materials used for containers –on site segregation of solid wastes -public health & economic aspects of storage - options under Indian conditions - Critical Evaluation of Options.

UNIT - III Collection and Transfer **[09]**

Collection services – Classification of container systems – Analysis of collection system – Collection routes – Guidelines – Transfer station –Site selection – Types – Manpower requirement.

UNIT - IV Off-Site Processing **[09]**

Processing techniques and Equipment; Resource recovery from solid wastes – composting – Factors affecting composting – Indore and Bangalore processes – Vermicomposting, Incineration, Pyrolysis - options under Indian conditions.

UNIT - V Disposal **[09]**

Sanitary landfills – site selection – merits and demerits - methods and operation of sanitary landfills - Leachate collection and control methods – Incinerators - types – hazardous wastes and its effects on environment – case studies.

Total (L= 40, T = 5) = 45 Periods

Text Books :

1. Tchobanoglous, G., Frank Kreith, Hand Book of Solid Waste Management, McGraw-Hill, Inc., California,Second Edition, 2002.
2. Ramachandra, T. V., Management of Municipal Solid Waste, TERI Press, New Delhi, First Edition, 2009

Reference Books :

1. William A. Worrell, P. Aarne Vesilind, Solid Waste Engineering, Cengage Learning Asia Pte Limited, Second Edition, 2012.
2. Rao, M.N., Sultana, Razia Kota, Sri Harsha, Solid and Hazardous Waste Management: Science and Engineering, Butterworth-Heinemann, Burlington, First Edition, 2016
3. John Pichtel, Waste Management Practices: Municipal, Hazardous, and Industrial, CRC Press, US, Second Edition, 2014.
4. Freeman, H. M., ―Standard Handbook of Hazardous Waste Treatment and Disposal‖, McGraw-Hill, Inc., Second Edition, Noida, 1997.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CE909 **Course name : SOLID WASTE MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Overview the concept of Solid waste and management.	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO2	Summarize about on-site storage and processing of solid waste.	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO3	Summarize about Collection and transportation of waste.	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO4	Summarize about off-Site Processing of solid waste.	3	3	3	-	-	-	-	-	2	-	-	-	-	-
CO5	Interpret about safe disposal of solid waste.	3	3	3	-	-	-	-	-	2	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CE910	**WATER AND AIR POLLUTION MANAGEMENT (Open Elective)**	3	0	0	3

Prerequisite: *No prerequisites are needed for enrolling into the course*

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain water and air quality standards*	*Understand*
CO2:	*Discuss water treatment and fundamentals of air pollution*	*Understand*
CO3:	*Demonstrate the particulate of air pollution.*	*Understand*
CO4:	*Classify air pollution control technologies.*	*Understand*
CO5:	*Describe air pollution control equipment.*	*Understand*

UNIT - I INTRODUCTION [09]

Water effluent standards -water quality indices - physical- chemical and biological parameters of water- water quality requirement - potable water standards -Air pollutants – Sources – Classification of air pollutants – Particulates and gaseous pollutants – Effects of air pollutants on human health, vegetation and property – Global issues and air pollution – Global warming – Ozone layer depletion – Ambient air quality and emission standards – Air pollution indices – Air act.

UNIT - II WATER TREATMENT AND FUNDAMENDALS OF ATMOSPHERIC POLLUTANTS [09]

Water purification systems in natural systems- physical processes-chemical processes and biological processes primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer – coagulation and flocculation, coagulation processes - stability of colloids –Disinfection - Fundamentals of meteorology – Wind roses – Atmospheric stability – Atmospheric diffusion of pollutants – Transport, transformation and deposition of air contaminants – Plume behaviour – Atmospheric diffusion theories – Plume rise.

UNIT - III PARTICULATE AIR POLLUTION [09]

Control principles – Principles and equipment description of control technologies – Particulates control by Gravitation, centrifugal, filtration, scrubbing, electrostatic precipitation – Absorption, adsorption, condensation, incineration and bio filtration for control of gaseous air pollutants.

UNIT - IV AIR POLLUTION CONTROL TECHNOLOGIES [09]

Biological air pollution control technologies – Bioscrubbers, bio filters. Air pollutants in indoor environments – Levels of pollutants in indoor and outdoor air – Indoor air pollution from outdoor sources – Measurement methods – Control Technologies.

UNIT - V AIR POLLUTION CONTROL EQUIPMENT [09]

Introduction – Installation of Settling chambers, Inertial separators, Dust trap, Involute cyclone, Multiple cyclone, Filters, Electrostatic precipitators, Scrubbers, Separating devices – Efficiency of equipment.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.

2 Davis M. L. and Cornwell D. A., Introduction to Environmental Engineering, Tata McGraw Hill Education Pvt. Ltd,. New Delhi, First Edition, 2010.

Reference Books :

1 Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, First Edition, 2006.

2 Anjaneyulu, D., Air Pollution and Control Technologies, Allied Publishers, Mumbai, First Edition 2002.

3 S.K. Garg, “Water Supply Engineering”, Khanna Publishers, New Delhi, Thirty three Edition, 2010.

4 https://nptel.ac.in/courses/122106030

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CE910 **Course name : WATER AND AIR POLLUTION MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain water and air quality standards	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO2	Discuss water treatment and fundamentals of air pollution	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO3	Demonstrate the particulate of air pollution.	3	2	-	-	-	-	2	-	-	-	-	3	-	-
CO4	Classify air pollution control technologies	3	3	-	-	-	-	2	-	-	-	-	3	-	-
CO5	Describe air pollution control equipment.	3	3	-	-	-	-	2	-	-	-	-	3	-	-
	Average	**3**	**3**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS901	**PROGRAMMING IN JAVA** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discover java programming fundamentals to solve real world problem.*	*Understand*
CO2:	*Implement the concept of class and constructor.*	*Apply*
CO3:	*Examine important features of java like inheritance and interfaces.*	*Understand*
CO4:	*Illustrate the features of package and exception handling.*	*Understand*
CO5:	*Apply the concepts of string manipulations.*	*Apply*

UNIT – I JAVA FUNDAMENTALS [09]

The Java Buzzwords – Data Types – Variables– Local Variable – Instant Variable – Static variable – Array-Single Dimensional Array-Multi Dimensional Array – Operators – Control Statements – if – if else – nested if– else if– for – for each – while – do while – Switch – Break– Continue.

UNIT – II CLASS FUNDAMENTALS AND CONSTRUCTORS [09]

Class Fundamentals –Declaring Objects – Methods – Instant Method– Static Method– Method Overloading– Recursion – this keyword – Garbage Collection – Constructors – Argument constructor– No-Argument Constructor – Constructor Overloading – Access Control.

UNIT – III INHERITANCE AND INTERFACES [09]

Inheritance – Single – Multilevel – Hierarchical – Super keyword – Method Overriding – Abstract class – Final variable– Final class – Interfaces – Default Interface Methods – Static Methods in Interface.

UNIT – IV PACKAGES AND EXCEPTION HANDLING [09]

Packages –User define Package – Predefine Package – Access Protection – Importing Packages – Array List– Wrapper Classes – Exception Handling Fundamentals – Exceptions Types –Try and Catch – Multiple Catch – Nested Try – Throw – Throws – Finally.

UNIT – V STRING AND STRING BUFFER [09]

The String Constructors – String Length – Character Extraction – String Comparison – Searching Strings – Modifying a String – Data Conversion using value Of method – Methods in String Buffer – append – delete – replace – insert – reverse – capacity.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Herbert Schildt, Java - The Complete Reference, Oracle Press, McGraw-Hill Education, New Delhi, Eleventh Edition, 2018.

2 Cay S. Horstmann, Core Java Volume 1 - Fundamentals, Prentice Hall, India, Tenth Edition, 2015.

Reference Books :

1 Herbert Schildt, Java - A Beginner Guide, Oracle Press, McGraw-Hill Education, New Delhi, Sixth Edition, 2014.

2 Joshua Bloch, Effective Java: A Programming Language Guide, Addison-Wesley Professional, USA, Third Edition, 2018.

3 Allen B. Downey and Chris Mayfield, Think Java: How to Think Like a Computer Scientist, O'Reilly, California, First Edition, 2016.

4 https://onlinecourses.nptel.ac.in/noc19_cs07/preview

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS901 **Course name : PROGRAMMING IN JAVA**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Discover java programming fundamentals to solve real world problem.	3	3	2	3	3	-	-	-	-	-	-	3	-	-
CO2	Implement the concept of class and constructor.	3	3	2	3	2	-	-	-	-	-	-	3	-	-
CO3	Examine important features of java like inheritance and interfaces.	3	3	1	3	2	-	-	-	-	-	-	2	-	-
CO4	Illustrate the features of package and exception handling.	3	3	2	2	3	-	-	-	-	-	-	3	-	-
CO5	Apply the concepts of string manipulations.	3	3	2	3	2	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS902	**BASIC CONCEPTS OF DATA STRUCTURE** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Elaborate the different linear data structure to solve simple problems.*	*Understand*
CO2:	*Build the various tree structures with its operations.*	*Understand*
CO3:	*Describe the concept of AVL tree, splay tree, B tree and B+ tree.*	*Understand*
CO4:	*Apply graph data structure to solve real time problems.*	*Apply*
CO5:	*Discover various sorting, hashing and searching techniques.*	*Apply*

UNIT– I ARRAY AND LINKED LIST [09]

Abstract Data Types (ADT) – List ADT – Array Based Implementation – Linked List Implementation – Singly Linked Lists – Doubly Linked Lists – Circularly Linked Lists – Applications of Lists: Polynomial Manipulation – Radix sort.

UNIT– II STACK AND QUEUE [09]

Stack ADT – Implementation of Stack using Array and Linked List – Applications of Stack : Evaluating arithmetic expressions – Conversion of Infix to postfix expression Recursion – Queue ADT – Implementation of Queue using Array and Linked List – Applications of Queues

UNIT – III TREE STRUCTURES [09]

Tree ADT – Binary Tree ADT – Binary Tree Traversal – Expression Trees – Applications of Trees – Binary Search Tree – AVL Trees – B Tree – B+ Tree.

UNIT – IV GRAPHS [09]

Introduction to Graphs and its Types – Breadth First Traversal – Depth First Traversal – Topological Sorting – Minimum Spanning Tree: Prim's and Kruskal's algorithms –- Shortest Path Algorithms: Dijkstra's Algorithm – Applications of Graphs.

UNIT – V SEARCHING,HASHING AND SORTING [09]

Searching: Linear and Binary Search – Hashing :Hash function– Separate Chaining – Open Addressing – Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Merge Sort.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 M. A. Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, India, Second Edition, 2015.

2 Reema Thareja, Data Structures Using C, Oxford University Press, England, Second Edition, 2011

Reference Books :

1 R. F. Gilberg, B. A. Forouzan, Data Structures, Thomson, India, Second Edition, 2005.

2 A.K. Sharma, Data Structures using C, Pearson Education, India, First Edition, 2011.

3 Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C++,University Press, United States, Second Edition, 2008

4 http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS902 **Course name : BASIC CONCEPTS OF DATA STRUCTURE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Elaborate the different linear data structure to solve simple problems.	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO2	Build the various tree structures with its operations.	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3	Describe the concept of AVL tree, splay tree, B tree and B+ tree.	3	3	2	-	2	-	-	-	-	-	-	2	-	-
CO4	Apply graph data structure to solve real time problems.	3	2	2	-	2	-	-	-	-	-	-	2	-	-
CO5	Discover various sorting, hashing and searching techniques.	3	2	2	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS903 **FUNDAMENTALS OF DATABASE CONCEPTS** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline database architecture and the E-R Model for Database design.*	*Understand*
CO2:	*Apply Structured query language to create and manipulate a relational database.*	*Apply*
CO3:	*Build functions, triggers and recursive queries.*	*Apply*
CO4:	*Demonstrate the purpose of normalization.*	*Understand*
CO5:	*Discover about transaction and query processing concepts.*	*Understand*

UNIT – I BASIC CONCEPTS AND E-R MODEL [9]

Database System Applications – Purpose of Database Systems – Views of Data – Database Languages –Database and Application Architecture. Overview of the Design Process – The Entity-Relationship model – Complex Attributes – Mapping Cardinalities and Keys.

UNIT – II RELATIONAL MODEL AND SQL FUNDAMENTALS [9]

Introduction to Relational Model: Structure of Relational Databases – Database Schema –Keys – Schema Diagrams. Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries – Additional Basic Operations – Set operations – Null values – Aggregate functions – Modification of the Database.

UNIT - III INTERMEDIATE SQL AND ADVANCED SQL [09]

Join Expressions – Views – Transactions – Integrity Constraints – Authorization –Accessing SQL from Programming Language – Functions and Procedures – Triggers – Recursive Queries.

UNIT - IV NORMALIZATION [09]

Functional Dependencies – Non-loss Decomposition – First, Second and Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT - V TRANSACTIONS AND QUERY PROCESSING [09]

Transaction Concept – A Simple Transaction Model – Storage Structure – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Concurrency Control – Lock-Based protocols – Query Processing overview

Total (L= 45, T = 0) = 45 Periods

Text Books :

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Seventh Edition, 2019.
2. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Education, New Delhi, Seventh Edition, 2016.

Reference Books :

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, New Delhi, Sixth Edition, 2015.
2. S.K.Singh, Database Systems Concepts, Design and Applications, Pearson Education, New Delhi, Second Edition, 2011.
3. C.J.Date, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Pearson Education, New DelhiEighth Edition, 2006.
4. http://freevideolectures.com/course/2668/database-management-system#

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DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS903 **Course name : FUNDAMENTALS OF DATABASE CONCEPTS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline database architecture and the E-R Model for Database design.	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO2	Apply Structured query language to create and manipulate a relational database.	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO3	Build functions, triggers and recursive queries.	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO4	Demonstrate the purpose of normalization.	3	3	3	-	2	2	-	-	-	-	-	2	-	-
CO5	Discover about transaction and query processing concepts.	3	3	3	-	2	2	-	-	-	-	-	2	-	-
	Average	**3**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS904	**INTERNET PROGRAMMING** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the technologies around the internet.*	*Understand*
CO2:	*Construct the idea of web designing at user interface.*	*Apply*
CO3:	*Discuss the concept of data processing on client and server side.*	*Understand*
CO4:	*Construct the web oriented response at server side in PHP and XML format*	*Apply*
CO5:	*Illustrate the web service architecture and to enable rich client presentation using AJAX.*	*Understand*

UNIT – I INTRODUCTION TO WEB [09]

Web Essentials: Clients, Servers, and Communications. The Internet – History – Basic Internet Protocols: TCP and IP – DNS – URL. The World Wide Web – HTTP: Request Message – Response Message – Web Clients – Web Servers – Case Study.

UNIT – II BASICS OF HTML AND CSS [09]

HTML. An Introduction to HTML History and Version - Structure of HTML Page – HTML tags for data formatting - Tables – Links – Images - List – Frames – Forms - HTML 5 Tags and Validation. Style Sheets: CSS Syntax and Structure – CSS Rules for Backgrounds, Colours, and Properties – Manipulating Texts, Fonts, borders and Boxes - Margin – Padding Lists – CSS Positioning.

UNIT– III CLIENT SIDE SCRIPTING [09]

JavaScript: Syntax and Execution – Internal, embedded and External JavaScript. JavaScript: Variables – Arrays – Functions – Conditions – Loops – Type Conversion – Objects and DOM – Inbuilt Functions – Validation and Regular Expressions – Event Handling.

UNIT – IV SERVER SIDE SCRIPTING [09]

PHP: Introduction – Using PHP – variables – Program Control. Built-in Functions: Connecting to Database – Using cookies – Regular Expression. XML: Basics – DTD – XML Scheme – DOM and Presenting XML – XML parsers and validation.

UNIT– V AJAX and WEB SERVICE [09]

AJAX: Introduction – Ajax Client Server Architecture, XML http Request Object – Call Back Methods. Introduction to Web Services – Java web services: Basics – SOAP – WSDL: Creating, Publishing and Describing a web service – Consuming a web service – Database Driven Web Service from an application.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Randy Connolly and Ricardo Hoar, Fundamentals of Web Development, Pearson Education New Delhi, First Edition, 2016.

2 Paul Deitel, Harvey Deitel and Abbey Deitel, Internet and World Wide Web – How to Program, Pearson Education, New Delhi, Fifth Edition, 2012.

Reference Books :

1 Chris Bates, Web Programming – Building Internet Applications, John Wiley & Sons Ltd, USA, Third Edition, 2007.

2 John Dean, Web Programming With HTML5, CSS and JavaScript, Jones and Bartlett Publishers, Inc, United States, Third Edition, 2008.

3 Jon Duckett, Beginning Web Programming With HTML, XHTML and CSS, Wiley Publishing Inc, India, Second Edition, 2008.

4 www.tutorialspoint.com

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DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS904 **Course name : INTERNET PROGRAMMING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the technologies around the internet.	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2	Construct the idea of web designing at user interface.	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3	Discuss the concept of data processing on client and server side.	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO4	Construct the web oriented response at server side in PHP and XML format	3	3	3	-	3	1	-	-	-	-	-	2	-	-
CO5	Illustrate the web service architecture and to enable rich client presentation using AJAX.	3	2	3	-	3	2	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS905	**FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify various concepts of mobile programming that make it unique from programming for other platforms.*	*Understand*
CO2:	*Critique mobile applications on their design pros and cons.*	*Understand*
CO3:	*Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.*	*Apply*
CO4:	*Program mobile applications for the Android operating system that use basic and advanced phone features.*	*Understand*
CO5:	*Deploy applications to the Android marketplace for distribution.*	*Apply*

UNIT – I OVERVIEW OF THE ANDROID PLATFORM [09]

Introducing Android – Setting Up Your Android Development Environment – Writing Your First Android Application – Mastering the Android Development Tools

UNIT – II ANDROID APPLICATION BASICS [09]

Understanding the Anatomy of an Android Application – Defining Your Application Using the Android Manifest File – Managing Application Resources

UNIT – III ANDROID USER INTERFACE DESIGN ESSENTIALS [09]

Exploring User Interface Screen Elements – Designing User Interfaces with Layouts – Working with Fragments – Working with Dialogs

UNIT – IV ANDROID APPLICATION DESIGN ESSENTIALS [09]

Android application design: Using Android Preferences – Working with Files and Directories – Using Content Providers – Designing Compatible Applications

UNIT– V PUBLISHING AND DISTRIBUTING ANDROID APPLICATIONS [09]

The Android Software Development Process – Designing and Developing Bulletproof Android Applications – Testing Android Applications – Publishing Your Android Application

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Lauren Darcey, Shane Conder, Android Wireless Application Development, Pearson Education, India, Second Edition, 2011.

2 Ed Burnette, Hello Android: Introducing Google's Mobile Development Platform, The Pragmatic Publishers, North Carolina USA, Third Edition, 2010.

Reference Books :

1 Google Developer Training, Android Developer Fundamentals Course – Concept Reference, Google Developer Training Team, 2016.

2 Zigurd Mednieks, Laird Dornin, Blake Meike G, Masumi Nakamura, Programming Android: Java Programming for the New Generation of Mobile Devices, OReilly Media, USA, Second Edition, 2011.

3 2016Reto Meier, Professional Android 4 Application Development, Wrox Publications, John Wiley, New York, First Edition, 2012.

4 https://developer.android.com/training/basics/firstapp

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS905 **Course name : FUNDAMENTALS OF MOBILE APPLICATION DEVELOPMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify various concepts of mobile programming that make it unique from programming for other platforms.	3	2	2	-	1	-	-	-	-	-	-	1	-	-
CO2	Critique mobile applications on their design pros and cons.	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO3	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.	3	2	3	-	2	-	-	-	-	-	-	2	-	-
CO4	Program mobile applications for the Android operating system that use basic and advanced phone features.	3	2	2	-	2	-	-	-	-	-	-	1	-	-
CO5	Deploy applications to the Android marketplace for distribution.	3	2	3	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS906	**PRINCIPLES OF ETHICAL HACKING** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss the basics of hacking with its ethics*	*Understand*
CO2:	*Extend the possibilities and types of Attacks*	*Understand*
CO3:	*Summarize the testing process with programming Language.*	*Understand*
CO4:	*Infer about the impact of hacking wireless network*	*Understand*
CO5:	*Outline about the protection scheme.*	*Understand*

UNIT - I ETHICAL HACKING OVERVIEW [9]

Introduction to Ethical Hacking – What You Can Do Legally – What You Cannot Do Legally – TCP/IP Concepts Review – IP Addressing – Overview of Numbering Systems

UNIT - II NETWORK ATTACKS AND ITS IMPACT [9]

Malicious Software – Protecting Against Malware Attacks – Intruder Attacks on Networks and Computers - Addressing Physical Security – Using Web Tools for Foot printing – Conducting Competitive Intelligence – Introduction to Social Engineering – Using Port-Scanning Tools – Conducting Ping Sweeps – Understanding Scripting.

UNIT - III SECURITY TESTING [9]

Enumerating Operating Systems – Introduction to Computer Programming – Understanding C,HTML, Pearl and Object Oriented Programming Basics – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities in Windows – Windows and Other Embedded Operating Systems – Vulnerabilities of Embedded OSs.

UNIT - IV WEB APPLICATION AND WIRELESS NETWORK [9]

Understanding Web Applications – Understanding Web Application Vulnerabilities – Tools for Web Attackers and Security Testers – Hacking Wireless Networks

UNIT - V PROTECTION SYSTEM [9]

Understanding Cryptography Basics – Understanding Symmetric and Asymmetric Algorithms – Understanding Public Key Infrastructure – Understanding Cryptography Attacks – Understanding Routers and Firewalls – Understanding Intrusion Detection and Prevention Systems – Understanding Honeypots

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Michael T. Simpson and Nicholas Antill, Ethical Hacking and Network defense, Cengage Learning, New Delhi, Third Edition, 2017.

2 Ankit Fadia, Ethical Hacking, Macmillan India Ltd, India, Second Edition, 2006.

Reference Books :

1 Steven Defino, Barry Kaufman and Nick Valenteen, Official Certified Ethical Hacker review guide, Cenage learning New Delhi, Second Edition, 2012.

2 Ankit Fadia, The Ethical Hacking Guide to Corporate Security, Macmillan Publishers, India, Second Edition, 2010.

3 James S. Tiller, The Ethical Hack: A Framework for Business value Penetration Testing, CRC Press, Florida, First Edition, 2005.

4 https://onlinecourses.nptel.ac.in/noc22_cs13

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS906 **Course name : PRINCIPLES OF ETHICAL HACKING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Discuss the basics of hacking with its ethics	3	3	3	-	3	3	-	3	-	-	-	2	-	-
CO2	Extend the possibilities and types of Attacks	3	3	2	-	1	2	-	1	-	-	-	1	-	-
CO3	Summarize the testing process with programming Language.	3	3	2	-	3	3	-	2	-	-	-	3	-	-
CO4	Infer about the impact of hacking wireless network	3	3	2	-	3	2	-	1	-	-	-	2	-	-
CO5	Outline about the protection scheme.	3	3	2	-	3	2	-	1	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20CS907	**GREEN TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify Green IT with its different dimensions and Strategies.*	Understand
CO2:	*Describe Green data centres and storage along with its green software methodologies.*	Understand
CO3:	*Outline the concepts o to manage the green IT with necessary components.*	Understand
CO4:	*Recognize various green enterprise activities, functions and their role with IT.*	Understand
CO5:	*Categorize various laws, standards and protocols for regulating green IT.*	Understand

UNIT – I GREEN IT **[09]**

Environmental Concerns and Sustainable Development – Environmental Impacts of IT – Green IT – Holistic Approach to Greening IT – Greening IT – Applying IT for enhancing Environmental sustainability – Green IT Standards and Eco-Labelling of IT – Enterprise Green IT strategy – Life Cycle of a device or hardware – Reuse, Recycle and Dispose.

UNIT – II SUSTAINABLE SOFTWARE DEVELOPMENT AND GREEN DATA CENTRES **[09]**

Current Practices – Sustainable Software – Attributes – Metrics – Methodology – Defining Actions – Data Centres: Associated Energy Challenges – IT Infrastructure – Management – Green Data Centre Metrics – Green Data Storage – Storage Media Power Characteristics – Energy Management Techniques for Hard Disks.

UNIT – III ENTERPRISE GREEN IT STRATEGY **[09]**

Approaching Green IT Strategies – Business Drivers – Business Dimensions for Green IT Transformation – Organizational Considerations – Steps to Develop Green IT Strategy – Metrics and Measurements – Multilevel Sustainable Information – Sustainability Hierarchy Models.

UNIT – IV GREEN ENTERPRISE READINESS AND THE ROLE OF IT **[09]**

Readiness and Capability – Development and Measuring of an Organization's G-Readiness Framework – Organizational and Enterprise Greening – Information systems in Greening Enterprises – IT Usage and Hardware – Inter-Organizational Enterprise activities and Green Issues – Enablers and making the case for IT and Green Enterprise.

UNIT – V LAWS, STANDARDS AND PROTOCOLS **[09]**

The regulatory environment and IT manufacturers – Non regulatory government initiatives – Industry associations and standards bodies – Green building standards – Green data centres – Social movements and Greenpeace – Cloud Computing – Energy Usage Model.

Total (L= 45, T = 0) = 45 Periods

Text Books :ENERGY MANAGEMENT

1 San Murugesan, G.R. Gangadharan, Harnessing Green IT - Principles and Practices, Wiley Publication, India, First Edition, 2012.

2 Bhuvan Unhelkar, Green IT Strategies and Applications - Using Environmental Intelligence, CRC Press, Florida, First Edition, 2016.

Reference Books :

1 Woody Leonhard, Katherrine Murray, Green Home computing for dummies, Wiley Publication, India, First Edition, 2009.

2 Bud E. Smith, Green Computing: Tools and Techniques for Saving Energy, Money and Resources, CRC Press, Florida, Second Edition, 2014.

3 Jason Harris, Green Computing and Green IT - Best Practices on regulations and industry, Lulu.com, First edition, 2008.

4 https://nptel.ac.in/courses/106/105/106105167/

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS907 **Course name : GREEN TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify Green IT with its different dimensions and Strategies.	3	3	3	-	3	-	-	-	-	-	-	2	-	-
CO2	Describe Green data centres and storage along with its green software methodologies.	3	2	2	-	3	-	-	-	-	-	-	1	-	-
CO3	Outline the concepts o to manage the green IT with necessary components.	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO4	Recognize various green enterprise activities, functions and their role with IT.	3	3	3	-	3	-	-	-	-	-	-	1	-	-
CO5	Categorize various laws, standards and protocols for regulating green IT.	3	3	3	-	3	-	-	-	-	-	-	2	-	-
	Average	3	3	3	-	3	-	-	-	-	-	-	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS908	**ARTIFICIAL INTELLIGENCE AND ROBOTICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe agents structure and predict uninformed search algorithms for any AI problem*	*Understand*
CO2:	*Illustrate appropriate AI methods to solve a given problem.*	*Apply*
CO3:	*Explain a problem using first order and predicate logic.*	*Understand*
CO4:	*Identify planning algorithms and illustrate about learning*	*Apply*
CO5:	*Infer about robotics concept.*	*Understand*

UNIT – I FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE [9]

Intelligent Agents – Agents and environments – Good behavior– The Nature of Environments – The Structure of Agents – Solving Problems by Searching: Problem-Solving Agents – Example problems – Searching for solutions – Uninformed search strategies.

UNIT – II INFORMED SEARCHING TECHNIQUES [9]

Informed (Heuristic) Search Strategies – Heuristic functions – Local Search and Optimization Problems – Adversarial Search – Games – Optimal decisions in games – Alpha-Beta Pruning – Constraint Satisfaction Problems – Defining Constraint Satisfaction Problems.

UNIT – III LOGICAL REASONING [9]

First order logic – Representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic – Inference in First order logic – Prepositional versus first order logic – Unification and lifting – Forward chaining – Backward chaining.

UNIT – IV PLANNING AND LEARNING [9]

Classical Planning: Definition of Classical Planning – Algorithm for Planning as State – Space Search –Planning graphs – Analysis of Planning Approaches – Learning from Examples: Forms of Learning – Supervised learning – Learning Decision trees – Ensemble Learning – Explanation-Based Learning.

UNIT – V ROBOTICS [9]

Introduction – Robot Hardware – Robot Perception – Planning to Move – Planning Uncertain Movements – Moving – Robotic Software Architectures – Application Domains.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Stuart Russell and Peter Norvig, Artificial Intelligence – A Modern Approach, Pearson Education, New Delhi, Third Edition, 2016

2 Kevin Night and Elaine Rich, Nair B., Artificial Intelligence (SIE) , McGraw Hill, New Delhi, Third Edition, 2008

Reference Books :

1 Dan W. Patterson, Introduction to AI and ES, Pearson Education, New Delhi, Third Edition, 2007.

2 Peter Jackson, Introduction to Expert Systems, Pearson Education, New Delhi, Third Edition, 2007.

3 Deepak Khemani, Artificial Intelligence, Tata McGraw Hill, New Delhi, Third Edition, 2013.

4 David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, England, First Edition, 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS908 **Course name : ARTIFICIAL INTELLIGENCE AND ROBOTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Describe agents structure and predict uninformed search algorithms for any AI problem	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO2:	Illustrate appropriate AI methods to solve a given problem.	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO3:	Explain a problem using first order and predicate logic.	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO4:	Identify planning algorithms and illustrate about learning	3	3	3	-	3	2	-	-	-	-	-	3	-	-
CO5:	Infer about robotics concept.	3	3	3	-	3	2	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS909	**BIG DATA AND ANALYTICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discover the insights of big data analytics*	*Understand*
CO2:	*Identify the file systems and to know the map reduce technique*	*Understand*
CO3:	*Summarize data by utilizing various statistical and data mining approaches*	*Understand*
CO4:	*Deploy and Perform analytics on real-time streaming data*	*Understand*
CO5:	*Comprehend the various NoSql alternative database models*	*Understand*

UNIT – I INTRODUCTION TO BIG DATA [9]

Big Data – Definition, Characteristic Features – Big Data Applications – Big Data vs Traditional Data – Risks of Big Data – Structure of Big Data – Web Data – Evolution of Analytic Scalability – Evolution of Analytic Processes, Tools and methods – Analysis Vs Reporting – Modern Data Analytic Tools.

UNIT – II HADOOP FRAMEWORK [9]

Distributed File Systems – Large-Scale File System Organization – HDFS concepts – MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN.

UNIT - III DATA ANALYSIS [9]

Statistical Methods : Regression modelling – Multivariate Analysis – Classification: SVM & Kernel Methods – Rule Mining – Cluster Analysis – Types of Data in Cluster Analysis – Predictive Analytics – Data analysis using R.

UNIT – IV MINING DATA STREAMS [9]

Streams: Concepts – Stream Data Model and Architecture – Sampling data in a stream – Mining Data Streams and Mining Time-series data – Real Time Analytics Platform Applications – Real Time Sentiment Analysis – Stock Market Predictions.

UNIT – V BIG DATA FRAMEWORKS [9]

Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced AnalyticsII, John Wiley & Sons, Incorporated, United States, First Edition, 2012.

2 David Loshin, Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Elsevier Science, Netherlands, First Edition, 2013.

Reference Books :

1 Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, Germany, Second Edition, 2014.

2 Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley, United States, First Edition, 2013.

3 P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, United States, Third Edition, 2013.

4 Richard Cotton, Learning R – A Step-by-step Function Guide to Data Analysis, O_Reilly Media, California, Third Edition, 2018.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS909 **Course name : BIG DATA AND ANALYTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Discover the insights of big data analytics	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO2	Identify the file systems and to know the map reduce technique	3	2	1	-	3	3	-	-	-	-	-	1	-	-
CO3	Summarize data by utilizing various statistical and data mining approaches	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO4	Deploy and Perform analytics on real-time streaming data	3	3	2	-	3	2	-	-	-	-	-	1	-	-
CO5	Comprehend the various NoSql alternative database models	3	3	1	-	3	2	-	-	-	-	-	1	-	-
	Average	**3**	**3**	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20CS910	**HARDWARE AND TROUBLE SHOOTING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify with the Basic functional units of a computer system.*	*Understand*
CO2:	*Discover the working Concepts of I/O devices in computer.*	*Understand*
CO3:	*Examine the interfaces and controllers connected to PC.*	*Understand*
CO4:	*Outline the system configuration, Installation and maintenance of PC.*	*Understand*
CO5:	*Summarize about faults, diagnostics and troubleshooting in PC.*	*Understand*

UNIT – I INTRODUCTION [9]

Introduction - Computer Organization – Number Systems and Codes – Memory – ALU – CU – Instruction prefetch – Interrupts – I/O Techniques – Device Controllers – Error Detection Techniques – Microprocessor – Personal Computer Concepts – Advanced System Concepts – Microcomputer Concepts – OS – Multitasking and Multiprogramming – Virtual Memory – Cache Memory – Modern PC and User.

UNIT – II PERIPHERAL DEVICES [9]

Introduction – Keyboard – CRT Display Monitor – Printer – Magnetic Storage Devices –FDD – HDD – Special Types of Disk Drives – Mouse and Trackball – Modem – Fax Modem – CD ROM Drive – Scanner – Digital Camera – DVD – Special Peripherals.

UNIT – III PC HARDWARE OVERVIEW [9]

Introduction – Hardware BIOS DOS Interaction – The PC family – PC hardware – Inside the System Box – Motherboard Logic – Memory Space – Peripheral Interfaces and Controllers – Keyboard Interface – CRT Display interface – FDC – HDC – Microprocessors in PC.

UNIT – IV INSTALLATION AND PREVENTIVE MAINTENANCE [9]

Introduction – system configuration – pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery.

UNIT – V TROUBLESHOOTING [9]

Introduction – computer faults – Nature of faults – Types of faults – Diagnostic programs and tools – Microprocessor and Firmware – Programmable LSI's – Bus Faults – Faults Elimination process – Systematic Troubleshooting – Symptoms observation and analysis – fault diagnosis – fault rectification – Troubleshooting levels – FDD, HDD, CD ROM Problems.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 B. Govindarajalu, IBM PC Clones Hardware, Troubleshooting and Maintenance, McGraw-Hill, New Delhi, Second Edition, 2003.

2 K.L. James, Computer Hardware Installation, Interfacing, Troubleshooting and maintenance, PHI Learning Private Limited, India, First Edition, 2013.

Reference Books :

1 Craig Zacker and John Rourke, PC Hardware: The Complete Reference, McGraw-Hill, New Delhi, Fifth Edition, 2001.

2 Jean Andrews, Guide to Hardware Managing, Maintaining and Troubleshooting, Cengage Learning (Course Technology), Boston, Fifth Edition, 2010

3 Cheryl A. Schmidt, Complete A+ guide to IT Hardware and Software, Pearson Education, India, Eighth Edition, 2020.

4 Scott M. Mueller, Upgrading and Repairing PCs, Pearson Education, India, Twenty Second Edition, 2012.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20CS910 **Course name : HARDWARE AND TROUBLE SHOOTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1:	Identify with the Basic functional units of a computer system.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO2:	Discover the working Concepts of I/O devices in computer.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO3:	Examine the interfaces and controllers connected to PC.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO4:	Outline the system configuration, Installation and maintenance of PC.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO5:	Summarize about faults, diagnostics and troubleshooting in PC.	3	2	-	-	2	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

BASICS OF MEDICAL ELECTRONICS

20EC901 (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite:

	Course Outcomes : On the successful completion of the course, students will be able to	***Cognitive Level***
CO1	*Describe the recording methods of various bio-potentials.*	*Understand*
CO2	*Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.*	*Understand*
CO3	*Discuss the different types of therapeutic equipment.*	*Understand*
CO4	*Interpret the principles of various medical imaging modalities.*	*Understand*
CO5	*Outline the recent trends in medical instrumentation.*	*Understand*

UNIT – I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING [09]

The origin of bio-potentials - Bio-potential electrodes - Carrier, chopper and isolation amplifiers -Transducers for biomedical applications: Strain gauge, piezoelectric transducer, thermocouple, thermistor, biosensors - ECG, EEG, EMG, PCG, ERG and EOG: Lead systems, recording methods.

UNIT - II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT [09]

Blood gas analyzers - Electrophoresis - Colorimeter & Photometer - Auto analyzer - Blood flow meter - Cardiac output - Respiratory measurement - Blood pressure measurement - Temperature measurement - Pulse measurement -Blood cell counters: Coulter counters.

UNIT - III THERAPEUTIC EQUIPMENTS [09]

Cardiac pacemakers - DC defibrillator - Dialyzers - Surgical diathermy - Physiotherapy and electrotherapy equipment - Oxygenators - Heart lung machine.

UNIT - IV MEDICAL IMAGING [09]

X-Ray - Computer Axial Tomography - Positron Emission Tomography - MRI and NMR - Ultrasonic Imaging systems.

UNIT - V RECENT TRENDS IN MEDICAL INSTRUMENTATION - [09]

Thermograph - Endoscopy unit - LASER in medicine - Biomedical telemetry - Radio-pill - Cardiac catheterization laboratory - Electrical safety of medical equipment.

Total (L: 45) = 45 Periods

Text Books :

1 R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, Third Edition, 2014

2 Leslie Cromwel, Fred J.Weibel, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson/Prentice Hall India, New Delhi, Second Edition, 2011.

Reference Books :

1 John G.Webster, Medical Instrumentation Application and Design, John Wiley & Sons Inc, New Jersy, Fourth Edition, 2009.

2 Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley &Sons, New Jersy, Fourth Edition, 2008.

3 M. Arumugam, Biomedical Instrumentation, Anuradha Publications, Chennai, Second Edition, Reprint 2009.

4 R.L. Reka & C. Ravikumar, Biomedical Instrumentation/ Medical Electronics, Lakshmi Publications, Chennai, Second Edition, Reprint 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EC901 **Course name : BASICS OF MEDICAL ELECTRONICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the recording methods of various bio-potentials.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO2	Illustrate the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO3	Discuss the different types of therapeutic equipment.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO4	Interpret the principles of various medical imaging modalities.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
CO5	Outline the recent trends in medical instrumentation.	2	1	2	-	-	1	-	-	-	-	-	1	-	-
	Average	**2**	**1**	**2**		**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC902	**NANO TECHNOLOGY**	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe the evolution and associated techniques of Nano science.*	*Understand*
CO2	*Interpret the diversities in Nano systems.*	*Understand*
CO3	*Classify different Nano particles, shells and their Characterization.*	*Understand*
CO4	*Illustrate the importance of nanotechnology in biotechnology.*	*Understand*
CO5	*Outline the applications of nanotechnology in industry and society.*	*Understand*

UNIT – I INTRODUCTION [09]

Nano science - Evolution - Electron microscopes - Scanning probe microscopes - Optical microscopes for nanotechnology - X ray diffraction - Associated techniques.

UNIT – II DIVERSITY IN NANO SYSTEMS [09]

Fullerenes - Synthesis and purification - Mass spectrometry and ion/molecule reactions - Chemistry of fullerenes - Endo-hedral chemistry - Conductivity and super conductivity in doped fullerenes - Carbon nanotubes - Synthesis and purification - Electronic structure - Transport - Mechanical - Physical properties applications - Semiconductor quantumdots - Synthesis and applications.

UNIT – III METAL NANO PARTICLES AND NANO SHELLS [09]

Method of preparation - Characterization - Functions and applications - Core shell nanoparticles: Types of system - Characterization - Functions and applications - Nano shells: Types, characterization, properties and applications.

UNIT – IV EVOLVING INTERFACES IN NANO [09]

Nano biology - Interaction between bio molecules and nano particle surfaces - Applications of nano in biology -Microprobes for medical diagnosis and biotechnology - Current status - Nano sensors - Order from chaos - Applications - Smart dust sensors - Nano medicines various kinds - Future directions.

UNIT – V IMPACT OF NANO TECHNOLOGY ON SOCIETY [09]

Introduction - Industrial revolution to Nano revolution - Implications of Nano sciences and Nano technology on society - Issues - Nano policies and institutions - Nanotech and war - Nano arms race - Harnessing nano technology for economic and social development.

Total = 45 Periods

Text Books :

1 PradeepT, Nano: The Essentials, Understanding Nano Science and Nano technology, TMH, New Delhi, First Edition, 2007.

2 Mick Wilson, Kamali Kannargare., Geoff Smith, Nano technology: Basic Science and Emerging technologies, Overseas Press, New Delhi, First Edition, 2005.

Reference Books :

1 Nalwa H S, Encyclopedia of Nanoscience and Nanotechnology, Vol 1-10, American Scientific Publishers, California, First Edition 2004.

2 Rao C N R and Govindaraj A, Nanotubes and Nanowires, Royal Society of Chemistry, London, Third Edition, 2005.

3 Richard A L Jones, Soft Machines: Nanotechnology and Life, Oxford University Press, Oxford, FirstEdition,2007

4 Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, Wiley Inter science, New Jersey, First Edition, 2003.

5 Mark A. Ratner, Daniel Ratner, Nanotechnology: A gentle introduction to the next Big Idea, Pearson Education, London, 2003.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EC902 **Course name : NANO TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the evolution and associated techniques of Nano science.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Interpret the diversities in Nano systems.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Classify different Nano particles, shells and their Characterization.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Illustrate the importance of nanotechnology in biotechnology.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Outline the applications of nanotechnology in industry and society.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC903	**ELECTRONICS AND MICROPROCESSOR** (Open Elective)	3	0	0	3

Prerequisite:

	Course Outcomes: On the successful completion of the course, students will be able to	***Cognitive Level***
CO1	*Interpret the fundamental concepts of semiconductor device.*	*Understand*
CO2	*Explain the various characteristics of amplifiers.*	*Understand*
CO3	*Outline the fundamental concepts of Digital Electronics*	*Understand*
CO4	*Describe about 8085 microprocessors*	*Understand*
CO5	*Explain the applications using microprocessor*	*Understand*

UNIT – I SEMICONDUCTORS AND RECTIFIERS [09]

Classification of solids based on energy band theory - Intrinsic semiconductors - Extrinsic semiconductors - PN junction diode: Characteristics - Half wave and full wave rectifiers - Zener diode: Characteristics - Voltage regulator.

UNIT – II TRANSISTORS AND AMPLIFIERS [09]

Bipolar junction transistor: Construction and characteristics - CE configuration and characteristics - Transistor biasing: Fixed and voltage divider biasing - Construction and characteristics: FET, SCR and UJT - Concept of feedback: Negative feedback – Application in temperature and motor speed control - Common Emitter Amplifier (Qualitative treatment only).

UNIT – III DIGITAL ELECTRONICS [09]

Number system: Binary, Octal, Hexadecimal - Boolean algebra - Logic gates - Half adder and full adder - Flip flops - Shift Registers: SISO, SIPO, PISO, PIPO - Counters: 3-bit Synchronous up & down, 3-bit Asynchronous up & down - A/D conversion: Single slope, Successive approximation - D/A conversion: Binary weighted resistor type.

UNIT – IV 8085 MICROPROCESSOR [09]

Block diagram of Microcomputer – 8085: Architecture, Pin configuration, Addressing modes, Instruction set and Simple programs using arithmetic and logical operations.

UNIT – V INTERFACING AND APPLICATIONS OF MICROPROCESSOR [09]

Basic interfacing concepts - Interfacing of Input and Output devices - Applications of microprocessor: Temperature control, Stepper motor control, Traffic light control - Case study: Mining problem, Turbine monitor using 8085.

Total (L: 45) = 45 Periods

Text Books :

1. Jacob Millman and Christos C. Halkias, Integrated Electronics, Tata McGraw-Hill publishers, US, Second Edition, 2011.
2. Ramesh Gaonkar, Microprocessor Architecture II, Programming and Applications with 8085, Penram International Publishing, USA, Sixth Edition, 2013.

Reference Books :

1. Malvino Leach and Saha, Digital Principles and Applications, Tata McGraw-Hill Education, New Delhi, Eighth Edition, 2014.
2. Mehta V.K, Principles of Electronics, S. Chand and Company Ltd., New Delhi, Seventh Edition, 2014.
3. Salivahanan S, Suresh Kumar N, Vallavaraj A, Electronic Devices and Circuits, Tata McGraw-Hill Education, New Delhi, Third Edition, 2012.
4. Krishna Kant, Microprocessors and Microcontrollers, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20EC903 **Course name : ELECTRONICS AND MICROPROCESSOR**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Interpret the fundamental concepts of semiconductor device.	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	Explain the various characteristics of amplifiers.	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	Outline the fundamental concepts of Digital Electronics	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	Describe about 8085 microprocessors	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	Explain the applications using microprocessor	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	3	3	2	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC904	ANALOG AND DIGITAL COMMUNICATION (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
CO1	*Describe analog communication techniques*	*Understand*
CO2	*Describe Digital communication techniques*	*Understand*
CO3	*Use data and pulse communication techniques*	*Understand*
CO4	*Explain Source and Error control coding*	*Understand*
CO5	*Utilize multi-user radio communication*	*Understand*

UNIT – I ANALOG COMMUNICATION [09]

Noise: Source of Noise – External Noise- Internal Noise- Noise Calculation. Introduction to Communication Systems: Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM – FM – PM).

UNIT – II DIGITAL COMMUNICATION [09]

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT – III DATA AND PULSE COMMUNICATION [09]

Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Error Detection and Correction Techniques – Data communication Hardware – serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM).

UNIT – IV SOURCE AND ERROR CONTROL CODING [09]

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

UNIT – V MULTI-USER RADIO COMMUNICATION [09]

Advanced Mobile Phone System (AMPS) – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Hand – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

Total (L: 45) = 45 Periods

Text Books :

1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition 2009.

2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersy, Fourth Edition, 2004.

Reference Books :

1 H.Taub, D L Schilling and G Saha, Principles of Communication, McGraw Hill Education, New York, Fourth Edition, 2017.

2 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition, 2007.

3 Rappaport T.S, Wireless Communications: Principles and Practice, Pearson Education, London, Third Edition 2007.

4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, Second Edition, 2001.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EC904 **Course name : ANALOG AND DIGITAL COMMUNICATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe analog communication techniques	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Describe Digital communication techniques	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Use data and pulse communication techniques	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Explain Source and Error control coding	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Utilize multi-user radio communication	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC905	**PRINCIPLES OF COMMUNICATION** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On the successful completion of the course, students will be able to		***Cognitive Level***
CO1:	Determine the performance of analog modulation schemes in time and frequency domains.	*Understand*
CO2:	Determine the performance of systems for generation and detection of modulated analog signals.	*Understand*
CO3:	Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	*Understand*
CO4:	Determine the performance of analog communication systems in the presence of Noise	*Understand*
CO5:	Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	*Understand*

UNIT – I **AMPLITUDE MODULATION** **[09]**

Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector. Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

UNIT – II **ANGLE MODULATION** **[09]**

Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver

UNIT - III **RANDOM VARIABLES & PROCESS** **[09]**

Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions

UNIT – IV **NOISE IN ANALOG MODULATION** **[09]**

Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth (refer Chapter 5 of Text), Noise Figure. Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

UNIT – V **DIGITAL REPRESENTATION OF ANALOG SIGNALS** **[09]**

Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing.

Total (L: 45) = 45 Periods

Text Books :

1 Wayne Tomasi, Advanced Electronic Communication Systems, Pearson Education, London, Sixth Edition, 2009.

2 Simon Haykin, Communication Systems, John Wiley & Sons, New Jersy, Fourth Edition2004.

Reference Books :

1 H.Taub & D.L.Schilling, Principles of Communication Systems**,** TMH, New Delhi, First Edition, 2011.

2 H.Taub, D L Schilling and G Saha, Principles of Communication, Pearson Education, London, Fourth Edition, 2017.

3 B. P.Lathi, Modern Analog and Digital Communication Systems, Oxford University Press, Oxford, Third Edition 2007.

4 Blake, Electronic Communication Systems, Thomson Delmar Publications, USA, First Edition, 2002.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EC905 **Course name : PRINCIPLES OF COMMUNICATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Determine the performance of analog modulation schemes in time and frequency domains.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Determine the performance of systems for generation and detection of modulated analog signals.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Determine the performance of analog communication systems in the presence of Noise	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Interpret the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC906	**FUNDAMENTALS OF ROBOTICS** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the students will be able to		***Cognitive Level***
CO1	*Describe the basis of Robotics*	*Understand*
CO2	*Describe the technologies applicable for Robotics in computer based vision*	*Understand*
CO3	*Interpret the different sensing elements of robot*	*Understand*
CO4	*Develop the algorithms applicable for robotics*	*Apply*
CO5	*Develop 4-axis and 6-axis robot*	*Apply*

UNIT – I INTRODUCTION TO ROBOTICS [09]

Motion - Potential function - Road maps - Cell decomposition sensor and sensor planning - Kinematics - Forward and inverse kinematics - Transformation matrix and DH transformation - Geometric methods and algebraic methods.

UNIT – II COMPUTER VISION [09]

Projection - Optics, projection on the Image plane and radiometry - Image processing - Connectivity - Images - Gray Scale and binary images - Blob filling - Histogram - Convolution - Digital convolution and filtering and Masking techniques - Edge detection - Face detection.

UNIT - III SENSORS AND SENSING DEVICES [09]

Introduction to various types of sensor - Resistive sensors - Range sensors – Radar and Infra-red - Introduction to sensing - Light sensing - Heat sensing - Touch sensing and position sensing.

UNIT – IV ARTIFICIAL INTELLIGENCE [09]

Uniform Search strategies - Breadth first, Depth first, Depth limited - Iterative and deepening depth first search and bidirectional search - The A* algorithm - Planning - State-space planning - Plan - space planning - Graph plan/Sat plan and their comparison - Multi-agent planning 1 and Multi-agent planning 2 - Probabilistic reasoning

UNIT – V INTEGARATION TO ROBOT [09]

Building of 4 axis or 6 axis robot - Vision system for pattern detection - Sensors for obstacle detection - AI algorithms for path finding - Decision making.

Total (L: 45) = 45 Periods

Text Books :

1 Duda, Hart and Stork, Pattern Recognition, Wiley-Inter science, New Jersy, First Edition, 2000.

2 Mallot, Computational Vision: Information Processing in Perception and Visual Behavior, MIT Press, USA, First Edition, 2000.

Reference Books :

1 Stuart Russell and Peter Norvig, Artificial Intelligence-A Modern Approach, Pearson Education Series in Artificial Intelligence, USA, First Edition, 2004.

2 Robert Schilling and Craig., Fundamentals of Robotics, Analysis and control, PHI, New Delhi, First Edition 2003.

3 Forsyth and Ponce, Computer Vision, A modern Approach, Pearson Education, USA, First Edition 2003.

4 https://nptel.ac.in/courses/112/108/112108093/

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EC906 **Course name : FUNDAMENTALS OF ROBOTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the basis of Robotics	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Describe the technologies applicable for Robotics in computer based vision	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Interpret the different sensing elements of robot	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Develop the algorithms applicable for robotics	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Develop 4-axis and 6-axis robot	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EC907	**INTERNET OF THINGS SENSING AND ACTUATOR DEVICES** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe what IoT is and how it works today.*	*Understand*
CO2	Design and program IoT devices.	*Understand*
CO3	*Describe the functions and characteristics of IoT sensors.*	*Understand*
CO4	*Illustrate the wireless, energy, power, RF and sensing modules.*	*Understand*
CO5	*Describe the applications and technological challenges faced by IoT devices.*	*Understand*

UNIT – I BASICS OF IOT [09]

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT – IoT Information Security.

UNIT – II IOT PROTOCOLS [09]

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security

UNIT – III IoT SENSORS [09]

Industrial sensors – Description & Characteristics–First Generation – Description &Characteristics– Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics – Polytronics Systems – Description &Characteristics–Sensors' Swarm – Description & Characteristics – Printed Electronics – Description & Characteristics – IoT Generation Roadmap.

UNIT– IV TECHNOLOGICAL ANALYSIS [09]

Wireless Sensor Structure–Energy Storage Module–Power Management Module – RF Module– Sensing Module.

UNIT – V APPLICATIONS [09]

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

Total = 45 Periods

Text Books:

1 David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, London, First Edition, 2010.

2 Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, Technologies & Sensors for the Internet of Things Businesses & Market Trends, First Edition, 2014.

Reference Books:

1 Honbo Zhou, Dieter Uckelmann; Mark Harrison, The Internet of Things in the Cloud: A Middleware Perspective - CRC Press, USA, First Edition, 2012.

2 Florian Michahelles, Architecting the Internet of Things –– Springer, Berlin, First Edition, 2011.

3 Ida N, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

4 Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, New Jersy, First Edition, 2012.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EC907 **Course name : INTERNET OF THINGS SENSING AND ACTUATOR DEVICES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe what IoT is and how it works today.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Design and program IoT devices.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Describe the functions and characteristics of IoT sensors.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Illustrate the wireless, energy, power, RF and sensing modules.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Describe the applications and technological challenges faced by IoT devices.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EC908	**CONSUMER ELECTRONICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes: On completion of this course, the student will be able to		***Cognitive Level***
CO1	*Describe the evolution and fundamentals of consumer electronics*	*Understand*
CO2	*Discuss various entertainment electronics appliances*	*Understand*
CO3	*Demonstrate various smart home systems*	*Understand*
CO4	*Outline various home appliances*	*Understand*
CO5	*Illustrate various communication equipment's used In day to day life*	*Understand*

UNIT – I CONSUMER ELECTRONICS FUNDAMENTALS [09]

History of Electronic Devices- Vacuum Tubes, Transistors, Integrated Circuits- Moore's Law, Semiconductor Devices, Diodes, Rectifiers, Transistors, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microprocessor Vs Microcontrollers, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

UNIT – II ENTERTAINMENT ELECTRONICS [09]

Audio systems: Construction and working principle of: Microphone, Loud speaker, AM and FM receiver, stereo, 2.1 home theatres, 5.1 home theatres, Display systems: CRT, LCD, LED and Graphics display Video Players: DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

UNIT – III SMART HOME [09]

Technology involved in Smart home, Home Virtual Assistants- Alexa and Google Home. Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT– IV HOME APPLIANCES [09]

Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT – V COMMUNICATION SYSTEMS [09]

Cordless Telephones, Fax Machines, PDAs - Tablets, Smart Phones and Smart Watches, Introduction to Smart OS - Android and iOS. Video Conferencing Systems - Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

Total = 45 Periods

Text Books:

1 Dennis C Brewer, Home Automation, Que Publishing, London, First Edition, 2013.

2 Jordan Frith, Smartphones as Locative Media, Wiley, New Jersy, First Edition, 2014.

Reference Books:

1 Lyla B Das, Embedded Systems-An Integrated Approach, Pearson, London, First Edition, 2013

2 Marilyn Wolf, Computers as Components - Principles of Embedded Computing System Design, Third Edition Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

3 Peckol, Embedded system Design, John Wiley & Sons, USA, First Edition, 2010

4 Thomas M. Coughlin, Digital Storage in Consumer Electronics, Elsevier and Newness, Amsterdam, Netherlands First Edition, 2012.

5 Philip Hoff, Consumer Electronics for Engineers, Cambridge University Press. London, First Edition, 1998.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EC908 **Course name : CONSUMER ELECTRONICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the evolution and fundamentals of consumer electronics	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Discuss various entertainment electronics appliances	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Demonstrate various smart home systems	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Outline various home appliances	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Illustrate various communication equipment's used In day to day life	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE901	**ELECTRICAL DRIVES AND CONTROL** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Categorize and explain the operation of electrical drives*	*Understand*
CO2:	*Explain the characteristics of various electrical drives*	*Understand*
CO3:	*Interpret the operation of starting and braking methods of AC and DC machines*	*Understand*
CO4:	*Choose the appropriate speed control techniques for DC motor drives*	*Understand*
CO5:	*Choose the appropriate speed control techniques for AC motor drives*	*Understand*

UNIT - I INTRODUCTION [09]

Electrical drives – Need – Advantage of electrical drives – Basic elements of electrical drives – Factors influencing the choice of electrical drives – Four quadrant operation of a motor driving a hoist load – Load torques – Selection of motors with regard to thermal overloading – Classes of motor duty.

UNIT - II CHARACTERISTICS OF ELECTRIC DRIVES [09]

DC Motors: DC shunt, DC series, DC compound and Permanent Magnet DC motors – AC Motors: Single phase and three phase Induction motors – Speed–Torque characteristics of various types of loads and drive motors.

UNIT - III MOTOR STARTING AND BRAKING METHODS [09]

Types of Starters: Two Point Starter, Three Point Starter, Four Point Starter, DOL Starter, Y-Δ Starter. Braking of Electrical Motors: Shunt Motor, Series Motor, Single Phase Induction Motor.

UNIT - IV DC DRIVES [09]

Speed control of DC series and shunt motors — Armature and field control – Ward-Leonard control system – Controlled Rectifiers Fed DC motor Drive – Chopper fed DC motor Drive: Buck, Boost and Buck-Boost – Applications.

UNIT - V AC DRIVES [09]

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverter and AC Voltage Controller Based Induction Drives – Applications.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Dubey G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2019.

2 Vedam Subramaniam, Electric Drives: Concepts and Applications, Tata McGraw Hill Publishing Company, New Delhi, Second Edition, 2010.

Reference Books :

1 Krishnan. R, Electric Motor Drives: Modeling, Analysis and Control, Prentice Hall Pvt. Ltd, New Delhi, Second Edition, 2003.

2 Pillai.S.K, A First Course on Electric Drives, Wiley Eastern Limited, New Delhi, Fourth Edition, 2012.

3 Nagrath I.J and Kothari D. P, Electrical machines, Tata McCraw Hill Publishing Company Ltd, New Delhi, Fifth Edition, 2017.

4 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2013.

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K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE901 **Course name : ELECTRICAL DRIVES AND CONTROL**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Categorize and explain the operation of electrical drives	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO2	Explain the characteristics of various electrical drives	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO3	Interpret the operation of starting and braking methods of AC and DC machines	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO4	Choose the appropriate speed control techniques for DC motor drives	3	-	1	-	-	2	2	1	-	-	-	2	-	-
CO5	Choose the appropriate speed control techniques for AC motor drives	3	-	1	-	-	2	2	1	-	-	-	2	-	-
	Average	**3**	**-**	**1**	**-**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE902	**POWER SEMICONDUCTOR DEVICES** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the power diode characteristics and applications for adjustable speed motor control*	Understand
CO2:	*Infer the static and dynamic characteristics of current controlled power semiconductor devices*	Understand
CO3:	*Realize the static and dynamic characteristics of voltage controlled power semiconductor devices*	Understand
CO4:	*Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits*	Understand
CO5:	*Discuss the electrical analogy of thermal models and the methods for cooling power devices*	*Understand*

UNIT - I POWER SEMICONDUCTOR DIODES AND CIRCUITS [09]

Power diode: Structure, V-I and reverse recovery characteristics–types of power diodes – Series and parallel connected diodes – Diode rectifiers: Single phase half wave and full wave rectifiers with R, RL load.

UNIT - CURRENT CONTROLLED DEVICES [09]

BJT's: Construction, operation, static and switching characteristics, Negative temperature coefficient and secondary breakdown, on-state losses, safe operating area. Thyristors: Construction, working, Two transistor analogy, V–I and switching characteristics, series and parallel operation; comparison of BJT and Thyristor – Basics of TRIAC, RCT,GTO, MCT.

UNIT - III VOLTAGE CONTROLLED DEVICES [09]

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, Comparison of Power MOSFET and IGBTs – Applications.

UNIT - IV FIRING AND PROTECTING CIRCUITS [09]

Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT – Necessity of isolation, Isolation of gate and base drives: pulse transformer and optocoupler – Overvoltage and overcurrent protections for power devices – Design of snubber circuits.

UNIT - V THERMAL PROTECTION [09]

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour and phase cooling; Guidance for heat sink selection – Thermal resistance and impedance – Electrical analogy of thermal components, heat sink types and design – Mounting types- switching loss calculation for power device.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rashid.M.H, Power Electronics Circuits Devices and Applications, PHI learning private limited, New Delhi, Fourth Edition, 2017.

2 Bimbhra.P.S, Power Electronics, Khanna Publishing, New Delhi, Fifth Edition, 2013.

Reference Books :

1 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, 2013.

2 Ned Mohan Tore. M. Undeland, William. P. Robbins, Power Electronics: Converters, Applications and Design, John Wiley and sons Ltd, United States, Second Edition, 2013.

3 Sen.P.C, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Thirtieth reprint, 2008.

4 Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGraw-Hill, 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE902 **Course name : POWER SEMICONDUCTOR DEVICES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the power diode characteristics and applications for adjustable speed motor control	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2	Infer the static and dynamic characteristics of current controlled power semiconductor devices	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	Realize the static and dynamic characteristics of voltage controlled power semiconductor devices	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	Examine the gate drive requirements for power devices and isolation techniques between the gate and power circuits	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	Discuss the electrical analog of thermal models and the methods for cooling power devices	3	2	-	-	-	-	-	-	-	-	-	2	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE903	ELECTRICAL POWER GENERATION SYSTEMS (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the layout and function of various parts inside the thermal power plant.*	*Remember*
CO2:	*Outline the layout, construction, working of the components inside the hydro power plant.*	*Understand*
CO3:	*Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.*	*Understand*
CO4:	*Discuss about the types, performance and layout of gas and diesel power plants.*	*Understand*
CO5:	*Infer the basic concepts of different non-conventional energy sources.*	*Understand*

UNIT - I Thermal power plant [09]

Basic thermodynamic laws - various components of steam power plant – layout - pulverized coal burners - Fluidized bed combustion - coal handling and ash handling systems - Forced draft and induced draft fans – Boilers - feed pumps – superheater - regenerator – condenser – deaerators - cooling tower.

UNIT - II Hydro power plant [09]

Hydel power plant classifications- essential elements, selection of water turbines - selection of site for a hydel power plant - layout – dams – pumped storage power plants - micro hydel developments.

UNIT - III Nuclear power plant [09]

Principles of nuclear energy - nuclear fission - nuclear reactor, types – pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor-nuclear power plants

UNIT - IV Gas and diesel power plant [09]

Fuels - gas turbine material, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance - advantages and disadvantages- types of diesel engine power plant- components and layout.

UNIT - V Renewable energy [09]

Solar energy collectors – OTEC - wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation principle.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Domkundwa, Arora Domkundwar, A Course in Power Plant Engineering, Dhanpat Rai and Co. Pvt. Ltd., New Delhi, Eighth edition, 2016.

2 P.K. Nag, Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2010.

Reference Books :

1 Philip Kiameh, Power Generation Handbook, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2013.

2 P.C. Sharma, Power Plant Engineering, S.K. Kataria and Sons, New Delhi, First Edition, 2013.

3 Raja, A.K., Amit Prakash Manish Dwivedi, Power Plant Engineering, New Age International, New Delhi, First Edition, 2012.

4 Gupta, Manoj Kumar, Power Plant Engineering, PHI learning private limited, New Delhi, First Edition, 2012.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE903 **Course name : ELECTRICAL POWER GENERATION SYSTEMS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the layout and function of various parts inside the thermal power plant.	3	1	-	-	-	2	3	2	-	-	-	1	-	-
CO2	Outline the layout, construction, working of the components inside the hydro power plant.	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO3	Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.	3	2	-	-	-	3	3	2	-	-	-	1	-	-
CO4	Discuss about the types, performance and layout of gas and diesel power plants.	3	2	-	-	-	2	3	1	-	-	-	1	-	-
CO5	Infer the basic concepts of different non-conventional energy sources.	3	1	-	-	-	3	3	2	-	-	-	1	-	-
	Average	**3**	**2**	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE904	**CONTROL ENGINEERING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: Applied Mathematics

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Obtain the transfer function of electrical and mechanical systems.*	*Apply*
CO2:	*Determine the time-domain response of first and second order systems.*	*Apply*
CO3:	*Examine the stability of open loop system using bode / polar plot.*	*Apply*
CO4:	*Analyze the stability of the system by Root locus and Routh Hurwitz criterion.*	*Apply*
CO5:	*Design lag, lead, lag-lead compensator using bode plot.*	*Apply*

UNIT - I SYSTEM AND THEIR REPRESENTATION [09]

Basic elements in control system – Classification of control systems: Open and closed loop systems– Electrical, Mechanical translational and rotational system – Block diagram reduction techniques – Signal flow graphs.

UNIT - II TIME RESPONSE ANALYSIS [09]

Types and order of systems – Types of test signal – First and second order time response –Time domain specification of second order under damped systems – Generalized error series–Steady state error and error constants.

UNIT - III FREQUENCY RESPONSE ANALYSIS [09]

Frequency response of the system – Bode plot – Polar plot – Constant M and N circles – Determination of closed loop response from open loop response.

UNIT - IV STABILITY OF CONTROL SYSTEM [09]

Characteristics equation – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition.

UNIT - V COMPENSATOR AND CONTROLLER [09]

Lag, lead and lag-lead networks – Lag, lead and lag-lead compensator using bode plots – P, PI, PID controllers.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Nagrath, J., and Gopal,V., Control Systems Engineering, New Age International (p) Limited, Publishers, New Delhi, Fourth Edition, 2007.

2 Benjamin C. Kuo, Automatic Control systems, PHI Learning, New Delhi, Seventh Edition, 2009.

Reference Books :

1 Ogata, K., Modern Control Engineering, PHI, New Delhi, Fifth Edition, 2009.

2 Norman S. Nise, Control Systems Engineering, John Wiley, New Delhi, Seventh Edition, 2014.

3 Smarajit Ghosh, Control systems, Pearson Education, New Delhi, Second Edition, 2009.

4 Roychoudhury,D., Modern control engineering, Prentice Hall of India, Second Edition, 2005.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE904 **Course name : CONTROL ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Obtain the transfer function of electrical and mechanical systems.	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO2	Determine the time-domain response of first and second order systems.	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO3	Examine the stability of open loop system using bode / polar plot.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO4	Analyze the stability of the system by Root locus and Routh Hurwitz criterion.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
CO5	Design lag, lead, lag-lead compensator using bode plot.	3	3	3	2	-	-	2	-	-	-	-	2	-	-
	Average	**3**	**3**	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE905	**INDUSTRIAL AUTOMATION** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the major components of Programmable Logic Controller and its applications.*	*Understand*
CO2:	*Summarize the logical functions, timers and counters of PLC*	*Understand*
CO3:	*Discuss the various instructions and modes of operation related to PLC.*	*Understand*
CO4:	*Realize the architecture and various interfacing techniques of Distributed Control Systems*	*Understand*
CO5:	*Examine the different applications of PLC and Distributed Control Systems (DCS).*	*Understand*

UNIT - I INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC) [09]

Introduction - PLC Evolution – PLC Vs Computers – Block Diagram of PLC – Parts of a PLC- Principles of Operation- Modifying the Operation**-** PLC Hardware Components: I/O modules, Power Supply, CPU – PLC size and Applications.

UNIT - II LOGIC FUNDAMENTALS, TIMER AND COUNTER [09]

Logic functions – Boolean instructions and functions – Hardwired logic Vs Programmed Logic - Developing circuits from Boolean instructions **–** PLC timer: classification and instructions – PLC counter: classification, instructions and applications

UNIT - III PLC PROGRAMMING [09]

PLC-memory map - Program scan – Relay type instructions – Instruction addressing - Branch instructions - Internal relay instructions - EXAMINE IF CLOSED and EXAMINE IF OPEN instructions - Modes of operation – Basic relay ladder logic and its control flow chart

UNIT - IV DISTRIBUTED CONTROL SYSTEM [09]

Distributed control system: Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities – HMI Interface – Low and high level operator interfaces – Operator displays – Low and high level engineering interfaces – Introduction to SCADA.

UNIT - V APPLICATIONS OF PLC AND DCS [09]

PLC applications: Automatic Control of Ware House Door – Automatic Lubricating Oil Supplier – Conveyor Belt motor Control – Automatic Car Washing Machine – DCS applications: Pulp and paper environment, Petroleum and refining environment.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Frank D. and Petruzella, Programmable Logic controllers, Tata McGraw Hill Publishing Company Limited, New Delhi, Fifth Edition,2017

2 Lucas ,M.P., Distributed Control System, Van Nostrand and Reinhold Co., New york, First Edition, 1986.

Reference Books :

1 Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning, New york, Third Edition, 2010

2 John W.Webb and Ronald A.Reis, Programmable Logic Controllers: Principles and Applications, PHI Private Ltd., New Delhi, Fifth Edition, 2003

3 Krishna Kant, Computer - Based Industrial Control, Prentice Hall, New Delhi, Second Edition(Revised), 2011

4 Madhuchhanda Mitra and Smarajit Sen Gupta, Programmable Logic Controllers and Industrial Automation, Penram International Publishing (India) Pvt. Ltd, Mumbai, Second Edition, 2009

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE905 **Course name : INDUSTRIAL AUTOMATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the major components of Programmable Logic Controller and its applications.	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO2	Summarize the logical functions, timers and counters of PLC	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO3	Discuss the various instructions and modes of operation related to PLC.	3	2	3	-	2	-	-	-	-	-	-	1	-	-
CO4	Realize the architecture and various interfacing techniques of Distributed Control Systems	3	2	3	-	1	-	-	-	-	-	-	1	-	-
CO5	Examine the different applications of PLC and Distributed Control Systems (DCS)	3	2	3	-	2	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	**3**	-	**2**	**–**	**-**	**-**	**-**	**-**	**-**	**1**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE906	**ELECTRICAL INSTRUMENTS AND MEASUREMENTS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the construction and calibration of moving coil and Moving iron meters*	*Understand*
CO2:	*Discuss the operation and error correction method of wattmeter and Energy meter.*	*Understand*
CO3:	*Describe the various types of potentiometer and their limitations*	*Understand*
CO4:	*Determine the values of resistor, inductor, capacitor and frequency using bridges.*	*Understand*
CO5:	*Explain the concepts of storage and display devices.*	*Understand*

UNIT - I MEASUREMENT OF VOLTAGE AND CURRENT [9]

Galvanometers – Ballistic, D'Arsonval galvanometer – Principle, construction, operation and comparison of moving coil, moving iron meter – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

UNIT - II MEASUREMENT OF POWER AND ENERGY [9]

Wattmeters: Induction, Electro-dynamometer - Theory & its errors - Methods of correction – Calibration of wattmeter – Energy meter: Single Phase Energy Meter - Construction, Theory, Errors - Adjustment of Errors – Construction and principle of working of single phase dynamometer type power factor meter.

UNIT - III POTENTIOMETERS & INSTRUMENT TRANSFORMERS [9]

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – C.T and P.T construction, theory, operation, phasor diagram – Applications.

UNIT - IV BRIDGE MEASUREMENT [9]

Measurement of resistance: Wheatstone bridge, Kelvin double bridge, Megger – Measurement of Inductance: Maxwell Bridge, Anderson bridge – Measurement of Capacitance: Schering bridge, Desauty's Bridge – Determination of frequency using Wein Bridge.

UNIT - V STORAGE AND DISPLAY DEVICES [9]

Recorders: Strip Chart, X-Y Recorders – Digital Plotters – Digital Storage Oscilloscope – Digital multimeters – LED – DLP – Dot Matrix Display – Data Loggers

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Golding, E.W and Widdis F.C, Electrical Measurements & Measuring Instruments, A.H.Wheeler & Co, Allahabad, India, Sixth Edition,2019.

2 Sawhney, A.K., A course in Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & Co (P) Ltd, Delhi, Nineteenth Edition, 2021.

Reference Books :

1 Gupta, J.B, Electrical Measurements and Measuring Instruments, S.K. Kataria & Sons, Delhi, Third edition, 2012.

2 Singh, S.K, Industrial Instrumentation and control, Tata McGraw Hill, New york, Second Edition, 2003.

3 Kalsi H.S, Electronic Instrumentation, Tata McGraw Hill, New york, Second Edition, 2004.

4 Martia U. Reissland, Electrical Measurement, New Age International (P) Ltd., New Delhi, Second Edition, 2001.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE906 **Course name : ELECTRICAL INSTRUMENTS AND MEASUREMENTS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the construction and calibration of moving coil and Moving iron meters	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO2	Discuss the operation and error correction method of wattmeter and Energy meter.	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO3	Describe the various types of potentiometer and their limitations	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO4	Determine the values of resistor, inductor, capacitor and frequency using bridges.	3	3	2	-	-	1	1	-	-	-	-	3	2	3
CO5	Explain the concepts of storage and display devices.	3	3	2	-	-	1	1	-	-	-	-	3	2	3
	Average	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**3**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE907 **ENERGY CONSERVATION AND MANAGEMENT** (Open Elective)

L	T	P	C
3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Give the introduction about energy conservation principle and practices*	*Remember*
CO2:	*Describe the concept of energy efficiency in the building.*	*Understand*
CO3:	*Explain the concept of energy efficiency in the industry*	*Understand*
CO4:	*Illustrate the concept of energy efficiency in the power plant*	*Understand*
CO5:	*Describe the importance energy management and Demand Control Techniques*	*Understand*

UNIT - I ENERGY CONSERVATION PRINCIPLES AND PRACTICES [09]

Energy scenario – Principles and imperatives of energy conservation – Energy consumption pattern – Resource availability – Need for energy saving – Overview of energy consumption and its effects –Energy Monitoring, targetng and reporting - Role of Bureau of Energy Efficiency - Standards and labeling.

UNIT - II ENERGY EFFICIENCY IN BUILDINGS [09]

Introduction, definition and concepts – Energy and water as a resource – Electrical energy conservation: Opportunities and techniques for energy conservation in buildings – Green buildings, Intelligent buildings, Rating of buildings, Efficient use of buildings – Solar passive architecture – Eco-housing concepts.

UNIT - III ENERGY EFFICIENCY IN INDUSTRIES [09]

Potential areas for electrical energy conservation in various industries – Conservation methods – Energy management opportunities in electrical heating, cable selection – Energy efficient motors – Adjustable AC drives – Application and its use – Energy efficiency in lighting.

UNIT - IV ENERGY EFFICIENCY IN POWER PLANTS [09]

Captive power generation systems – Sequence operation of power plants – Gas Insulated Substation – Bus ducts – Types and working principle - Energy management opportunities in transformer – Power transformer – Types of switchgear (HT and LT switchgear) GCB and generator.

UNIT - V ENERGY MANAGEMENT AND AUDIT [09]

Energy Management: Definition, Objective, Importance of energy management, Load management: Demand control techniques - Utility monitoring control system. Energy Audit: definition, types of energy audit, Methodology, Need for energy Audit, Steps involved in energy auditing.

Total (L= 45, T = 0) = 45 Periods

Text Books :ENERGY MANAGEMENT

1 Mehmet Kanoglu and Yunus A. Cengel Dr, Energy Efficiency and Management for Engineers, Tata Mcgrow Hill, New Delhi, First Edition, 2019

2 Craig B. Smith, Energy Management Principles, Pergamon Press, United Kingdom, Second Edition, 2015.

Reference Books :

1 Wayne C Turner, Energy Management Handbook, The Fairmount Press, Newyork, Eighth Edition, 2006.

2 Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV

3 G. G. Rajan, Optimizing Energy Efficiencies in Industry", Tata McGraw Hill, New Delhi , Fourth Edition, , 2004

4 Frank Kreith and Yogi Goswami D, Energy Management and Conservation Handbook, Taylor & Francis, New Delhi Second Edition, 2016.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE907 **Course name : ENERGY CONSERVATION AND MANAGEMENT**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Give the introduction about energy conservation principle and practices	2	1	2	-	-	-	1	3	1	-	-	3	-	-
CO2	Describe the concept of energy efficiency in the building.	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO3	Explain the concept of energy efficiency in the industry	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO4	Illustrate the concept of energy efficiency in the power plant	2	2	2	-	-	-	1	3	1	-	-	3	-	-
CO5	Describe the importance energy management and Demand Control Techniques	2	2	2	-	-	-	1	3	-	-	-	3	-	-
	Average	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**3**	**1**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE908	**ELECTRICAL WIRING, ESTIMATION AND COSTING** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the various wiring materials and protective devices.*	Understand
CO2:	*Discuss the internal wiring system and illumination.*	Understand
CO3:	*Outline the external wiring system and installations.*	Understand
CO4:	*Apply the knowledge to prepare electrical estimation for domestic installation.*	Apply
CO5:	*Apply the knowledge to prepare the electrical estimation details for industrial installation.*	Apply

UNIT - I INTRODUCTION TO WIRING AND PROTECTIVE DEVICES [09]

Wiring accessories – main switch – isolator and load break duty – classification of main switches – functional switches – one way, two way, intermediate switches – knife switches – specification of switches – function and specification of socket outlets, ceiling roses, fan regulators – Fuses, need, classification, Neutral link – Miniature circuit breaker, classification, function and specification – ELCB – RCCB.

UNIT - II INTERNAL WIRING SYSTEM [09]

Design and Drawing of Internal wiring system for various types of Residential, Commercial and Industrial buildings – Electrical layout – Clearance of line – Different types of circuits, Light circuit, Power circuit, Sub-main wiring, Main wiring, Single Line diagram – Different types of Lamps used in Residential, Commercial and Industrial buildings.

UNIT - III EXTERNAL WIRING SYSTEM AND EARTHING [09]

Different types of Under Ground (UG) Cables – Cable Laying – Electrical Control Panels – External Electrical Distribution System – Single Line Diagram – Load Calculations – General Specifications of Generating Set, Transformer – Street Lighting – Earthing, Different types of earthing system – Plate earthing, Pipe Earthing.

UNIT - IV ESTIMATION OF DOMESTIC INSTALLATION [09]

Selection of cables for internal wiring – Cable size calculation – Selection criteria for control switches – main switch – size of earth continuity conductor and earthing conductor – Preparation of schematic diagrams and wiring diagrams – Estimation problems regarding Electrification of domestic buildings – Relevant rules regarding electrification of high rise buildings.

UNIT - V ESTIMATION OF INDUSTRIAL INSTALLATIONS [09]

Installation of motor pump set – Estimation problem regarding domestic and irrigation pump sets – Estimation problems in small workshops below 50kW connected load – Service connection, definition, classification – use of weather proof cables – estimation problems for single phase and three phase overhead service connections.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Raina, K.B. and Bhattacharya, S.K., Electrical Design Estimating and Costing, New Age International, Bengaluru, Second Edition, 2017.

2 Gupta, J.B., A Course in Electrical Installation Estimating and Costing, S K Kataria & Sons,New Delhi, First Edition Reprint, 2013.

Reference Books :

1 Surjith Singh, Electrical estimating and costing, Dhanpat Rai Publishing Company, New Delhi, First Edition,2016.

2 Uppal, S.L., Electrical Wiring, Estimating and Costing, Khanna Publisher, New Delhi, Sixth Edition, 1987.

3 Soni, P.M. and Upadhyay, P.A., Wiring, Estimating, Costing & Contracting, ATUL PRAKASHAN, Gujarat, First Edition, 2017.

4 Bureau of Indian Standards, I.E. rules for wiring, Electricity Supply Act-1948.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE908 **Course name : ELECTRICAL WIRING, ESTIMATION AND COSTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the various wiring materials and protective devices.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO2	Discuss the internal wiring system and illumination.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	Outline the external wiring system and installations.	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO4	Explain the electrical estimation for domestic installation.	3	2	1	-	1	-	-	-	-	-	-	-	-	-
CO5	Describe the electrical estimation details for industrial installation.	3	2	1	-	1	-	-	-	-	-	-	-	-	-
	Average	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE909	**FUNDAMENTALS OF ELECTRICAL MACHINERY** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Discuss fundamentals in various electrical circuits.*	Understand
CO2:	*Explain the operation and characteristics of DC machines.*	Understand
CO3:	*Determine the efficiency and regulation of the transformer.*	Understand
CO4:	*Explain the operation and starting methods of Induction Motors.*	Understand
CO5:	*Describe the applications of Synchronous Machines.*	Understand

UNIT - I INTRODUCTION [09]

Electromagnetic Induction– Faraday's Laws – Series and Parallel circuits – Self and Mutual Inductance-Numerical problems – Purpose of Earthing – Methods of Earthing – Merits of Earthing – Different types of Electrical Machines.

UNIT - II DC MACHINES [09]

Principle of operation of DC generator – Types of DC machines – EMF equation – Open Circuit Characteristics – Principle of operation of DC Motor – Torque Equation – Speed control methods of DC motor – Losses in DC machines – Performance Characteristics.

UNIT - III TRANSFORMERS [09]

Principle of operation and construction Details – Classification of Transformers – EMF equation – Losses in a Transformer – Calculation of efficiency and regulation – Autotransformer.

UNIT - IV INDUCTION MOTORS [09]

Principle of operation – Constructional Details – Classification – Revolving Magnetic Fields – Starting Methods – Principle of operation of Single Phase Induction Motor – Starting Methods – Applications.

UNIT - V SYNCHRONOUS MACHINES [09]

Principle of operation and construction of alternators – EMF Equation – Regulation of alternator by Synchronous Impedance Method – Principle of operation of synchronous motor – Synchronous Condenser – Applications.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rajendra Prasad, Fundamentals of Electrical Engineering, PHI Publications, New Delhi, Second Edition, 2005

2 B L Theraja and AK Theraja, A Textbook of Electrical Technology: Volume 2 AC and DC Machines, S. Chand & Co Ltd, New Delhi, Twenty Third Edition, 2006

Reference Books :

1 D. P. Kothari and I. J. Nagrath, Electric Machines, Tata McGraw Hill Publishing Company Ltd, Noida, Fourth Edition, 2017

2 Stephen J.Chapman, Electric Machinery Fundamentals, Tata McGraw Hill, New Delhi, Fourth Edition, 2018.

3 P. S. Bimbhra, Electrical Machinery, Khanna Publishers, New Delhi, Seventh Edition, 2018

4 J.B. Gupta, Theory & Performance of Electrical Machines, S.K. Kataria & Sons, New Delhi, First Edition Reprint, 2013.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE909 **Course name : FUNDAMENTALS OF ELECTRICAL MACHINERY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Discuss fundamentals in various electrical circuits.	3	1	-	-	-		-	-	-	-	-	-	-	-
CO2	Explain the operation and characteristics of DC machines.	3	1	-	-	-		2	-	-	-	-	-	-	-
CO3	Determine the efficiency and regulation of the transformer.	3	1	-	-	-		2	-	-	-	-	-	-	-
CO4	Explain the operation and starting methods of Induction Motors.	3	1	-	-	-		2	-	-	-	-	-	-	-
CO5	Describe the applications of Synchronous Machines.	3	1	-	-	-		2	-	-	-	-	-	-	-
	Average	**3**	**1**	**-**	**-**	**-**		**2**	**-**	**-**	**-**	**-**	**-**	-	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20EE910	**PRINCIPLES OF SOFT COMPUTING TECHNIQUES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concepts of artificial neural network*	*Understand*
CO2:	*Summarize the various types of neural network*	*Understand*
CO3:	*Discuss the basic concepts of fuzzy logic system*	*Understand*
CO4:	*Illustrate various methods used in fuzzy systems*	*Understand*
CO5:	*Outline the genetic algorithm and hybrid genetic algorithm concepts*	*Understand*

UNIT - I Introduction artificial neural network [09]

Artificial neural networks - biological neurons, Basic models of artificial neural networks – Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.

UNIT - II Neural network architecture and algorithms [09]

Perceptron networks – Learning rule – Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network – Architecture, Training algorithm.

UNIT - III Introduction to fuzzy logic [09]

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets, fuzzy relations - operations on fuzzy relations.

UNIT - IV Fuzzy logic system [09]

Fuzzy membership functions, fuzzification, Methods of membership value assignments – intuition – inference – rank ordering, Lambda –cuts for fuzzy sets, Defuzzification methods.

UNIT - V Genetic and hybrid algorithms [09]

Introduction to genetic algorithm, operators in genetic algorithm - coding - selection - crossover – mutation, Stopping condition for genetic algorithm , Genetic neuro hybrid systems, Genetic-Fuzzy rule based system

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 S.N.Sivanandam and S.N.Deepa, Principles of soft computing, Wiley India, New Delhi, Third edition, 2011.

2 Timothy J. Ross, Fuzzy Logic with engineering applications, Wiley India, New Delhi, Third edition, 2010.

Reference Books :

1 N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications, Academic Press /Elsevier, Massachusetts, First edition, 2009.

2 Simon Haykin, Neural Network, A Comprehensive Foundation, Prentice Hall International, New Jersey, Third edition, 2009.

3 Bart Kosko, Neural Network and Fuzzy Systems, Prentice Hall, New Jersey, First edition,1992.

4 Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning, Addison Wesley, Boston ,First edition,1989

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE910 **Course name : PRINCIPLES OF SOFT COMPUTING TECHNIQUES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the concepts of artificial neural network	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	Summarize the various types of neural network.	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	Discuss the basic concepts of fuzzy logic system.	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO4	Illustrate various methods used in fuzzy systems	3	2	-	-	3	-	-	-	-	-	-	1	-	-
CO5	Outline the genetic algorithm and hybrid genetic algorithm concepts	3	2	-	-	3	-	-	-	-	-	-	1	-	-
	Average	**3**	**2**	-	-	**3**	-	-	-	-	-	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20EE911	**EMBEDDED SYSTEM TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the fundamentals of embedded systems.*	*Understand*
CO2:	*Outline the various types of embedded communication protocols*	*Understand*
CO3:	*Explain the concept of software development process and tools*	*Understand*
CO4:	*Describe the functions of real time operating systems*	*Understand*
CO5:	*Discuss the applications of real time embedded systems*	*Understand*

UNIT – I INTRODUCTION TO EMBEDDED SYSTEMS [09]

Embedded System Vs General Computing System – Classification of embedded systems – Functional building blocks of embedded systems – Structural units in embedded processor – Selection of processor & memory devices – Processor interfacing with memory and I/O units – Embedded hardware unit.

UNIT - II EMBEDDED NETWORKS [09]

Introduction to I/O device ports & buses – Serial communication using I^2C,CAN,SPI and USB bus – Parallel communication using PCI, PCI-X buses, ARM bus.

UNIT – III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT [09]

Introduction to embedded software development process and tools – Host and target machines – linking and locating software – Embedded Product Development Life Cycle – objectives, different phases of EDLC, Modeling of EDLC.

UNIT – IV REAL TIME OPERATING SYSTEMS [09]

Introduction to basic concepts of RTOS – Task, process & threads – Context switching – Multiprocessing and Multitasking – Preemptive and nonpreemptive scheduling – Round Robin scheduling – Task communication – shared memory, message passing – Interprocess communication – semaphores, Message queue, Mailbox, pipes.

UNIT – V RTOS BASED EMBEDDED SYSTEM DESIGN [09]

Basic Functions and Types of RTOS – Interrupt routines in RTOS – Case Study of Washing Machine – Automotive Application – Smart card system – ATM machine – Digital camera.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Rajkamal.P, Embedded System – Architecture, Programming, Design, Tata McGraw Hill Education Private Limited, New Delhi, Third Edition, 2016.

2 John B.Peatman, Design With PIC microcontroller, Pearson Education, India, First Edition, 2009.

Reference Books :

1 Frank Vahid and Tony Givargi, Embedded System Design - A Unified Hardware & Software Introduction, John Wiley, New Jersey, Third Edition, 2011.

2 David E.Simon, An Embedded software primer, Pearson Education, India, First Edition, 2007.

3 Steve Heath, Embedded System Design, Elsevier, India, Second Edition, 2003.

4 Wayne wolf, Computers as components: Principles of embedded computing system design, Morgan Kaufmann publishers, USA, Third Edition, 2012.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20EE911 **Course name : EMBEDDED SYSTEM TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate the fundamentals of embedded systems	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO2	Outline the various types of embedded communication protocols	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO3	Explain the concept of software development process and tools.	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO4	Describe the functions of real time operating systems.	3	2	3	-	3	3	-	-	-	-	-	3	-	-
CO5	Discuss the applications of real time embedded systems	3	2	3	-	3	3	-	-	-	-	-	3	-	-
	Average	**3**	**2**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT901	**DATA SCIENCE USING R** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explain the life cycle of data science.	*Understand*
CO2:	Interpret the data manipulation statements and functional programming in R.	*Understand*
CO3:	Outline the packages to implement machine learning techniques.	*Understand*
CO4:	Explore the concepts of object-oriented programming in R.	*Understand*
CO5:	Discuss the data visualization packages in R.	*Understand*

UNIT – I DATA SCIENCE **[9]**

Data Science : Data Science Lifecycle – Dealing with Missing Values – Using R Packages – Expression – Data Types – Control Structures – Functions – Recursive Functions – Simple Programs.

UNIT – II DATA MANIPULATION AND FUNCTIONAL PROGRAMMING **[9]**

Data Manipulation – Data Import and Export – Manipulation Data – Vectoring Functions – Infix Operator – Replacement Functions – Function with arguments and return statement.

UNIT – III MACHINE LEARNING **[9]**

Dealing with large Dataset – Sampling – Supervised Learning Methods: Linear Regression – Logistic Regression – Evaluating and Validating Models – Decision Trees – Neural Network – Support Vector Machine – Unsupervised Learning – Clustering – Association Rule Mining.

UNIT – IV CLASS AND OBJECTS **[9]**

Immutable objects and Polymorphic functions – Data structures – Classes – Programming with New Classes – Inheritance and Inter-Class Relations – Virtual Classes – Creating and Validating Objects.

UNIT – V DATA VISUALIZATION AND PACKAGES **[9]**

Data Visualization**:** XY Plot – Graphics Package – ggplot2 – Package concept and tools – Creating R package – Namespace – R Oxygen – Adding data to Package – Documentation for Packages.

Total (L= 45, T = 0) = 45 Periods

Text Book:

1 Thomas Mailund, Beginning Data Science in R – Data Analysis, Visualization and Modeling for the Data Scientist, Apress Publication, New York, First Edition, 2017.

2 Hadley Wickham and Garrett Grolemund, R for Data Science, Import, Tidy, Transform, Visualize, and Model Data, O'Reilly, India, First Edition, 2017.

Reference Books :

1 Nicholas J. Horton, Ken Kleinman, Using R and R Studio for Data Management, Statistical Analysis, and Graphics, CRC Press, United States, Second Edition, 2015.

2 Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education, India, Third Edition, 2010.

3 K.G.Srinivasa, G M Siddesh, Chetan Shetty, Statistical Programming in R, Oxford University Press, New Delhi, First Edition , 2017.

4 John Maindonald, W. John Braun, Data Analysis and Graphics Using R: An Example-Based Approach, University Press, Cambridge, Third Edition, 2010.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT901 **Course name : DATA SCIENCE USING R**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the life cycle of data science.	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO2	Interpret the data manipulation statements and functional programming in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO3	Outline the packages to implement machine learning techniques	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO4	Explore the concepts of object-oriented programming in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
CO5	Discuss the data visualization packages in R	3	2	3	-	2	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	2	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT902	**PRINCIPLES OF CYBER SECURITY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basic concepts in cyber security and cybercrime.*	*Remember*
CO2:	*Explore about classification of cyber forensics.*	*Understand*
CO3:	*Summarize the latest trends in ethical hacking.*	*Understand*
CO4:	*Discuss the fundamentals of computer forensics and evidence collection.*	*Understand*
CO5:	*Describe the vulnerabilities in cyber security.*	*Remember*

UNIT – I CYBER CRIME **[9]**

Cyber Crime – Types of Cyber Crime – Classification of Cyber Criminals – Tools used in Cyber Crime – Challenges – Strategies – Crypto Currency – Bitcoin and Block chain – Ransomware.

UNIT – II CYBER FORENSICS **[9]**

Cyber Forensics: Definition – Disk Forensics – Network Forensics – Wireless Forensics – Database Forensics – Malware Forensics – Mobile Forensics – Email Forensics.

UNIT – III ETHICAL HACKING **[9]**

Ethical Hacking– Hacking Windows – Network Hacking – Web Hacking – Password Hacking – Malware – Scanning – Cracking.

UNIT – IV DIGITAL EVIDENCE IN CRIMINAL INVESTIGATIONS **[9]**

Digital Evidence in Criminal Investigations: The Analog and Digital World – Training and Education – Evidence Collection and Data Seizure: Collection Options Obstacles – Types of Evidence –Rules of Evidence –Volatile Evidence.

UNIT – V CYBER SECURITY VULNERABILITIES **[9]**

Vulnerabilities in software – System administration – Complex Network Architectures – Open Access to Organizational Data — Unprotected Broadband communications – Poor Cyber Security Awareness – Encryption Tool: KeePass.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 Dejey, Dr.Murugan, Cyber Forensics, Oxford University Press, India, First Edition, 2018.

2 William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Prentice Hall, United States, Third Edition, 2017.

Reference Books :

1 John W. Rittinghouse, William M. Hancock, Cyber Security Operations Handbook, Elsevier Publications , India ,First Edition,2008

2 Deborah G Johnson, Computer Ethics, Pearson Education Publication, India ,Fourth Edition , 2014

3 https://onlinecourses.swayam2.ac.in/cec20_cs15/preview

4 https://www.simplilearn.com/tutorials/cyber-security-tutorial/cyber-security-for-beginners

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT902 **Course name : PRINCIPLES OF CYBER SECURITY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the basic concepts in cyber security and cybercrime.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2	Explore about classification of cyber forensics.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3	Summarize the latest trends in ethical hacking.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4	Discuss the fundamentals of computer forensics and evidence collection.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5	Describe the vulnerabilities in cyber security.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	2	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT903	**FUNDAMENTALS OF BUSINESS INTELLIGENCE** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the nuances of extracting information from the various sources of digital data*	*Understand*
CO2:	*Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.*	*Understand*
CO3:	*Discuss the concept of data integration.*	*Remember*
CO4:	*Summarize the various methods of data integration.*	*Understand*
CO5:	*Describe the various process involved in the Enterprise Reporting.*	*Understand*

UNIT – I DIGITAL DATA [09]

Digital Data: Sources and Characteristics –Structured– Unstructured– Semi-Structured – Business Intelligence (BI) : Definition – BI Component Framework – BI Users – BI Applications – BI Tools.

UNIT – II OLTP AND OLAP [09]

OLTP: Advantages – Challenges – OLAP: Types of Data – OLAP Architectures: MOLAP – ROLAP – HOLAP – OLAP and OLTP – Data models for OLTP – Data models for OLAP.

UNIT – III DATA INTEGRATION [09]

Data Integration : Approaches and Advantages – Technologies – Data Quality – Data Profiling – Data Warehouse : Goals and Sources – Data Mart –Operational Data Store – Ralph Kimball's Approach– Data Mapping –Staging.

UNIT – IV MULTIDIMENSIONAL DATA MODELING [09]

Data Modeling: Entity and Attribute – Cardinality of Relationship – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension table – Dimensional Models –Dimensional Modeling Life Cycle.

UNIT – V ENTERPRISE REPORTING [09]

Enterprise Reporting: Reporting Perspectives– Report Standardization and Presentation Practices – Enterprise Reporting Characteristics in OLAP –Balanced Scorecards – Create Dashboards – Scorecards Vs Dashboards.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 R. N. Prasad, Seema Acharya, Fundamentals of Business Analytics, Wiley Publication Hoboken, New Jersey, Second Edition, 2016.

2 Regi Mathew, Business Analytics for Decision Making, Pearson Education, India, First Edition,2020.

Reference Books :

1 David Stephenson, Big Data Demystified, FT Publishing International, United States, First Edition, 2018.

2 Wayne Winston, Microsoft Excel 2019 Data Analytics and Business Modeling, Microsoft Press, United States, Sixth Edition, 2019.

3 Soheil Bakhshi, Expert Data Modelling with Power BI, Packt Publishing, Mumbai, First Edition, 2021.

4 https://nptel.ac.in/courses/110107092

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT903 **Course name : FUNDAMENTALS OF BUSINESS INTELLIGENCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the nuances of extracting information from the various sources of digital data	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2	Infer the techniques involved in Online Transaction Processing and Online Analytical processing systems.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Discuss the concept of data integration.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Summarize the various methods of data integration.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Describe the various process involved in the Enterprise Reporting.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT904	**BLOCK CHAIN TECHNOLOGIES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Infer the theoretical aspects of blockchain and apply in real casescenarios.*	*Understand*
CO2:	*Discuss the core components and working of blockchain.*	*Remember*
CO3:	*Explain the technical concepts of bit coin.*	*Understand*
CO4:	*Interpret the Ethereum blockchain for different use cases.*	*Understand*
CO5:	*Outline the end-to-end development of a decentralized application.*	*Understand*

UNIT – I BLOCKCHAIN ARCHITECTURE [9]

History –Blockchain –Centralized vs. Decentralized Systems–Layers of Blockchain–Versions of Blockchain: 3.0 and 4.0 – Blockchain Uses and Use Cases – Laying the Blockchain Foundation – Cryptography.

UNIT – II WORKING OF BLOCKCHAIN [9]

Game Theory –Prisoner's Dilemma –Byzantine Generals' Problem – The Blockchain – Merkle Trees – Properties of Blockchain Solutions – Blockchain Transactions – Distributed consensus mechanisms – Blockchain applications.

UNIT – III BITCOIN [9]

History of Money – Working with Bitcoins – Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full NodesvsSPVs – Bitcoin Wallets.

UNIT – IV ETHEREUM AND HYPERLEDGER [9]

Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution–Ethereum Ecosystem – Swarm – Whisper – DApp – Development components – Hyperledger: Iroha – Blockchain Explorer – Fabric Chain tool.

UNIT – V APPLICATIONS OF BLOCKCHAIN [9]

Decentralized Applications – Blockchain Application Development – Interacting with Bitcoin Blockchain – Sending Transactions–Creating a Smart Contract – Executing Smart Contract Functions – Public vs. Private Blockchains.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions, A Press, New York, First Edition, 2018.

2 Brenn Hill, Samanyu Chopra, Paul Valencourt, Blockchain Quick Reference: A guide to exploring decentralized blockchain application development, Packt Publishing, Mumbai, First Edition, 2018.

Reference Books :

1 Imran Bashir, Mastering Blockchain Distributed Ledgers, Decentralization and Smart Contracts Explained, Packt Publishing, Mumabi, First Edition, 2017.

2 Pethuru Raj, Chellammal Suria Narayanan, Kavita Saini, Blockchain Technology and Applications, CRC Press, United States, First Edition, 2021.

3 E. Golden Julie, J. Jesu VedhaNayahi, Noor Zaman Jhanjhi, Blockchain Technology Fundamentals, Applications, and Case Studies, CRC Press , United States, First Edition, 2021.

4 https://onlinecourses.nptel.ac.in/noc20_cs01/preview

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT904 **Course name : BLOCK CHAIN TECHNOLOGIES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Infer the theoretical aspects of blockchain and apply in real case scenarios.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2	Discuss the core components and working of blockchain.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Explain the technical concepts of bit coin.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Interpret the Ethereum blockchain for different use cases.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Outline the end-to-end development of a decentralized application.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-		-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT905	**INTERNET OF THINGS AND APPLICATIONS** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the physical and logical design of IoT.*	*Understand*
CO2:	*Summarize the various design methodologies of IoT.*	*Understand*
CO3:	*Outline the various packages in Python for IoT real world application.*	*Understand*
CO4:	*Discuss IoT applications using Raspberry PI and Python.*	*Remember*
CO5:	*Infer the knowledge on design of smart IoT applications.*	*Understand*

UNIT–I FUNCTIONAL BLOCKS OF IoT **[09]**

Definition and Characteristics of IoT – Physical Design: Layers and Protocols – Logical Design: IoT Functional Blocks – IoT Communication models and APIs – IoT Enabling Technologies –IoT Levels and Deployment Templates.

UNIT–II IoT DESIGN METHODOLOGY **[09]**

M2M – M2M Vs IoT – Software Defined Networks – Network function Virtualization – IoT Platform Design Methodologies – Domain Specific IoT.

UNIT – III PYTHON PACKAGES FOR IOT AND RASPBERRY PI **[09]**

JSON – XML – HTTPLib and URLLib – SMTPLib. Raspberry Pi: Pin Configurations – Interfaces: Serial, SPI, 12C Programming – Python program with Raspberry Pi –Controlling Output – Reading input from pins.

UNIT –IV IoT APPLICATIONS USING RASPBERRY PI **[09]**

LED Controlling – Traffic Light controller – Integrating Sensors – Developing web application to control IoT device – Uploading the sensor values onto the cloud for analysis – Sending SMS – Sending images and video via mail.

UNIT–V IoT USE CASES **[09]**

Smart and Connected Cities – An IoT Strategy for Smarter Cities – Architecture – Use Cases: Street Lighting – Smart Parking – Smart Traffic – Smart Home Automation – Smart Agriculture– Weather Monitoring.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 Arshdeep Bahga and Vijay Madisetti, Internet of Things –A Hands-on Approach, Orient Blackswan Private Limited, New Delhi, First Edition, 2015.

2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Pearson Education, First Edition, 2017.

Reference Books :

1 Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, New York, First Edition, 2013.

2 Rajkamal, Internet of Things: Architecture, Design Principles And Applications, McGraw Hill Education, New York, First Edition, 2017.

3 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key Applications and Protocols, Wiley, New York, 2015.

4 https://onlinecourses.nptel.ac.in/noc22_cs53/preview

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20IT905 **Course name : INTERNET OF THINGS AND APPLICATIONS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the physical and logical design of IoT.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2	Summarize the various design methodologies of IoT.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Outline the various packages in Python for IoT real world application.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Discuss IoT applications using Raspberry PI and Python.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Infer the knowledge on design of smart IoT applications.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT906	**PRINCIPLES OF SOFTWARE TESTING** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the strategies for software testing.*	*Understand*
CO2:	*Infer the need and conduct of testing levels.*	*Understand*
CO3:	*Discuss the various techniques used in testing.*	*Understand*
CO4:	*Interpret the various types of testing used in real world application.*	*Understand*
CO5:	*Explain the test case templates and reviews process.*	*Understand*

UNIT - I SOFTWARE TESTING **[9]**

Software Testing – Definition of Software Testing – Objective and limits of testing – Testing Strategy – Roles and Responsibilities of a Software Tester – Independent Verification and Validation.

UNIT - II SOFTWARE TESTING REQUIREMENTS **[9]**

Software Testing Requirements – Analyzing the requirements –Functional and Non-Functional Requirements. Software Testing Review Process – Types of Reviews: Peer Review – Walkthrough – Inspection – Checklists of Review Process.

UNIT - III WHITE AND BLACK BOX TESTING **[9]**

White Box Testing Techniques: Decision/Branch Coverage – Basic Path Testing – Control Flow Graph Coverage – Conditional Coverage. Black Box Test Techniques: Boundary Value Analysis – Equivalent Class Partition – Cause-Effect Analysis – State Transition Table.

UNIT - IV TESTING TECHNIQUES **[9]**

Functional Testing: Smoke Testing – Integration and System Testing User Acceptance Testing – Non-Functional Testing: – Performance Testing – Recovery Testing – Security Testing – Compatibility Testing – Usability Testing – Ad Hoc Testing.

UNIT - V TEST CASE DESIGN **[9]**

Test Case :Standards, Characteristics , Guidelines and Naming Conventions – Test Case Templates – Creation of Test Case – Requirement Coverage –Traceability Matrix – Test Case Review Process – Test Execution – Test Log – Reporting of Test Execution

Total (L= 45, T = 0) = 45 Periods

Text Books:

1. S.Subashni, N.Satheesh Kumar, Dr.B.G.Geetha, Dr.G.Singaravel, Software Testing, Umayam Publications, First Edition, 2013.
2. Srinivasan Desikan, Gopalaswamy Ramesh, and Software Testing: Principles and Practice, Pearson Education, India, Second Edition, 2017.

Reference Books :

1. Marnie L.Hutchson**,** Software Testing Fundamentals Methods and Metrics, Wiley, India, Second Edition, 2003.
2. Glenford J.Myess**,** The Art of Testing, Wiley, India, Third Edition, 2003.
3. https://onlinecourses.nptel.ac.in/noc22_cs12/preview
4. https://www.digimat.in/nptel/courses/video/106105150/L01.html

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT906 **Course name : PRINCIPLES OF SOFTWARE TESTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline the strategies for software testing.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2	Infer the need and conduct of testing levels.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Discuss the various techniques used in testing.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Interpret the various types of testing used in real world application.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Explain the test case templates and reviews process.	3	2	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	2	3	-	-	-	-	-		-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT907	**FOUNDATION SKILLS IN LOGIC BUILDING** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the various approaches in problem solving.*	*Understand*
CO2:	*Discuss the different algorithm design techniques.*	*Remember*
CO3:	*Demonstrate the various array based problem.*	*Understand*
CO4:	*Summarize the concept of sorting and searching.*	*Understand*
CO5:	*Outline the various methods to solve number based problem.*	*Understand*

UNIT – I PROBLEM SOLVING PROCESS [9]

Problem Solving Process –Approaches in Problem Solving: System Centric– Problem Centric– Solution Centric and Solver Centric Approach – Algorithm– Pseudocode – Flowchart– Important Problem Types.

UNIT – II ALGORTHMIC PROBLEM SOLVING [9]

Notion of the Algorithm – Algorithm Design and Analysis Process – Time and Space Complexity – Algorithm Design Techniques: Divide and Conquer – Dynamic Programming – Greedy Technique – Backtracking.

UNIT – III ARRAY BASED PROBLMES [9]

Array Order Reversal – Array Counting – Removal duplicates – Finding the kth smallest element – Swapping of elements – Subarray with given Sum – Find the longest consecutive subsequence.

UNIT – IV SORTING AND SEARCHING [9]

Searching: Linear Search – Binary Search. Sorting: Bubble Sort– Selection Sort– Insertion Sort – Merge Sort – Quicksort – Heap Sort.

UNIT – V NUMBER BASED PROBLEMS [9]

Swapping the values –Summation of Set of Number – Fibonacci Sequence and Factorial Computation – Integer Reversal – Euclid's algorithm – Prime Numbers Generation.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 R.G.Dromey, How to Solve it by Computer, Pearson Education, India, Fifth Edition, 2008.

2 ISRD GROUP, Programming and Problem Solving Using C Language, McGraw Hill Education, India , First Edition 2017.

Reference Books :

1 ITL Educational Solutions Limited, Introduction to Information Technology, Pearson Education, India, Second Edition, India, 2012.

2 G. Polya, How to Solve It : A New Aspect of Mathematical Method, Princeton University Press, New Jersey, Second Edition, 2008

3 Ellis Horowitz, Fundamentals of Programming languages, Galgotia Publications, New Delhi, Second Edition, 2012.

4 www.nptel.ac.in/courses/106104074

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT907 **Course name : FOUNDATION SKILLS IN LOGIC BUILDING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the various approaches in problem solving.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	Discuss the different algorithm design techniques.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Demonstrate the various array based problem.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Summarize the concept of sorting and searching.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Outline the various methods to solve number based problem.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20IT908	PRINCIPLES OF CLOUD COMPUTING	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the characteristics of cloud computing.*	*Understand*
CO2:	*Interpret the performance of cloud computing in various computing environment.*	*Understand*
CO3:	*Discuss the concept of cloud architecture.*	*Understand*
CO4:	*Infer the knowledge on cloud simulators.*	*Understand*
CO5:	*Outline the usage of simulators like VMWare simulator.*	*Understand*

UNIT – I CLOUD COMPUTING [9]

Origins of Cloud Computing – Cloud Components – Essential Characteristics –– Broad Network Access – Location Independent Resource Pooling – Rapid Elasticity – Measured Service – Roots of Cloud Computing.

UNIT – II CLOUD INSIGHTS [9]

Architectural Influences – High-Performance Computing – Utility and Enterprise Grid Computing – Cloud Scenarios – Benefits– Application Development – Security level of Third Party – Security Benefits – Regularity Issues.

UNIT – III CLOUD ARCHITECTURE [9]

Layers in Cloud Architecture – Software as a Service– Features of SaaS and benefits– Platform as a Services – Features of PaaS and benefits– Infrastructure as a Service– Features of IaaSand benefits– Cloud Service Providers – Challenges and risks in cloud adoption –Types of Cloud.

UNIT – IV CLOUD SIMULATORS [9]

CloudSim Simulator –Architecture– User code–CloudSim– GridSim– SimJava – Working platform for CloudSim– GreenCloud.

UNIT-V VMWARE SIMULATOR [9]

VMWare– Advantages of VMWare virtualization–VMWare workstation–Virtual Machines – Create a new virtual machine on local host – Cloning virtual machine – Recent Trends.

Total (L= 45, T = 0) = 45 Periods

Text Book:

1 Anthony T.Velte, Toby J. Velte Robert Elsenpeter, and Cloud computing: A Practical Approach, Tata McGraw- Hill, New Delhi, Second Edition, 2017.

2 Dan C Marinescu, Cloud Computing: Theory and Practice, MK Elsevier, Second Edition, United States, 2017.

Reference Books :

1 Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud computing for Dummies, Wiley, India, Second Edition,2020.

2 Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing: Principles and Paradigms, Wiley, India, First Edition, 2011.

3 https://onlinecourses.nptel.ac.in/noc22_cs20/preview

4 https://archive.nptel.ac.in/courses/106/105/106105167/

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT908 **Course name : PRINCIPLES OF CLOUD COMPUTING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the characteristics of cloud computing.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO2	Interpret the performance of cloud computing in various computing environment.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO3	Discuss the concept of cloud architecture.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO4	Infer the knowledge on cloud simulators.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
CO5	Outline the usage of simulators like VMWare simulator.	3	3	3	-	2	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	2	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT909	**OPEN SOURCE TECHNOLOGIES** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Outline the need and importance of Linux Open Source Software.*	*Understand*
CO2:	*Discuss the manipulations on Array and String using PHP.*	*Remember*
CO3:	*Summarize various functions in String and Date object*	*Understand*
CO4:	*Describe simple code segment using list and tuple in Python.*	*Understand*
CO5:	*Outline the usage of decision and looping statements in PERL.*	*Remember*

UNIT – I LINUX **[09]**

Open Sources: Need, Advantages and Applications – Open Source Operating Systems: LINUX – Kernel Mode and – Process – Scheduling – Personalities – Cloning and Signals.

UNIT – II PHP **[09]**

PHP: Syntax of PHP –Common PHP Script Elements –Variables and Constants – Data types – Operators and Statements –Arrays and Functions –String Manipulations– Regular Expression.

UNIT – III MySQL **[09]**

Setting up an account – Starting, Terminating and writing your own MySQL Programs – Record Selection Technology – Strings – Date and Time – Sorting Query Results module – DDL – DDL –DCL –TDL.

UNIT – IV PYTHON **[09]**

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Decision and Loops – Files – Input and Output Statements – Errors and Exceptions – Functions.

UNIT – V PERL **[09]**

Perl: Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines – Packages and Modules – Files and Data Manipulation.

Total (L= 45, T = 0) = 45 Periods

Text Book:

1 Martin C.Brown, Python: The Complete Reference, McGraw Hill Education, India, Fourth Edition, 2018.
2 Richard Petersen, The Complete Reference Linux, TataMcGraw Hill, New Delhi, Sixth Edition, 2017.

Reference Books :

1 Frank M. Kromann, Beginning PHP and MySQL, Apress, New York, Fifth Edition, 2018.
2 Martin C. Brown, Perl: The Complete Reference, Tata McGraw-Hill, New Delhi, Fifth, 2017.
3 Steven Holzner, PHP: The Complete Reference, Tata McGraw-Hill, New Delhi, Sixth Edition, 2017.
4 https://nptel.ac.in/courses/106106145

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT909 **Course name : OPEN SOURCE TECHNOLOGIES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Outline the need and importance of Linux Open Source Software.	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	Discuss the manipulations on Array and String using PHP.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Summarize various functions in String and Date object	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Describe simple code segment using list and tuple in Python.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Outline the usage of decision and looping statements in PERL.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20IT910	**PRINCIPLES OF SOFTWARE ENGINEERING** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the software engineering process and its various models*	*Understand*
CO2:	*Summarize how requirements may be organized in software requirements document*	*Understand*
CO3:	*Illustrate the architectural design decisions and apply real time systems.*	*Understand*
CO4:	*Outline the methods rely on documented specifications and Design.*	*Understand*
CO5:	*Discuss the process involved in verification and validation.*	*Understand*

UNIT - I SYSTEMS ENGINEERING **[9]**

Professional and Ethical Responsibility - Systems Engineering – Legacy Systems – Critical System – Software Process Models – Process Iteration – The Rational Unified Process – Project Planning – Project Scheduling.

UNIT - II REQUIREMENTS ANALYSIS **[9]**

Software Requirements: Functional and Non-Functional Requirements - User Requirements - System Requirements – Requirements Validation – Requirements Management – System Models: Context Models, Behavioral Models, Data Models, Object Models, Structured Methods– Risk-Driven Specification, Safety Specification.

UNIT - III ARCHITECTURAL DESIGN **[9]**

Architectural Design Decisions – System Organization – Multiprocessor Architectures – Client – Server Architectures – Data Processing Systems – Objects and Object Classes – Real–Time Operating Systems – Monitoring and Control Systems – User Interface Design : Issue, Process, Analysis.

UNIT - IV CRITICAL SYSTEMS **[9]**

Agile Methods – Rapid Application Development – Software Prototyping – Components and Component Models – Fault Tolerance – Fault-Tolerance Architectures – Software Maintenance – Evolution Processes – Legacy System Evolution .

UNIT - V VERIFICATION AND VALIDATION **[9]**

Planning Verification and Validation – Software Inspections – Verification and Formal Methods – Systems Testing – Component Testing – Test Case Design – Test Automation – Safety Assurance – Security Assessment.

Total (L= 45, T = 0) = 45 Periods

Text Books:

1 Lan Sommerville, Software Engineering, Pearson Education, India, Tenth Edition, 2017.

2 Roger Pressman, Software Engineering: A Practitioner's Approach, McGraw Publications , India , Seventh Edition ,2017

Reference Books :

1 Jalote P, An Integrated Approach to Software Engineering, Narosa Publishers, New Delhi, Third Edition, 2015.

2 Mark Richards and Neal Ford, Fundamentals of Software Architecture: An Engineering Approach, O'Relly, First Edition, 2020.

3 Rajib Mall, Fundamentals of Software Engineering, PHI Learning, India, Fifth Edition, 2018.

4 https://nptel.ac.in/courses/106105087

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20IT910 **Course name : PRINCIPLES OF SOFTWARE ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the software engineering process and its various models	3	2	3	-		-	-	-		-	-	3	-	-
CO2	Summarize how requirements may be organized in software requirements document	3	2	3	-		-	-	-		-	-	3	-	-
CO3	Illustrate the architectural design decisions and apply real time systems.	3	2	3	-		-	-	-		-	-	3	-	-
CO4	Outline the methods rely on documented specifications and Design.	3	2	3	-		-	-	-		-	-	3	-	-
CO5	Discuss the process involved in verification and validation.	3	2	3	-		-	-	-		-	-	3	-	-
	Average	3	2	3	-		-	-	-		-	-	3	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME901	**BASIC MECHANICAL ENGINEERING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explore the fundamental knowledge on basics of mechanical engineering*	*Understand*
CO2:	*Demonstrate the concepts of manufacturing technology.*	*Understand*
CO3:	*Describe the knowledge of power plants and pumps.*	*Understand*
CO4:	*Interpret the basic concepts of IC Engines.*	*Understand*
CO5:	*Analyze the Refrigeration and air conditioning systems*	*Analyze*

UNIT - I FUNDAMENTALS [09]

Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering, and manufacturing technology.

UNIT - II MANUFACTURING TECHNOLOGY [09]

Manufacturing, classification, lathe, drilling machines, milling machines, metal joining, metal forming, casting, forging, and introduction to powder metallurgy.

UNIT - III POWER PLANT ENGINEERING [09]

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT - IV I C ENGINES [09]

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

UNIT - V REFRIGERATION AND AIR CONDITIONING SYSTEM [09]

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air condition.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Shantha Kumar S R J., Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai, Second Edition, 2000.

2 Venugopal K and Prahu Raja V, Basic Mechanical Engineering, Anuradha Publishers, Kumbakonam, Fourth Edition 2000.

Reference Books :

1 Lecture notes prepared by Department of Mechanical Engineering, NITT, 2020.

2. R. K. Rajput, Manufacturing Processes, University Science Press, New Delhi, Fourth Edition, 2020.

3 Hajra Choudry, S. K., Elements of Work Shop Technology – Vol. I, Media Promoters, New Delhi, Fourth Edition, 2010.

4 Ramesh Babu, Basic civil and Mechanical Engineering, VRB Publishers, Chennai, Fourth Edition, 2017.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME901 **Course name : BASIC MECHANICAL ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the fundamental knowledge on basics of mechanical engineering	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Demonstrate the concepts of manufacturing technology	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	Describe the knowledge of power plants and pumps.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	Interpret the basic concepts of IC Engines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5	Analyze the Refrigeration and air conditioning systems	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME902	**SOLAR ENERGY UTILIZATION**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the measurement of solar radiation and their application to various systems.	Understand
CO2:	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	Apply
CO3:	Describe the concept of concentrating collectors and their application to a wide range of systems.	Apply
CO4:	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	Analyze
CO5:	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	Understand

UNIT - I INTRODUCTION TO SOLAR ENERGY [09]

Introduction - Sun-Earth relationships- solar constant- solar radiation at the earth surface- depletion of solar radiation- measurement of solar radiation- solar radiation data- solar time- solar radiation geometry- solar radiation on tilted surfaces-Sun as the source of energy sun angles - overview of applications.

UNIT - II NON CONCENTRATING COLLECTORS [09]

Types and classification of solar collectors - terminology related to flat plate collectors - evacuated collectors-Heat transfer processes and efficiency of a solar collector -solar drying- solar desalination- solar mechanical cooling- solar desiccant cooling- detailed study on heat pump – it needed.

UNIT - III CONCENTRATING COLLECTORS [09]

Tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats- comparison of various designs - central receiver systems - parabolic trough systems - solar performance analysis - solar power plant - solar furnace.

UNIT - IV SOLAR PHOTOVOLTAIC [09]

Fundamentals of solar cells- - types of solar cell- P-N junction photodiode- description and principle of working of a solar cell- cell structure- solar module and panel- I-V characteristics of a PV module- maximum power point- cell efficiency- fill factor- Manufacturing of solar cell.

UNIT - V SOLAR ENERGY STORAGE AND ECONOMIC ANALYSIS [09]

Storage of solar energy - thermal storage-sensible and latent heat storage-Economic Analysis: Initial and annual costs-definition of economic terms for a solar system- present worth calculation-repayment of loan in equal annual installments- annual savings- cumulative savings and life cycle savings- payback period- clean development mechanism -solar vehicle -BIPV(Building Integrated photo voltaic) - house hold appliances.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Garg H P and Prakash J, Solar Energy: Fundamentals & Applications, McGraw Hill, New Delhi, First Revised Edition 2014.

2 Duffie.J.A and Beckman W.A, Solar Engineering of Thermal processes, John Wiley And Sons, New York, Fourth Edition,2013 .

Reference Books :

1 Sukhatme. K and Sukhatme S.P., Solar Energy principles of thermal collection and storage, Tata McGraw Hill education, New Delhi, Third Edition,2008.

2 Rai G.D., Solar energy Utilization, Khanna Publishers, New Delhi, Fifth Edition, 2020.

3 Bhattachariya.T, Terrestrial Solar Photovoltaic, Narosa Publishers, New Delhi, Fourth Edition, 2008.

4 Sukhatme S.P., Solar Energy, Tata McGraw Hills P Co., Third Edition, 2008.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME902 **Course name : SOLAR ENERGY UTILIZATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Evaluate the measurement of solar radiation and their application to various systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Illustrate the principles of non-concentrating collectors and apply the principles in various real time applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	Describe the concept of concentrating collectors and their application to a wide range of systems.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	Analyze the various material characteristics of solar cell and determine maximum efficiency of solar cells.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5	Demonstrate the solar storage equipment and evaluate the economic analysis of various solar equipment.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME903	**PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Acquire various engineering materials, classifications, compositions and properties	Understand
CO2:	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	Understand
CO3:	Apply the manufacturing process in welding for component production.	Apply
CO4:	Demonstrate various advanced manufacturing process in engineering field.	Understand
CO5:	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	Understand

UNIT – I ENGINEERING MATERIALS [09]

Engineering materials - their classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

UNIT - II MACHINING [09]

Basic principles of lathe - machine and operations performed on it. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.

UNIT - III WELDING [09]

Introduction, classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

UNIT - IV ADVANCED MANUFACTURING PROCESS [09]

Abrasive flow machining - abrasive jet machining - water jet machining - Electro Discharge Machining (EDM) - Wire cut EDM - Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD) - Electron Beam Machining (EBM) - Laser Beam Machining (LBM).

UNIT - V CNC MACHINE [09]

Numerical control (NC) machine tools - CNC: types, constitutional details, special features – design considerations of CNC machines for improving machining accuracy - structural members – slide ways - linear bearings - ball screws - spindle drives and feed drives. Part programming fundamentals - manual programming.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Kalpakjian and Schmid, Manufacturing Engineering and Technology, Pearson, New Delhi, Eighth Edition, 2016.

2 Hajra Choudry, Elements of workshop technology - Vol II, Media promoters, New Delhi ,Fourth Edition,2018.

Reference Books :

1 Gupta. K.N., and Kaushik, J.P., Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi, Second Edition, 1998,

2 Arthur. D., et. al., General Engineering Workshop Practice, Asia Publishing House, Bombay, Third Edition, 2001.

3 Chapman W.A.J., Workshop Technology, Part I, II, III, E.L.B.S. and Edward Amold Publishers Ltd, London, First Edition, 1992.

4 Dr. P. Kamaraj, Dr. V. R. Ramachandran, Production Technology of Agricultural Machinery, Kerela, First Edition, 2020.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20ME903 **Course name : PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Acquire various engineering materials, classifications, compositions and properties	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Explore the concept and basic mechanics of metal cutting, working of standard machine tools and allied machines.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	Apply the manufacturing process in welding for component production.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	Demonstrate various advanced manufacturing process in engineering field.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5	Describe the basic concepts of Computer Numerical Control (CNC) machine tool and CNC programming.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME904	**SELECTION OF MATERIALS**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the classification and properties of engineering materials	Understand
CO2:	Acquire the knowledge on mechanical properties of various metal alloys.	Understand
CO3:	Identify different types of availability materials.	Analyze
CO4:	Examine required materials for engineering applications.	Analyze
CO5:	Select suitable material for various applications	Evaluate

UNIT - I ENGINEERING MATERIALS [09]

Introduction – classification of engineering materials – selection of materials for engineering purposes –selection of materials and shape –classification metal and alloys, polymers, ceramics and glasses, composites, natural materials,- non metallic materials- smart materials - physical, metrical properties of metals.

UNIT - II MATERIAL PROPERTIES [09]

Mechanical properties – fatigue strength – fracture Toughness - Thermal Properties - Magnetic Properties - Fabrication Properties –electrical , optical properties - Environmental Properties , Corrosion properties –shape and size - Material Cost and Availability– failure analysis.

UNIT - III MANUFACTURING PROCESSING AND ECONOMIC ANALYSIS [09]

Interaction of Materials Selection, Design, and Manufacturing Processes - Production Processes and Equipment for Metals - Metal Forming, Shaping, and Casting - Plastic Parts Processing - Composites Fabrication Processes - Advanced Ceramics Processing – surface treatment - Resource -The Price and Availability of Materials.

UNIT - IV MATERIALS SELECTION CHARTS AND TESTING [09]

Ashby material selection charts-Testing of Metallic Materials - Plastics Testing - Characterization and Identification of Plastics - Professional and Testing Organizations - Ceramics Testing - Nondestructive Inspection.

UNIT - V APPLICATIONS AND USES [09]

Selection of Materials for Biomedical Applications - Medical Products - Materials in Electronic Packaging - Advanced Materials in Sports Equipment - Materials Selection for Wear Resistance - Advanced Materials in Telecommunications - Using Composites - Manufacture and Assembly with Plastics, fiber and Diamond Films.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Ashby, M. F., Materials selection in mechanical design, Elsevier, New Delhi, Third Edition, 2005.
2 Ashby, M. F. and Johnson, K. Materials and design – the art and science of material selection in product design. Elsevier, New Delhi, First Edition, 2002.

Reference Books :

1 Charles, J. A., Crane, F. A. A. and Furness, J. A. G. ,Selection and use of engineering materials, Butterworth-Heinemann, New Delhi, Third Edition, 1997.
2 Handbook of Materials Selection. Edited by Myer Kutz John Wiley & Sons, Inc., New York, Second Edition, 2002.
3 Fisher P.E., Selection of Engineering Materials and Adhesives ,CRC Press, US, First Edition,2020
4 Joseph Datsko ,Materials Selection for Design and Manufacturing theory and practice, CRC Press, US, First edition,2020.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME904 **Course name : SELECTION OF MATERIALS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the classification and properties of engineering materials	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2	Acquire knowledge on mechanical properties of various metal alloys.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3	Identify different types of availability materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4	Examine required materials for engineering applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5	Select suitable material for various applications	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME905	**MARINE VEHICLES**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the various types of marine vehicles and its applications	Understand
CO2:	Acquire marine vehicle Safety, Operations and controls of bunkering.	Understand
CO3:	Demonstrate remotely operable vehicle design, construction and its components.	Apply
CO4:	Analyze submersible and autonomous under water vehicles.	Analyze
CO5:	Design and operational consideration of manned and un manned submersible.	Create

UNIT - I MARINE VEHICLES [09]

Types – general – by function – commercial marine vehicles- passenger ship, cargo ships, oil and chemical tankers, cattle carriers, harbor crafts, off shore platform, container ships.

UNIT - II REEFERS AND GAS CARRIERS [09]

.Introduction – Types, design considerations, safety – operation and controls, precaution during bunkering.

UNIT - III REMOTELY OPERABLE VEHICLE (ROV), UMS SHIPS [09]

Remotely Operable Vehicles (ROV) – The ROV business – Design theory and standards – control and simulation – design and stability – components of ROV – applications, UMS operation, and controls.

UNIT - IV SUBMERSIBLES AND AUTONOMOUS UNDERWATER VEHICLE (AUV) [09]

Submersibles types – applications, AUV – Design and construction considerations – components – sensors – Navigation -control strategies – applications.

UNIT - V MANNED AND UN MANNED SUBMERSIBLE [09]

Introduction – Design and operational consideration – pressure hull exo-structure – ballasting and trim – maneuvering and control – Life support and habitability – emergency devices and equipment's – certification and classification, towed vehicles – gliders – crawler – Design and construction.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Jonathan M. Ross, human factors for naval marine vehicle design and operation, CRC Press, US, Second Edition, 2001.
2 Sabiha A. Wadoo, Pushkin Kachroo, Autonomous underwater vehicles, modeling, control design and Simulation, CRC press, US, Second Edition, 2011.

Reference Books :

1 Ferial L hawry, The ocean engineering handbook, CRC press, US, First Edition, 2000.
2 Richard A Geyer, Submersibles and their use in oceanography and ocean engineering, Elsevier, New Delhi, First Edition, 1997.
3 Robert D. Christ, Robert L. Wernli, Sr., The ROV Manual A User Guide for Remotely Operated Vehicles, Elsevier, New Delhi, second edition, 2014.
4 Frank Busby. R, Manned Submersibles, Office of the oceanographer of the Navy, United states, First Edition, 1976.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME905 **Course name : MARINE VEHICLES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the various types of marine vehicles and its applications	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO2	Acquire Safety, Operations and controls of bunkering.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO3	Demonstrate remotely operable vehicle design, construction and its components.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO4	Analyze submersible and autonomous under water vehicles.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
CO5	Design and operational consideration of manned and un manned submersible.	3	3	3	-	-	2	-	-	1	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	1	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME906	**SENSORS AND TRANSDUCERS**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Explore the basic concepts of various sensors and transducers.	Understand
CO2:	Develop knowledge in mechanical and electromechanical sensor.	Apply
CO3:	Differentiate the types of thermal sensor which are used in various applications.	Apply
CO4:	Identify various types of magnetic sensors and working principles	Analyze
CO5:	Acquire suitable sensors and its applications.	Understand

UNIT - I INTRODUCTION [09]

Definition, classification, static and dynamic parameters, Characterization - Electrical, mechanical, thermal and chemical. Classification of errors - Error analysis, Static and dynamic characteristics of transducers.

UNIT - II MECHANICAL AND ELECTROMECHANICAL SENSORS [09]

Resistive Potentiometer - strain gauge - Inductive sensors and transducer - capacitive sensors – ultrasonic sensors.

UNIT - III THERMAL SENSOR [09]

Gas thermometric sensors - acoustic temperature sensors - magnetic thermometer, resistance change -type thermometric sensors.

UNIT - IV MAGNETIC SENSOR [09]

Force and displacement measurement - Magneto resistive sensors - Hall Effect sensor, Inductance andeddy current sensors - Angular/rotary movement transducer - Electromagnetic flow meter, squid sensor.

UNIT - V SENSORS AND THEIR APPLICATIONS [09]

Automobile sensor - Home appliance sensor - Aerospace sensors - sensors for manufacturing medicaldiagnostic sensors - environmental monitoring.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Ernest O Doebelin, Measurement Systems – Applications and Design, Tata McGraw-Hill, New Delhi, Fourth edition, 2016.

2 Sawney A K and PuneetSawney, A Course in Mechanical Measurements and Instrumentation and Control, DhanpatRai and Co, New Delhi, Fourteenth edition, 2016.

Reference Books :

1 Patranabis D, Sensors and Transducers, PHI, New Delhi, Sixth Edition, 2015.

2 Richard Zurawski, Industrial Communication Technology Handbook, CRC Press, US, Second edition, 2015.

E-Resources :

1 https://nptel.ac.in/courses/108/108/108108147/

2 https://www.youtube.com/watch?v=1uPTyjxZzyo

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME906 **Course name : SENSORS AND TRANSDUCERS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explore the basic concepts of various sensors and transducers.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2	Develop knowledge in mechanical and electromechanical sensor.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3	Differentiate the types of thermal sensor which are used in various applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4	Identify various types of magnetic sensors and working principles	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5	Acquire suitable sensors and its applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME907	**ENERGY AUDITING**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	Understand
CO2:	Identify the tools, techniques, management practices for the audit and management of electrical energy.	Understand
CO3:	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	Apply
CO4:	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	Understand
CO5:	Interpret the basic economic concepts of underlay energy production and end use.	Evaluate

UNIT - I INTRODUCTION [09]

Energy – Power – Past & Present scenario of world; National energy consumption data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of energy managers. Instruments for energy auditing.

UNIT - II ELECTRICAL SYSTEMS [09]

Components of EB billing – HT and LT supply, Transformers, Cable sizing, Concept of capacitors, Power factor improvement, Harmonics, Electric motors – Motors efficiency computation, Energy efficient motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED lighting and scope of economics in illumination – Auditing in electrical systems.

UNIT - III THERMAL SYSTEMS [09]

Stoichiometry, Boilers, Furnaces and Thermal fluid heaters – Efficiency computation and economic measures. Steam: Distribution & usage, Steam traps, Condensate recovery, Flash steam utilization, Insulators & Refractories – Auditing in thermal systems.

UNIT - IV ENERGY CONSERVATION IN MAJOR UTILITIES [09]

Pumps, Fans, Blowers, Compressed air systems, Refrigeration and Air Conditioning systems – Cooling towers – D.G. sets - Auditing and energy conservation.

UNIT - V ECONOMICS [09]

Energy economics – Discount rate, Payback period, Internal rate of return, Net present value, Life cycle costing – ESCO concept – Auditing and Economics.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Energy manager training manual (4 Volumes) available at www.energymanagertraining.com, a website administered by Bureau of energy efficiency (BEE), a statuary body under ministry of power, Government Of India, 2004.
2 Abbi, Y.B, Energy Audit, Open University, The Energy and Resources Institute, Government Of India, 2012.

Reference Books :

1 Witte. L.C., P. S. Schmidt, D.R. Brown, Industrial Energy Management and Utilization, Hemisphere Pub, Washington, First Edition, 1988.
2 Sonal Desai, Handbook of Energy Audit, Tata McGraw Hill, New Delhi, Second Edition, 2015.
3 Dryden. I.G.C., The Efficient Use Of Energy, Butterworth's, London, Fourth Edition, 2013.
4 Turner W.C., Energy Management Handbook, Wiley, New York, Eighth Edition, 2014.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME907 **Course name : ENERGY AUDITING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the energy crisis & environmental concerns associated with the energy management and the importance of energy auditing.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO2	Identify the tools and techniques, and the management practices for the audit and management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO3	Recognize the techniques of energy analysis and the associated energy efficient technologies for the routinely used thermal energy systems.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO4	State about the typical electrical energy powered utilities, services of industrial facilities & organizations and be able to identify the opportunities and options for the conservation & management of electrical energy.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
CO5	Interpret the basic economic concepts of underlay energy production and end use.	3	3	3	-	2	2	-	-	1	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**2**	2	-	-	1	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME908	**FIBRE REINFORCED PLASTICS**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Select various materials for designing composite structures.	Understand
CO2:	Apply knowledge of fracture mechanics of composites during designing of composite structures.	Apply
CO3:	Analyze critically damping capacity of composite materials.	Analyze
CO4:	Correlate various manufacturing/fabricating techniques for composite structures based on design.	Analyze
CO5:	Explore various composite applications.	Understand

UNIT - I INTRODUCTION [09]

Definition, Reason for composites, Classifications of composites, Thermosets - Epoxy; Unsaturated polyester resin; vinyl ester, polyimides etc.,-preparation, properties, and uses.

UNIT - II REINFORCEMENTS [09]

Types, Properties, chemistry and applications of fillers such as silica, titanium oxide, talc, mica etc., Manufacturing process, Properties, structure and uses of Glass fiber -.Carbon, Aramid, Boron, jute, sisal, cotton.

UNIT - III FABRICATIONS OF THERMOSET COMPOSITES [09]

Hand layup method, compression and transfer moulding, pressure and vacuum bag process, filament winding, protrusion, reinforced RIM, Injection moulding, of thermosets, SMC and DMC, Advantages and disadvantages of each method.

UNIT - IV TESTING OF COMPOSITES [09]

Destructive and non-destructive tests; Destructive-tensile, compression, flexural, impact strength, Hardness–Fatigue-toughness HDT, basic concepts of fracture mechanisms.

UNIT - V APPLICATIONS OF COMPOSITES [09]

Aerospace, land transport, marine, structural, chemical plants and corrosion resistant products and energy applications sports, electrical, electronic and communication applications.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Chawla, K.K, Composite Material s, Springer Science in progress, USA, Sixth Edition, 2019.
2 Balasubramaniam, Composite Materials, John Wiley & Sons, Indian Ed., New York, Fourth Edition, 2016.

Reference Books :

1 Sharma S.C., Composite materials, Narosa Publications, NewDelhi, Third Edition, 2015.
2 Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, Oxford University Press, UK, Second Edition, 2017.

E-RESOURCES

1 https://nptel.ac.in/courses/112/105/112105232/
2 https://nptel.ac.in/courses/112/107/112107142/

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME908 **Course name : FIBRE REINFORCED PLASTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Select various materials for designing composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO2	Apply knowledge of fracture mechanics of composites during designing of composite structures.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO3	Analyze critically damping capacity of composite materials.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO4	Correlate various manufacturing / fabricating techniques for composite structures based on design.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
CO5	Explore various composite applications.	3	3	3	-	-	1	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	1	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

		L	T	P	C
20ME909	**LEAN MANUFACTURING**	3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Demonstrate the lean manufacturing principles to find and eliminate wastes.	Understand
CO2:	Identify the lean manufacturing tools and their potential applications.	Understand
CO3:	Summarize the usage of visual management, TPM and lean practices.	Apply
CO4:	Acquire the technology drivers of lean manufacturing.	Understand
CO5:	Describe technology drivers of lean manufacturing.	Analyze

UNIT - I LEAN MANUFACTURING PRINCIPLES [09]

Lean manufacturing paradigms - lean manufacturing - origin - Toyota Production System - types of wastes -tools and techniques to eliminate wastes - value stream mapping (VSM) - primary icons - secondary icons - developing the VSM.

UNIT - II LEAN MANUFACTURING TOOLS [09]

5S concepts - stages of 5S and waste elimination - Kaizen - steps of Kaizen - lean manufacturing through Kaizen – Single Minute Exchange of Die - theory of SMED - design for SMED - strategic SMED and waste elimination - pull production through Kanban - one piece flow production.

UNIT - III VISUAL MANAGEMENT, TPM AND LEAN IMPLEMENTATION [09]

Visual management - tools for eliminating wastes - overproduction, inventory, delay, transportation, processing, unnecessary motion, defective parts, underutilization of people - implementation - total productive maintenance - implementation of lean practices.

UNIT - IV MANAGEMENT AND TECHNOLOGY DRIVERS OF LEAN MANUFACTURING [09]

Lean manufacturing - twenty criteria model - management driver - organizational structure - devolution of authority - employee status and involvement - nature of management - business and technical processes - time management - agility through technology driver.

UNIT - V MANUFACTURING STRATEGY AND COMPETITIVE DRIVERS OF LEAN MANUFACTURING [09]

Quick manufacturing setups - quick response - product life cycle management - product service elimination - automation - competitive driver - status of quality and productivity - compatible cost accounting system.

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Devadasan.S.R, Mohan Sivakumar.V, Murugesh.R and Shalij.P.R, Lean Manufacturing: Theoretical, Practical and Research Futurities, PHI Learning Private Limited, New Delhi, Second Edition, 2012.

2 Pascal Dennis, Lean Production Simplified, Productivity Press, New York, Third Edition, 2007.

Reference Books :

1 Bill Carreira, Lean Manufacturing That Works, PHI Learning Private Limited, New Delhi, Third Edition, 2016.

2 Dennis P. Hobbs, LEAN Manufacturing Implementation, Cengage Learning, New Delhi, Fifth Edition, 2015.

E-RESOURCES

1 https://nptel.ac.in/courses/112/104/112104188/ - (Lean Manufacturing System Technology)

2 https://freevideolectures.com/course/4162/nptel - (Toyota Production system)

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME909 **Course name : LEAN MANUFACTURING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate the lean manufacturing principles to find and eliminate wastes.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO2	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO3	Summarize the usage of visual management, TPM and lean practices.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	Acquire the technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
CO5	Describe technology drivers of lean manufacturing.	3	3	3	-	-	2	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	2	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

OPEN ELECTIVE

20ME910	**SURFACE ENGINEERING**	L	T	P	C
		3	0	0	3

Prerequisite:

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Demonstrate the various factors influencing wear in materials	Understand
CO2:	Identify wear resistance techniques in engineering materials	Apply
CO3:	Acquire various surface treatment methods for alloy metals	Understand
CO4:	Describe various surface treatment techniques and its applications	Analyze
CO5:	*Explore the corrosion behaviour of engineering materials*	Understand

UNIT - I WEAR **[09]**

Introduction tribology, surface degradation, wear and corrosion, types of wear, roles of friction and lubrication- overview of different forms of corrosion, introduction to surface engineering, importance of substrate

UNIT - II COATING **[09]**

Chemical and electrochemical polishing, significance, specific examples, chemical conversion coatings, phosphating, chromating, chemical colouring, anodizing of aluminium alloys, thermochemical processes -industrial practices

UNIT - III SURFACE TREATMENT **[09]**

Surface pre-treatment, deposition of copper, zinc, nickel and chromium - principles and practices, alloy plating, electrocomposite plating, electroless plating of copper, nickel-phosphorous, nickel-boron; electroless composite plating; application areas, properties, test standards (ASTM) for assessment of quality deposits

UNIT - IV SURFACE TREATMENT TECHNIQUES **[09]**

Definitions and concepts, physical vapour deposition (PVD), evaporation, sputtering, ion plating, plasma nitriding, process capabilities, chemical vapour deposition (CVD), metal organic CVD, plasma assisted CVD, specific industrial applications

UNIT - V SPRAYING **[09]**

Thermal spraying, techniques, advanced spraying techniques - plasma surfacing, D-Gun and high velocity oxy-fuel processes, laser surface alloying and cladding, specific industrial applications, tests for assessment of wear and corrosion behaviour

Total (L= 45, T = 0) = 45 Periods

Text Books :

1 Stachowiak, G.W &Batchelor A.W, Engineering Tribology, Butterworth-Heinemann, UK, First Edition, 2005.

2 Rabinowicz.E, Friction and Wear of materials, John Willey &Sona, New York, Second Edition, 1995.

Reference Books :

1 Sudarshan T S, Surface modification technologies - An Engineer's guide, Marcel Dekker, New york, First Edition, 1989.

2 Varghese C.D, Electroplating and Other Surface Treatments - A Practical Guide, TMH, New Delhi, First Edition, 1993.

3 Williama. J.A, Engineering Tribology, Oxboarduniv. Press, UK, Second Edition, 1994.

4 Basu S.K,.Sengupta S.N &Ahuja B.P, Fundamentals of Tribology, Prentice-Hall of India Pvt. Ltd, New Delhi, Second Edition,2005.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20ME910 **Course name : SURFACE ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate the lean manufacturing principles to find and eliminate wastes.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Identify the lean manufacturing tools and their potential applications.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Acquire various surface treatment methods for alloy metals	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Describe various surface treatment techniques and its applications	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Explore the corrosion behaviour of engineering materials	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	**-**	-	-	-	-	-	-	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF901	**OCCUPATIONAL HEALTH AND HYGIENE (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Compare the concept and spectrum of health functional units and activities of occupational health service.*	*Understand*
CO2:	*Identify physical chemical and biological hazards in the work environment and its control measures.*	*Apply*
CO3:	*Explain the principles of ventilation and its requirements.*	*Understand*
CO4:	*Demonstrate about the lighting and its requirements.*	*Understand*
CO5:	*Reduce the gas poisoning and its effects.*	*Apply*

UNIT - I **OCCUPATIONAL HEALTH** **[09]**

Concept and spectrum of health - functional units and activities of occupational health services - occupational and work-related disease - Levels of prevention of diseases - notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax.

UNIT - II **VIBRATION** **[09]**

Recognition, evaluation and control of physical hazards. Vibration - Description and measurement of vibration. Vibration control methods. Effects of whole-body vibration on human body and control measures - Noise - noise measurement, evaluation, noise control methods - hearing loss - causes - Biological effects of noise exposure.

UNIT - III **VENTILATION** **[09]**

Ventilation systems - Purpose of ventilation - General principles ventilation requirements. Physiological and comfort level. Natural ventilation - Dilution ventilation - Mechanical ventilation - Local exhaust ventilation - Ventilation measuring instruments. Fundamentals of hood and duct designs. Standards on ventilation.

UNIT - IV **LIGHTING** **[09]**

Purpose of lighting - Advantages of good illumination - Lighting and the work - Sources and kinds of artificial lighting principles of good illumination. Design of Lighting installation - Maintenance - Lighting and Color Standards on lighting and illuminations.

UNIT - V **GAS POISONING** **[09]**

Lead - Nickel, Chromium and Manganese toxicity - Gas poisoning (such as CO, ammonia, coal and dust) their effects and prevention - Local and systemic and chronic effects - Carcinogens, Mutagens, Teratogens. Personal monitoring devices - Medical support.

Total = 45 Periods

Text Books:

1. Jeanne Mager Stellman(ed) Encyclopedia of Occupational Health and Safety, International Labour Office, Geneva, Fourth Edition, 1998.
2. The Industrial Environment -Its Evaluation and Control, DHHS (NIOSH), 1973.

Reference Books:

1. Barbara Cohrssen, Patty´sIndustrial Hygiene and Toxicology, Wiley, Inderscience, New York. Seventh Edition, 2021.
2. Yudenich, V.V., Accident First Aid, Mir Publishers, Moscow, 1986.
3. Cantlie, James, First aid to the injured. St John Ambulance Association, 1932.
4. S.K. Halder, Industrial and Occupational Health, Kindle Edition, 2017.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20SF901 **Course name : OCCUPATIONAL HEALTH AND HYGIENE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Compare the concept and spectrum of health functional units and activities of occupational health service.	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO2	Identify physical chemical and biological hazards in the work environment and its control measures.	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO3	Explain the principles of ventilation and its requirements.	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO4	Demonstrate about the lighting and its requirements.	3	2	2	-	-	3	2	2	-	-	-	2	-	-
CO5	Reduce the gas poisoning and its effects.	3	2	2	-	-	3	2	2	-	-	-	2	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF902	**CONSTRUCTION SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*List out Hazards from various Construction equipment and activities.*	*Remember*
CO2:	*Mention various Control measures adopted in each Construction activity to avoid Incidents.*	*Apply*
CO3:	*Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.*	*Understand*
CO4:	*Compare various components of cranes, safety features and its function.*	*Understand*
CO5:	*Choose the minimum requirements of BOCW act to the Construction site when they work.*	*Apply*

UNIT - I INTRODUCTION [09]

Safety aspects of construction planning- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry.

UNIT - II SAFETY IN VARIOUS CONSTRUCTION OPERATIONS [09]

Excavation- underwater works- Ladders & Scaffolds - Tunneling- Blasting- Demolition- Pneumatic caissons- Confined Space- Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.

UNIT - III SAFETY IN MATERIAL HANDLING EQUIPMENTS [09]

Storage & stacking of construction materials, Safety in the use of construction equipment's - Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Temporary power supply, Mixers, Conveyors, Pneumatic and hydraulic tools in construction.

UNIT - IV CONTRACT CONDITIONS ON SAFETY [09]

Health, Welfare, Social Security and Insurance. Application of ergonomics for construction safety.

UNIT - V CONTRACT LABOUR ACT AND CENTRAL RULES [09]

Buildings and other Construction Workers (RE & CS) Act and Central Rules. Provisions regarding Licensing, safety, health, welfare and social security aspects only.

Total = 45 Periods

Text Books:

1. National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
2. Building & Other Construction Workers (RE &CS) Actand Central Rules, 1966.

Reference Books:

1. V.J. Davies & K. Tomasin, Construction Safety Handbook, Thomas Telford Publishing, London. 1990.
2. K.N. Vaid (Ed.), Construction Safety Management, National Institute of Construction Management and Research, Bombay, 1988.
3. James B. Full man, Construction Safety, Security & Loss Prevention, John Wiley & Sons. 1984.
4. R.T. Ratay, Handbook of Temporary Structures in Construction, Mc Graw-Hill, 1984.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF902 **Course name : CONSTRUCTION SAFETY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	List out Hazards from various Construction equipment and activities.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO2	Mention various Control measures adopted in each Construction activity to avoid Incidents.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO3	Demonstrate the safe use of various types of ladders, Hand held power tools, Hydraulic tools used in Construction industry.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO4	Compare various components of cranes, safety features and its function.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
CO5	Choose the minimum requirements of BOCW act to the Construction site when they work.	3	2	3	-	2	-	3	-	1	-	-	2	-	-
	Average	**3**	**2**	**3**	**-**	**2**	**-**	**3**	**-**	**1**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF903	**BUILDING FIRE SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.*	*Understand*
CO2:	*Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.*	*Understand*
CO3:	*Illustrate the fire and life safety requirements for buildings of specific occupancy.*	*Understand*
CO4:	*Choose and distribute portable and fixed fire fighting systems in buildings of different occupancies as per BIS.*	*Apply*
CO5:	*Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.*	*Apply*

UNIT - I BASIC BUILDING PLANNING AND DESIGN [09]

Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people; Stages of evacuation; Planning and design of evacuation routes and exits; planning of seating arrangements in large assembly buildings.

UNIT - II NBC CODES FOR BUILDINGS [09]

Classification of buildings based on occupancy and type of construction according to fire resistance as per NBC; Fire zone; General fire safety requirements applicable to all individual occupancies. General exit requirements as per NBC; Internal staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders; Planning of location and calculation of capacity, number and width of exit as per NBC for different occupancy classification.

UNIT - III FIRE PREVENTION AND BIS STANDARD [09]

Fire and life safety requirements in different groups of buildings-Hotel, Schools & Colleges, Hospitals, Theatres, shopping malls, etc., Fire protection and prevention in high rise buildings - Fire protection in underground structures and in buildings under construction. Sitting of detectors as per relevant Indian standard specifications; Selection and planning of alarm system as per relevant standards (BIS).

UNIT - IV FIRE PREVENTION AND BIS STANDARD [09]

Selection and distribution of portable extinguishers (for class A and B fires) and other fire protection equipment and systems for different occupancy classification as per NBC; Planning of fixed fire fighting installation for different occupancy classification-sprinkler system; total flooding system; CO2 system; foam system; Fire Investigation; Detection of arson; Fire training and education - fire drill, fire order; Fire safety audits; Fire risk assessment.

UNIT - V FIRE SAFETY AND CODES [09]

Causes of fire in buildings. Stages of fire and how it spreads. Fire drill. Heat / fire / smoke detection. Alarm and extinguisher systems. Fire safety standards. General guidelines for egress design for multi-storey buildings. Understanding all the above through product literature/ field visits. Exercise on design of fire safety systems for different building types through choice, calculations, layout and drawings.

Total = 45 Periods

Text Books:

1. Butcher, E.G. and Parnell, A.C., Designing of fire safety. John Wiley and Sons Ltd., New York, U.S.A, 1983.
2. Roytman, M. Ya., Principles of Fire Safety Standards for Building Construction, Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975.

Reference Books:

1. Barendra Mohan Sen, Fire Protection and Prevention the Essential Handbook, UBS Publishers and Dist., New Delhi, 2013.
2. Jain, V.K., Fire Safety in Buildings, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
3. Huang, Kai, Population and Building Factors That Impact Residential Fire Rates in Large U.S. Cities, Applied Research Project, Texas State University.
4. Life Safety Code Handbook, National Fire Protection Association, Lathrop, James K.Ed. NFPA, 1991.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF903 **Course name : BUILDING FIRE SAFETY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the human behaviour under emergency movement and the concept of planning and design of seating arrangements in assembly buildings, evacuation routes and exits.	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO2	Outline the general life safety requirements applicable to all buildings and to plan, design and locate exits in buildings.	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO3	Illustrate the fire and life safety requirements for buildings of specific occupancy.	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO4	Choose and distribute portable and fixed fire fighting systems in buildings of different occupancies as per BIS.	3	3	3	-	-	-	2	-	-	1	-	2	-	-
CO5	Develop the method of carrying out fire investigation, arson identification, fire training, fire safety audit and fire risk assessment.	3	3	3	-	-	-	2	-	-	1	-	2	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF904	**SAFETY IN ELECTRICAL ENGINEERING (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the working principles and applications of various kinds of Electrical Machines and/or systems.*	*Understand*
CO2:	*Choose & brief the hazards associated with electricity at work place.*	*Apply*
CO3:	*Recall human safety aspects over electric and magnetic fields.*	*Remember*
CO4:	*Compare various protective equipment and enumerate their working and application.*	*Understand*
CO5:	*Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.*	*Apply*

UNIT - I **INTRODUCTIONTO ELECTRICAL EQUIPMENTS** **[09]**

Transformers, DC Machines, Alternators, Induction Machines- Characteristics, application Protection Relays: Requirements of relay- types of protection, Classification: Distance Relay, Differential Relay, Static Relay- Definitions and types.

UNIT - II **CIRCUIT BREAKERS** **[09]**

Function switch gear, Arc Phenomenon- Initialization of an Arc, Arc interruption, Recovery voltage, and Restriking voltage classification and working, Working of MCB and ELCB. Faults in Power System: Causes and types, Fuses: Definition, types of fuses, selection of fuses, advantages and disadvantages.

UNIT - III **EFFECT OF ELECTRIC FIELD AND MAGNETIC FIELD** **[09]**

Human Safety Aspects, Effect of Current and Voltage on Human being- distance from the source, Typical V-I characteristics of skin - Nervous System, Electrical Shocks and their prevention, Insulation: Classes of Insulation, FRLS insulation, Continuity test.

UNIT - IV **SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT** **[09]**

Safe sequences in installation -Risk during installation, Safety during testing and commissioning- steps, Test on relays- Protection and interlock system on safety.

UNIT - V **HAZARDOUS ZONES** **[09]**

Classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus, Selection of equipment in hazardous area. Electrical Fires: Hazards of static electricity, Safety procedures in electrical maintenance, Statutory requirements from Electrical Inspectorate. Introduction to Indian Electricity Act and Rules.

Total = 45 Periods

Text Books:

1. S. Rao, Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers, New Delhi, Third Edition, 2019.
2. John Cadick, Electrical Safety Hand book, John Cadick, TMH Publishers, Sixth Edition, 2019.

Reference Books:

1. Charles A Gross, Fundamentals of Electrical Engineering, Taylor and Francis Group, 2012.
2. H. Wayne Beaty, Handbook for Electrical Engineers, Mc GrawHill, Fifteenth Edition, 2007.
3. Donald G Fink, Standard Handbook for Electrical Engineers, Mc GrawHill, Twelth Edition, 1987.
4. Donald G Fink, Electrical Engineering, Mc Graw Hill, Fifteenth Edition, 1907.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF904 **Course name : SAFETY IN ELECTRICAL ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the working principles and applications of various kinds of Electrical Machines and/or systems.	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO2	Choose & brief the hazards associated with electricity at work place.	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO3	Recall human safety aspects over electric and magnetic fields.	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO4	Compare various protective equipment and enumerate their working and application.	3	1	2	-	-	2	1	-	-	-	-	-	-	-
CO5	Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment.	3	1	2	-	-	2	1	-	-	-	-	-	-	-
	Average	**3**	**1**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF905	**LEGAL ASPECTS OF SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe about the factories act and rules.*	*Understand*
CO2:	*Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.*	*Understand*
CO3:	*Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.*	*Understand*
CO4:	*Explain the Environment (Protection) act and Rules.*	*Understand*
CO5:	*Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories.*	*Apply*

UNIT - I FACTORIES ACT **[09]**

Factories Act- Definitions, Preliminary, inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions - Definitions, Powers of inspectors, Power of Govt. to direct inquiry. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.

UNIT - II WORKMEN'S COMPENSATION ACT **[09]**

Workmen's Compensation Act: Definitions, Employer´s liability for compensation, Calculation of amount of compensation. ESI Act and Rules: Applicability, Definitions and Benefits. Public Liability Insurance Act and Rules- Definitions, Calculation of amount of relief, Environmental Relief Fund, Advisory Committee, Powers of District Collector, Extent of Liability, Contribution to Relief Fund.

UNIT - III EXPLOSIVES ACT **[09]**

Explosives Act: Definitions, Categories of Explosives, General Safety Provisions, and Use of Explosives, Grant of license, Notice of Accidents, Inquiry into ordinary and more serious accidents. Extension of definition to other explosive substances. Explosives Rules, SMPV Rules and Gas Cylinder Rules (in brief). Petroleum Act with important rules - definitions, safety in the import, transport, storage, license, exemption, notice of accidents.

UNIT - IV ENVIRONMENT (PROTECTION) ACT **[09]**

Water Act and Air Act: Definitions, powers and functions of Boards, prevention and control of pollution, consent administration. Environment (Protection) Act and Rules-Definitions, powers of central government, power of giving directions, authorities. MSIHC Rules- Definitions, Duties of Authorities, Notification of major accidents, Safety Reports, Safety Audit, On- site & Off-site Emergency plans.

UNIT - V POWER TO MAKE RULES **[09]**

Powers and Functions of Central, State and Joint Boards, Provisions regarding prevention and control of water pollution, Penalties, Central & State Water Laboratories, Power to make rules, Power of supersession and overriding effect. Rules on Consent for Establishment.

Total = 45 Periods

Text Books:

1. S.K.T. Narayanan, Safety, Health and Environment Handbook Hardcover, McGraw Hill Education (India) Private limited, First Edition, 2017.
2. Gayle Wood Side and Dianna Koeurek, Environmental Safety and Health Engineering, John Wiley & Sons, 1997.

Reference Books:

1. Ganguly & Changeriya, Health Safety and Environment, 2016.
2. Explosives Act and Related Rules & The Gas Cylinder Rules, Professional Book Publishers, 2004.
3. James B. Well, Environmental Management Handbook for Hydrocarbon Processing Industries, Factories Act, 1948.
4. Petroleum Act and Rules & The Petroleum Act, Universal Law Publishing, 1934.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF905 **Course name : LEGAL ASPECTS OF SAFETY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe about the factories act and rules.	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO2	Illustrate the legal obligations regarding any injury by gaining knowledge of Workmen's Compensation Act. ESI Act & Rules.	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO3	Outline about the legal aspects granting of license for storage, transportation and usage of explosive substance as applicable as per Petroleum Act and Explosive Act.	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO4	Explain the Environment (Protection) act and Rules.	3	-	3	-	-	3	3	2	-	-	-	2	-	-
CO5	Choose the concept, powers and functions of Central, State and Joint Boards, provisions regarding prevention and control of Water & Air pollution, Penalties, Central & State Laboratories.	3	-	3	-	-	3	3	2	-	-	-	2	-	-
	Average	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF906	**SAFETY IN INDUSTRIES (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.*	*Understand*
CO2:	*Apply the concepts of safety in design of building fire safety.*	*Apply*
CO3:	*Develop the safety in industrial operations.*	*Apply*
CO4:	*Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.*	*Remember*
CO5:	*Illustrate on safety in finishing, inspection and testing of machines.*	*Understand*

UNIT - I FOUNDRY OPERATIONS SAFETY **[09]**

Foundry Operations - Furnace - health hazard - safe methods of operation. Forging operations heat radiation - maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills. Shearing -bending - rolling - drawing - turning - boring - milling - planning - grinding. Selection and care of tools - health hazards and prevention.

UNIT - II BUILDING FIRE SAFETY **[09]**

Building Fire Safety Objectives of fire safe building design, Fire load, fire resistant material and fire testing - structural fire protection - structural integrity - concept of exit design -exists width calculations -fire certificates - fire safety requirements for high rise buildings - snookers.

UNIT - III PERSONNEL RISK IN INDUSTRIAL OPERATIONS **[09]**

Storages and Transportation General consideration, petroleum product storages, storage tanks and vessel-storages layout segregation, separating distance, secondary containment - venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief - fire prevention and protection - LPG storages -underground storages-loading and unloading facilities-drum and cylinder storage ware house, storage hazard assessment of LPG and LNG Hazards during transportation – pipeline transport.

UNIT - IV WORKSHOP PROCESS SAFETY **[09]**

Workshop Safety Hand tools and Power tools - Safety while using Grinding stone - Welding and gas cutting safety - Identification of Dangerous points - Lubrication Safety-Safety in Cold Forming and Hot Working of Metals.

UNIT - V SAFETY INSPECTION AND AUDIT **[09]**

Safety Inspections Safety Audit- Safety Survey - Plant safety inspection - Safety tour – Safety samplings - What is safety budget - Direct cost - indirect cost- Safety Equipment's & their budget preparation.

Total = 45 Periods

Text Books:

1. Elahi Naseer, Industrial Safety Management, Kalpaz Publication, 2006.
2. Dr. Shailednrakumar U Kale, Dr. Umesh Gramopadhye, Industrial Safety Management.

Reference Books:

1. Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process Safety, Third Edition, and AICHE 2008.
2. Guidelines for Chemical Process Quantitative Risk Analysis, Centre for Chemical Process Safety, Second Edition, AICHE, 2000.
3. Methodologies for Risk and Safety Assessment in Chemical Process Industries, Common Wealth Science Council, UK.
4. Trevor A Klett, Hazop and Hazon, Institute of Chemical Engineering.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF906 **Course name : SAFETY IN INDUSTRIES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the General safety rules, principles, maintenance, Inspections in Foundry Operations.	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO2	Apply the concepts of safety in design of building fire safety.	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO3	Develop the safety in industrial operations.	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO4	Recall about welding, common hazards in welding, personal protective equipment and safety precautions in welding.	2	3	-	-	-	3	3	2	-	-	-	2	-	-
CO5	Illustrate on safety in finishing, inspection and testing of machines.	2	3	-	-	-	3	3	2	-	-	-	2	-	-
	Average	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF907	**FOOD SAFETY (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Apply the knowledge on food quality in food industry.*	*Apply*
CO2:	*Identify the food additives and food contaminants and their chemical and toxicological properties.*	*Apply*
CO3:	*Summarize the effects of pests on food and the various methods for controlling them.*	*Understand*
CO4:	*Explain about the national and international regulations for biosafety.*	*Understand*
CO5:	*Demonstrate an ability to recognize the environmental, social and ethical implications of Biotech applications.*	*Understand*

UNIT - I FOOD QUALITY **[09]**

Objective and importance of quality control, classification of quality attributes and its role in food quality, quality assessment of food materials (fruits, cereals, milk and meat), types of quality characteristics of food, methods used for determination of the quality in food industry, factors influencing the quality of food, sample and sampling methods of quality evaluation.

UNIT - II FOOD SANITATION **[09]**

Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods and pest control, sanitation and safety in foodservices.

UNIT - III FOOD SAFETY **[09]**

Principles of food safety and quality, quality assurance, Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Veterinary Practice (GVP), Applications of HACCP in food safety, Current challenges to food safety.

UNIT - IV FOOD LAWS AND REGULATIONS **[09]**

Basic concepts of food standards, Role of national regulatory agencies: Food safety and Standards Act: salient provision and prospects, FSSAI, PFA, certification- AGMARK, ISI (BIS). Role of international regulatory agencies: USDA, FDA, BRC, WHO, FAO, Codex Alimentarius commission, WTO agreements: SPS and TBT agreements, ISO and its standards for food quality and safety.

UNIT - V FOOD SAFETY AUDITING **[09]**

Food surveillance: International and national practices, procedure and protocols, food alerts, traceability and food product recall. Export and import of food in India: introduction, import and export policies, FDA import policy, export-import policy, export control systems. Import intelligence and alert systems, packaging and labelling, specifications and certifications.

Total = 45 Periods

Text Books:

1. Fleming & Hunt, Biological Safety, Principles and Practices, ASM Press, Fourth Edition, 2006.
2. Fawatt, H.H. and Wood, W.S., Safety and Accident Prevention in Chemical Operation, Wiley Interscience, 1965.

Reference Books:

1. N.G. Marriott, G.W. Schilling and B. Robert, Principles of Food Sanitation, Springer, Fifth Edition 2018.
2. I. Alli, Food Quality Assurance - Principles & Practices, CRC Press, India, 2018.
3. Cynthia A. Robert, The Food Safety Information Hand Book, 2009.
4. Early, Guide to Quality Management Systems for the Food Industry, Springer, First Edition, 2005.

CO PO MAPPING

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20SF907 **Course name : FOOD SAFETY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply the knowledge on food quality in food industry.	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO2	Identify the food additives and food contaminants and their chemical and toxicological properties.	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO3	Summarize the effects of pests on food and the various methods for controlling them.	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO4	Explain about the national and international regulations for biosafety.	3	3	3	-	-	3	3	3	-	-	-	3	-	-
CO5	Demonstrate an ability to recognize the environmental, social and ethical implications of biotech applications.	3	3	3	-	-	3	3	3	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF908	**SAFETY MANAGEMENT AND ITS PRINCIPLES (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Demonstrate the knowledge and understanding of basic terms in safety management.*	*Understand*
CO2:	*Compare safety organizational requirements for effective safety management.*	*Understand*
CO3:	*Solve the workplace hazards and apply controls measures using hierarchy of control.*	*Apply*
CO4:	*Develop the safety performance of an organization.*	*Apply*
CO5:	*Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.*	*Understand*

UNIT - I INTRODUCTION OF SAFETY [09]

Safety – Goals of safety engineering – Need for safety, Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents, History of safety movement – Theories of accident causation.

UNIT - II SAFETY ORGANIZATION [09]

Objectives, Types, Functions, Role of management, Supervisors, Workmen, Unions, Government and voluntary agencies in safety – Safety policy – Safety Officer – Responsibilities – Safety committee – Need, Types, Advantages.

UNIT - III ACCIDENT PREVENTION AND TRAINING [09]

Accident Prevention Methods – Engineering, Education and Enforcement, Safety Education & Training – Importance, Various training methods, Effectiveness of training, Behavior Oriented Training – Communication – Purpose, Barrier to communication. Housekeeping: Responsibility of management and employees – Advantages of good housekeeping – 5 ‘s of housekeeping – Work permit system – objectives, hot work and cold work permits. Typical industrial models and methodology – Entry into confined spaces.

UNIT - IV MONITORING SAFETY PERFORMANCE [09]

Frequency rate, Severity rate, Incidence rate, Activity rate – Cost of accidents – Computation of Costs – Utility of Cost data – Plant safety inspection types, Inspection procedure – Safety sampling techniques – Job safety Analysis (JSA), Safety surveys, Safety audits – Safety Inventory Technique.

UNIT - V INVESTIGATION ON ACCIDENTS [09]

Why? When? Where? Who? & How? Basics – Man – Environment & Systems. Process of Investigation – Tools – Data Collection - Handling witnesses - Case study. Accident analysis – Analytical Techniques – System Safety – Change Analysis.

Total = 45 Periods

Text Books:

1. N.V. Krishnan, Safety Management in Industry, Jaico Publishing House, 1997.
2. Ronald P. Blake, Industrial Safety, Prentice Hall, New Delhi, 1973.

Reference Books:

1. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall, Fifth Edition, 2007.
2. Ted S. Ferry, Modern Accident Investigation and Analysis, John Wiley & Sons, Second Edition, 2007.
3. John V. Grimaldi and Rollin H. Simonds, Safety Management, American Society of Safety Engineers, Fifth Edition, 1993.
4. Accident Prevention Manual for Industrial Operations, National Safety Council, Chicago, 1982.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF908 **Course name : SAFETY MANAGEMENT AND ITS PRINCIPLES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Demonstrate the knowledge and understanding of basic terms in safety management.	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO2	Compare safety organizational requirements for effective safety management.	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO3	Solve the workplace hazards and apply controls measures using hierarchy of control.	3	2	2	-	-	3	3	2	2	-	-	1	-	-
CO4	Develop the safety performance of an organization.	3	3	2	-	-	3	3	2	2	-	-	1	-	-
CO5	Explain accident investigation methodologies and apply systematic procedure to identify and unearth the root cause of the incident and accident.	3	3	2	-	-	3	3	2	2	-	-	1	-	-
	Average	**3**	**2**	**2**	**-**	**-**	**3**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF909	**SAFETY IN AUTOMOBILE ENGINEERING (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explain about automobile engines, fuel systems and CMV rules for proto type testing and emission standards.*	*Understand*
CO2	*Demonstrate the electrical systems-ignition, lighting, horn, wipers, HVAC and concerned CMV rules*	*Understand*
CO3	*Classify the transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.*	*Understand*
CO4	*Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.*	*Understand*
CO5	*Choose passive and active safety.*	*Apply*

UNIT - I INTRODUCTION AND EMISSION [09]

Types of automobiles. Limiting Dimensions as per Central Motor Vehicles Rules. Engines - Classification, Construction, Materials of engine components. Prototype Testing as per Central Motor Vehicles Rules. Fuel System - Fuel tank, Fuel filter, Types of Fuel system. Carburettor – Simple and Modern, Fuel injection System. Emission Standards as per CMV Rules.

UNIT - II ELECTRICITY STORAGE AND ITS UTILLIZATION [09]

Electrical System - Storage Battery Operations and Maintenance. Ignition System - Coil and Magneto Ignition System. Starting System, Lighting System, Horn System-Wind Shield Wiper Motors, Fans, Heaters, Trafficators. Automobile air conditioning. Central Motor Vehicles Rules regarding Lighting, Windshields, Wipers.

UNIT - III TRANSMISSION SYSTEM AND BRAKING SYSTEM [09]

Transmission System - Clutches - operation and fault finding of clutches, Fluid Flywheel, Gear Box types, Steering Systems, Chassis Springs, and Suspension. Differential, Dead and Live axles, Rims, Tyre etc. Brakes - Types, construction and fault finding. CMV Rules-Brakes, Steering & Tyre.

UNIT - IV LUBRICATION AND COOLING SYSTEM [09]

Lubrication Systems-Types, Components, Lubricating oil, Cooling system- Details of components, Study of Systems, Types. Miscellaneous - Special gadgets and accessories for fire fighting vehicles. Automobile accidents. CMV Rules regarding Safety devices for drivers, passengers.

UNIT - V PASSIVE AND ACTIVE SAFETY [09]

Design of body for safety, deceleration of vehicle, passenger. Concept of crumble zone, Safety Cage. Optimum crash pulse. Barrier test - Crash tests - Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System. ADAS, DAT.

Total = 45 Periods

Text Books:

1. Robert Bosch GmbH, Safety, Comfort and Convenience Systems, Wiley, Third Edition, 2007.
2. Ljubo Vlacic, Michel Parent, Fumio Harashima, Intelligent Vehicle Technologies Theory and Applications, Butterworth Heinemann, 2001.

Reference Books:

1. GBS Narang, Automobile Engineering, Khanna Publishers, Delhi, 2014.
2. Kirpal Singh, Automobile Engineering, Vol.I &II. Standard publishes, Delhi, Thirteenth Edition, 2012.
3. Joseph Heitner, Automotive Mechanics-Principles & Practices, CBS Publisher-Delhi, Second Edition, 2006.
4. P. L. Kohli, Automotive Electrical Equipment's, McGraw Hill, New Delhi, 1993.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF909 **Course name : SAFETY IN AUTOMOBILE ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain about automobile engines, fuel systems and CMV rules for proto type testing and emission standards.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO2	Demonstrate the electrical systems - ignition, lighting, horn, wipers, HVAC and concerned CMV rules.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO3	Classify the transmission systems - clutch, gearbox, steering, and differential. Chassis - springs, axles and brakes and corresponding CMV rules.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO4	Outline the lubricating systems, cooling systems and miscellaneous systems. CMV rules for safety devices.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
CO5	Choose passive and active safety.	3	3	2	-	-	3	3	3	-	-	-	2	-	-
		3	**3**	**2**	**-**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SF910	**SAFETY IN TRANSPORTATION (Open Elective)**	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes: On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Explain the Working of railways and safety aspects in railway operation*	*Understand*
CO2	*Apply the Basic geometric design features of roads*	*Apply*
CO3	*Summarize about traffic studies and traffic safety*	*Understand*
CO4	*Outline the basic layout and facilities of docks and harbour*	*Understand*
CO5	*Choose the Working of airways and safety aspects in airway operation*	*Remember*

UNIT - I RAILWAY ENGINEERING [09]

Introduction of Railway Engineering: Permanent way. Curves, super-elevation, negative super elevation, transition curve, grade compensation on curves. Railway operation and control - points and crossings turn-out. Signalling and interlocking. Centralized traffic control. Railway accidents & safety. Rapid transit railways - types, merits & demerits.

UNIT - II HIGHWAY ENGINEERING [09]

Introduction of Highway Engineering: Classification of highways and urban road patterns. Typical cross section of roads. Factors controlling the alignment of roads. Basic geometric design - stopping and overtaking sight distances.

UNIT - III TRAFFFIC ENGINEERING [09]

Introduction of Traffic Engineering: Traffic characteristics. Various traffic studies and their applications. Traffic signals. Carriage-way markings. Traffic islands. Highway intersections. Principles of highway lighting. Road Accidents prevention, investigation and reduction.

UNIT - IV HARBOUR AND DOCK ENGINEERING [09]

Introduction of Harbour & Dock Engineering: Water transportation, classification of harbours, accessibility and size, ports, Indian ports. Layout of ports, breakwater, facilities (in brief) for docking, repair, approach, loading and unloading, storing and guiding.

UNIT - V AIR TRANSPORTATIONENGINEERING [09]

Classification of air transportation, Types of air craft engines - Propellants-feeding systems – Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity-Applications – spaceflights. Air way accidents & safety.

Text Books:

1. B.S. Dhillon, Transportation Systems, Reliability and Safety, CRC Press, 2011.
2. John Khisty C, Kent Lall B, Transportation Engineering - An Introduction, Prentice Hall of India, New Delhi, Third Edition 2002.

Reference Books:

1. Srinivasan, R., Harbour, Dock and Tunnel Engineering, Charotar Publishing House Pvt. Ltd, Anand, 2013.
2. Chandra, S. & Agarwal, M. M. Railway Engineering, Oxford University Press, New Delhi, 2007.
3. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2004.
4. Khanna, S. K. and Justo, C.E.G., Highway Engineering, Nem Chand & Brothers, New Delhi, Ninth Edition,2001.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SF910 **Course name : SAFETY IN TRANSPORTATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the Working of railways and safety aspects in railway operation	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO2	Apply the Basic geometric design features of roads	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO3	Summarize about traffic studies and traffic safety	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO4	Outline the basic layout and facilities of docks and harbour	3	3	3	-	-	2	-	2	-	-	-	3	-	-
CO5	Choose the Working of airways and safety aspects in airway operation	3	3	3	-	-	2	-	2	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20SH901	**APPLICATIONS OF STATISTICS** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1:	*Analyze the measures of central tendency and dispersion.*	*Analyze*
CO2:	*Applying the concepts of Correlation and Regression analysis*	*Apply*
CO3:	*Testing the samples using method of hypothesis to obtain inferences.*	*Remember*
CO4:	*Develop their skills in Design of Experiments.*	*Remember*
CO5:	*Solving Non Parametric data to obtain inferences.*	*Understand*

UNIT– I DESCRIPTIVE STATISTICS [09]

Introduction to Statistics, Measures of Central Tendency - Mean, Median, Mode, Weighted Mean, Geometric Mean, Harmonic Mean, and Measures of Variability- Range, Inter-Quartile Range, Variance, Standard Deviation, and Coefficient of Variation.

UNIT – II CORRELATION AND REGRESSION ANLYSIS [09]

Types of Correlation-Karl Pearson's Coefficient of Correlation- Spearman's Rank Correlation-Regression Analysis-Uses-Regression equations-X on Y and Y on X Estimation.

UNIT – III TESTING OF HYPOTHESIS [09]

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t - F distributions for testing means and variances-Chi-Square Test.

UNIT – IV DESIGN OF EXPERIMENTS [09]

Analysis of variance - One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.

UNIT – V NON PARAMETRIC TESTS [09]

The Sign Test- Rank Sum Test- Mann-Whitney U Test, One Sample run Test-Spearman's Rank Correlation and Kruskal-Wallis Test (H-test).

Total (L: 45 T:0) = 45 Periods

Text Books :

1 Gupta. S.P., Statistical Methods , Sultan Chand & Sons Educational Publishers, New Delhi, Thirty first Edition, 2002.

2 Ross, S.M., Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, Third Edition, 2004.

Reference Books :

1 Srivatsava TN and Shailaja Rego, Statistics for Management, Tata McGraw Hill, Fifth Edition, 2008.

2 Walpole. R.E., Myers. R.H., and Ye. K., Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, Eighth Edition, 2007.

3 Richard I. Levin, David S. Rubin, Statistics for Management, Pearson Education, Seventh Edition, 2011.

4 Pillai R.S.N and Bagavathi.V, Statistics, S.Chand Publishers, New Delhi, Seventeenth Reprint Edition 2008.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SH901 **Course name : APPLICATIONS OF STATISTICS**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Analyze the measures of central tendency and dispersion.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Applying the concepts of Correlation and Regression analysis	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Testing the samples using method of hypothesis to obtain inferences.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Develop their skills in Design of Experiments	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Solving Non Parametric data to obtain inferences.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	3	3	3	**3**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SH902	**COMBINATORICS AND GRAPH THEORY** (Open Elective)	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the cours

Course Outcomes : On Completion of this course, the student will be able to		**Cognitive Level**
CO1	*Interpret the concept of combinatorics Principles in Computer applications.*	*Understand*
CO2	*Acquire knowledge in Recurrences and Generating Functions.*	*Evaluate*
CO3	*Applying the concepts of graph theory*	*Apply*
CO4	*Constructing algorithm using Trees..*	*Remember*
CO5	*Developing Skills in Colouring and Directed Graphs.*	*Analyze*

UNIT– I COMBINATORICS [09]

The pigeon-hole principle - Basic counting problems- The binomial coefficients (the binomial theorem, algebraic vs. combinatorial proof, Pascal's identity, Pascal's triangle, Catalan numbers) - the principle of inclusion and exclusion.

UNIT – II RECURRENCES [09]

Fibonacci numbers - The substitution method- Linear recurrences (mostly homogenous recurrences, the characteristic polyr Generating functions.

UNIT – III INTRODUCTION TO GRAPH THEORY [09]

. Definition - examples – subgraphs – complements and graph isomorphism – Euler trail and circuits – planar graphs – Hamilton paths and cycles.

UNIT – IV TREES [09]

Definition – rooted trees – trees and sorting – weighted trees and prefix codes – bi connected components and Articulation points.

UNIT – V MATRICES, COLOURING AND DIRECTED GRAPH [09]

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem – Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs.

Total (L: 45 T:0) = 45 Periods

Text Books :

1. Grimaldi, R.P. Discrete and Combinatorial Mathematics: An Applied Introduction, Fourth Edition, Pearson Education Asia, Delhi, 2007.
2. Narsingh Deo, Graph Theory With Application to Engineering and Computer Science, Prentice Hall of India, Second Edition, 2003.

Reference Books :

1. Douglas B. West, Introduction to Graph Theory, Prentice-Hall of India, Second Edition, 2012.
2. John Clark, Derek Allan Holton, A first look at Graph Theory, World Scientific Publishing Company Ilustrated edition, Reprint, 1991
3. Rosen, K.H., Discrete Mathematics and its Applications, Seventh Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
4. Diestel, R, Graph Theory, Springer, Third Edition,2006

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K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SH902 **Course name : COMBINATORICS AND GRAPH THEORY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Interpret the concept of combinatorics Principles in Computer applications.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Acquire knowledge in Recurrences and Generating Functions.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Applying the concepts of graph theory	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Constructing algorithm using Trees.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Developing Skills in Colouring and Directed Graphs.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	3	3	3	**3**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20SH903	**OPTIMIZATION TECHNIQUES** (Open Elective)	3	0	0	3

Prerequisite: No prerequisites are needed for enrolling into the course.

Course Outcomes : On successful completion of the course , the student will be able to		**Cognitive Level**
CO1:	*Enable to develop the decision making during the uncertain situations by linear programming approach.*	*Apply*
CO2:	*Identify to minimize the Transportation and Assignment cost and maximize the profit in Industries.*	*Analyze*
CO3:	*Developing the network techniques in project scheduling.*	*Apply*
CO4:	*Study the importance of stock controlling to maximize the profit.*	*Remember*
CO5:	*Understand and apply the Replacement and sequencing methods in manufacturing engineering.*	*Understand*

UNIT - I LINEAR PROGRAMMING PROBLEM [09]

Introduction - scope and role of OR - phases of OR - limitations of OR - linear programming problem - formulation of linear programming problem - optimum solution by graphical method - simplex method (using slack variables only).

UNIT - II TRANSPORTATION AND ASSIGNMENT PROBLEM [09]

Transportation Models (Minimizing and Maximizing Cases) - Balanced and unbalanced cases - Initial Basic feasible solution by North West Corner Rule, Least cost and Vogel's approximation methods. Check for optimality by Modified method.

Assignment Models (Minimizing and Maximizing Cases) - Balanced and Unbalanced Cases - Solution by Hungarian method.

UNIT - III NETWORK MODELS [09]

Network - Fulkerson's rule - construction of a network - critical path method (CPM) - optimistic, pessimistic and most likely time estimates - project scheduling by PERT analysis.

UNIT - IV INVENTORY MODEL [09]

Types of Inventory - Deterministic inventory models - EOQ and EBQ models with and without shortages - Quantity discount model - Price breaks - probabilistic inventory model.

UNIT - V REPLACEMENT MODELS AND SEQUENCING [09]

Replacement of items that deteriorate with time - value of money changing with time - not changing with time - optimum replacement policy - individual and group replacement. Sequencing problem - assumptions - processing of 'n' jobs in 2 machines, 'n' jobs with 'm' machines.

Total (L: 45 T: 0) = 45 Periods

Text Books :

1 P.K. Gupta and Man Mohan, Problems in Operations Research, S. Chand and Co, New Delhi ,Fourteenth Edition, 2016.

2 Wayne. L. Winston, Operations Research applications and algorithms, Thomson learning, New Delhi, Tenth Edition, 2016.

Reference Books :

1 Hira and Gupta, Problems in Operations Research, S. Chand and Co, New Delhi, Eighth Edition, 2015.

2 Taha H.A, Operation Research, Pearson Education, New Delhi, Sixth Edition, 2016.

3 J k Sharma , Operation Research, Macmillan India Pvt. Ltd., New Delhi, Seventh Edition,2007

4 R.Panneerselvam Operations Research, PHI Learning, Second Edition, 2011.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SH903 **Course name : OPTIMIZATION TECHNIQUES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Enable to develop the decision making during the uncertain situations by linear programming approach.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO2	Identify to minimize the Transportation and Assignment cost and maximize the profit in industries.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Developing the network techniques in project scheduling.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	Study the importance of stock controlling to maximize the profit.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	Understand and apply the Replacement and sequencing methods in manufacturing engineering.	3	3	3	3	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

	BASIC MILITARY EDUCATION AND TRAINING	L	T	P	C
20SH904	(Open Elective)	3	0	0	3

Prerequisite: **Only NCC Cadets are eligible for opting into the course.**

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1:	*Develop the character, camaraderie of NCC cadets*	*Apply*
CO2:	*Inculcate the discipline and secular outlook.*	*Apply*
CO3:	*Educate weapon handling and training.*	*Understand*
CO4:	*Leam the quality of selfless service among the cadets by working as a team.*	*Remember*
CO5:	*Learn the basis of military management.*	*Understand*

UNIT – I NCC ORGANIZATION & NATIONAL INTEGRATION [9]

NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

UNIT – II BASIC PHYSICAL TRAINING & DRILL [9]

Basic physical Training – various exercises for fitness (with Demonstration). Food – Hygiene and Cleanliness.

Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION)

UNIT – III WEAPON TRAINING [9]

Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing(WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun.

UNIT – IV SOCIAL AWARENESS AND COMMUNITY DEVELOPMENT [9]

Aims of Social service-Various Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY-Terrorism and counter terrorism- Corruption – female feticide -dowry –child abuse-RTI Act-RTE Act- Protection of children from sexual offences act- civic sense and responsibility

UNIT – V SPECIALIZED SUBJECT (ARMY) [9]

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defense forces- Service tests and interviews-Field craft and Battle craft-Basics of Map reading including practical.

Total = 45 Periods

Text Books :

1 National Cadet Corps- A Concise handbook of NCC Cadets by Ramesh Publishing House, New Delhi, 2014.

Reference Books :

1 *Cadets Handbook – Common Subjects SD/SW published by DG NCC, New Delhi.*

2 *Cadets Handbook- Specialized Subjects SD/SW published by DG NCC, New Delhi*

3 *NCC OTA Precise published by DG NCC, New Delhi.*

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SH904 **Course name : BASIC MILITARY EDUCATION AND TRAINING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO2	Demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders	3	1	1	1	3	3	3	3	3	3	-	-	-	-
CO3	Basic knowledge of weapons and their use and handling.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO4	Understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils	3	2	1	1	3	3	3	3	3	3	-	-	-	-
CO5	Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.	3	2	1	1	3	3	3	3	3	3	-	-	-	-
	Average	3	2	1	1	3	3	3	3	3	3	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **2020**

		L	T	P	C
20SH905	**PROFESSIONAL COMMUNICATION (Open Elective)**	**1**	**0**	**2**	**3**

Prerequisite:

Course Outcomes : On Successful Completion of the Course, the student will be able to		**Cognitive Level**
CO1:	*Organize and compose resume' and SWOT analysis.*	*Understand*
CO2:	*Prioritize the skills for interviews and job hunt.*	*Understand*
CO3:	*Interpret by Listening and reading a text and comprehend it.*	*Understand*
CO4:	*Identify the purpose of writing short messages and presentation.*	*Understand*
CO5:	Optimize the speaking skills to do well in Group Discussion.	*Understand*

UNIT – I SWOT Analysis and Resume' Writing [09]

SWOT Analysis – Key SWOT Questions- Assessment of strength and weakness – Mind map and Activity – Job Application and Resume' – Types of Resume' – Common mistakes in Resume' writing – Cover Letter (Email).

UNIT – II Interview Skills [09]

Types of Interviews – Telephone Interview (HR and Technical) – Dos and Don'ts in telephone Interview – Video Interviews – Practice for successful interviews – Video Samples.

UNIT - III Listening and Reading [09]

Listening – Listening and typing – Listening and sequencing of sentences – Filling in the blanks – Listening and answering questions.

Reading – Filling in the blanks – Cloze exercise – Vocabulary building – Reading and answering questions.

UNIT - IV Writing Short Messages and Presentation Skills [09]

Writing Memos – Email writing - Business Email – Elements of effective presentation – Structure of presentation – Audience analysis – Body Language.

UNIT - V Group Discussion and Essay Writing [09]

Introduction to Group Discussion – Structure of GD – Brainstorming the topic – Body Language – Mock GD – Five steps to writing an essay – writing short essays.

Total = 45 Periods

Text Books :

1 Ravindran, Padma, English for Work, Ebek Language Laboratories Private Limited, Trichy, First Edition, 2011

2 Kalpana V, Communication Skills Laboratory Manual, Vijay Nicole Imprints Private Limited, Chennai, First Edition,2013

Reference Books :

1 Norman Whitby, Business Benchmark: Pre-Intermediate to Intermediate –BEC Preliminary, Cambridge University Press, New Delhi, First Edition, 2008.

2 Meenakshi Raman and Sangeeta Sharma, Technical Communication English for Engineers, Oxford University Press, New Delhi, 2008.

3 Rizvi Ashraf M, Effective Technical Communication, Mc GrawHill, New Delhi, 28th Reprint, 2015.

4 Department of English, English for Technologies and Engineers, Orient Black Swan, Hyderabad, First Edition, 2016.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SH905 **Course name : PROFESSIONAL COMMUNICATION**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Organize and compose resume' and SWOT analysis.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO2	Prioritize the skills for interviews and job hunt.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO3	Interpret by Listening and reading a text and comprehend it.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO4	Identify the purpose of writing short messages and presentation.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
CO5	Optimize the speaking skills to do well in Group Discussion.	-	-	-	-	-	-	-	-	3	3	-	2	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

	FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY	L	T	P	C
20SH906	(Open Elective)	3	0	0	3

Prerequisite: NIL

Course Outcomes: On Completion of this course , the student will be able to		***Cognitive level***
CO1;	*Learn the basics of nanotechnology in physics, chemistry and biology*	*Remember*
CO2:	*Recognize the methods of preparation of nanomaterials*	*Analyze*
CO3:	*Relate the characterization techniques for confirming nanomaterials*	*Apply*
CO4:	*Categorize the nanomaterials and its preparation*	*Analyze*
CO5:	*Identify the area of application and its field*	*Understand*

UNIT – I INTRODUCTION [9]

Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thin films multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.

UNIT – II GENERAL METHODS OF PREPARATION [9]

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapor phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT – III NANOMATERIALS [9]

Nanoforms of Carbon – Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-properties. Applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nano alumina, CaO, AgTiO2, Ferrites, Nano clays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT – IV CHARACTERIZATION TECHNIQUES [9]

X-ray diffraction technique, Scanning Electron Microscopy – experimental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, STM, ESCA-Nanoindentation.

UNIT – V APPLICATIONS [9]

Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products – In Photostat, printing, solar cell, battery.

Total = 45 Periods

Text Books :

1 John Dinardo. N, Nanoscale characterization of surfaces & Interfaces. Second edition, Weinheim Cambridge, Wiley-VCH, 2000

2 Introduction to Nanoscience and Nanotechnology by Chattopadhyay K.K 1 January 2013

Reference Books :

1 Timp .G, Nanotechnology, AIP press/Springer, 1999.

2 AkhleshLakhtakia (Editor), The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

3 NANO: The Essentials: Understanding Nanoscience and Nanotechnology by T. Pradeep

4 An Introduction To Nanomaterials And Nanoscience (Pb 2020) by DAS A

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20SH906 **Course name : FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Learn the basics of nanotechnology in physics, chemistry and biology	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO2	Recognize the methods of preparation of nanomaterials	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO3	Relate the characterization techniques for confirming nanomaterials	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO4	Categorize the nanomaterials and its preparation	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO5	Identify the area of application and its field	3	3	-	-	2	-	-	1	-	2	-	2	-	-
	Average	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**2**	**-**	**2**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20AU901	**BASICS OF AUTOMOBILE ENGINEERING** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Provide basic platform knowledge of automobile engineering*	*Understand*
CO2:	*Explain the working principal of petrol and diesel engines*	*Understand*
CO3:	*Interpret the method of power transmission unit*	*Understand*
CO4:	*Built knowledge of steering and brake*	*Understand*
CO5:	*Illustrate the knowledge of automotive electrical systems and functioning*	*Understand*

UNIT - I INTRODUCTION [09]

Automobile - Components of an automobile - Classification of automobiles - Layout of chassis - Types of drives front wheel - rear wheel - four wheel.

UNIT - II IC ENGINES [09]

Classification - ignition system - firing order - Otto/ Diesel cycles - Two stroke and four stroke engines – scavenging - Cooling and Lubrication systems - Fuel Supply system – air fuel ratio - Carburettor – types.

UNIT - III TRANSMISSION SYSTEM [09]

Clutch - Function - single plate - multi plate - friction clutches - Centrifugal and semi centrifugal clutch - Gear Box –slide mesh - constant mesh and synchromesh gear box - Torque convertor – overdrive - Propeller shaft and rear axle- Universal joint – Differential - Rear axle drives - Wheels and Tyres.

UNIT - IV STEERING AND BRAKE [09]

Steering system - function and principle - Ackerman and Davis steering principles - wheel alignment –steering gear boxes. Brakes - Mechanical - hydraulic and vacuum brake - master cylinder - wheel cylinder -Bleeding of brakes.

UNIT - V ELECTRICAL SYSTEMS [09]

Battery – types - Dynamo and Alternator – Cut-out relay - Diagram of Wiring system - Lighting System and Accessories - Headlight - switches - Windscreen Wipers – Horn – Speedometer – Heater and Air conditioning.

Total = 45 Periods

Text Books :

1 Kirpal Singh, Automobile Engineering, Vol. I & II, Standard Publishers, New Delhi, Fourteenth Edition, 2018.

2 Gupta, S. K., A Textbook of Automobile Engineering, S. Chand Publishing, New Delhi, Second Edition, 2020.

Reference Books :

1 Rajput, R K, A Textbook of Automobile Engineering, Laxmi Publications (P) Ltd, New Delhi, Second Edition, 2017.

2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

3 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

4 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU901 **Course name : BASICS OF AUTOMOBILE ENGINEERING**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Provide basic platform knowledge of automobile engineering	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	Explain the working principal of petrol and diesel engines	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	Interpret the method of power transmission unit	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	Built knowledge of steering and brake	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	Illustrate the knowledge of automotive electrical systems and functioning	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU902	**AUTOMOTIVE ENGINE TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Illustrate the fundamental concepts and functions of an automotive engine and working cycles*	*Understand*
CO2:	*Explain the combustion phenomena in SI engines*	*Understand*
CO3:	*Identify the CI engines injection, ignition and combustion phenomena*	*Understand*
CO4:	*Outline the emission control techniques.*	*Understand*
CO5:	*Demonstrate the measurement techniques and emission standards.*	*Understand*

UNIT – I CONSTRUCTION AND OPERATION [09]

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles. Introduction to Lean burn engine technologies.

UNIT – II SI ENGINES [09]

Air fuel ratio requirements - Carburetion - Throttle body injection, Multi point injection. Function of Components, Spark plug, Ignition System - battery coil, magneto coil, Electronic. Combustion in SI Engines - Combustion Chambers, Stages of Combustion - factors affecting flame propagation, Knock in SI engines, variables affecting knocking. Pollution from SI engines.

UNIT – III CI ENGINES [09]

Diesel fuel injection system, Function of Components, Jerk type pump, Distributor pump, Mechanical and pneumatic Governor, Fuel Injector, Types of nozzles, importance of Swirl, Squish, Turbulence air motion, Combustion in CI Engines - Combustion Chambers, Stages of Combustion, Factors affecting Ignition Delay, Knock in CI engines. Pollution from CI engines.

UNIT - IV EMISSION CONTROL TECHNIQUES [09]

Design of engine, optimum selection of operating variables for control of emissions, EGR, charge stratification, SCR, DPF, Lean NOX catalyst technology. Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution and control.

UNIT - V MEASUREMENT TECHNIQUES, EMISSION STANDARDS AND TEST PROCEDURES [09]

NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - Chassis dynamometers, dilution tunnels.

Total = 45 Periods

Text Books :

1 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

Reference Books :

1 Ramalingam K.K, Automobile Engineering, Scitech Publications (India) Pvt. Ltd, Chennai, Second Edition, 2011.

2 John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education, New Delhi, Second Edition, 2018.

3 Gupta H.N, Fundamentals of Internal Combustion Engines, PHI Learning Private Ltd., New Delhi, Second Edition, 2013.

4 Obert, E.F., Internal Combustion Engineering and Air Pollution, Intext Education Publishers, New York, Third Edition, 1988.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU902 **Course name : AUTOMOTIVE ENGINE TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Illustrate the fundamental concepts and functions of an automotive engine and working cycles	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	Explain the combustion phenomena in SI engines.	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	Identify the CI engines injection, ignition and combustion phenomena	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	Outline the emission control techniques.	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	Demonstrate the measurement techniques and emission standards.	3	3	2	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU903	**AUTOMOTIVE VEHICLE TECHNOLOGY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the construction and working of various types of automobile engines.*	*Understand*
CO2:	*Evaluate the significance of clutch and transmission system.*	*Understand*
CO3:	*Illustrate the types of axle, suspension and classification of steering system.*	*Understand*
CO4:	*Discuss the various vehicle control systems.*	*Understand*
CO5:	*Demonstrate the various new generation vehicles.*	*Understand*

UNIT - I AUTOMOBILE ENGINE [09]

Construction layout, types and components of engines, SI – CI – Wankel engine, working of engines, lubrication system, coolant system, power supply, alternate and dynamo, flywheel and damper.

UNIT - II CLUTCH AND TRANSMISSION [09]

Types of clutches, construction and working procedure of single plate clutch, multi-plate clutch, cone clutch, gears – types of gears, terminology of spur gear, gear trains, construction and working of manual and automatic gear box.

UNIT - III AXLE, SUSPENSION AND STEERING [09]

Types of axles, necessity of axle for an automobile, suspension system, types and construction of suspension system, significance of suspension system, steering system and vehicle handling, classification of steering system, merits and demerits of power steering.

UNIT - IV VEHICLE CONTROL SYSTEM [09]

Cruise control, antilock braking system, tyre slip controller, electronic steering control, global positioning system, autonomous navigation system.

UNIT - V NEW GENERATION VEHICLES [09]

Electric vehicles, hybrid vehicles, flexible fuel vehicles, solar powered vehicles, high energy and power density batteries, regenerative braking, safety air bags.

Total = 45 Periods

Text Books :

1 David A. Crolla, Automotive Engineering – Powertrain, Chassis system and Vehicle body, Butterworth-Heinemann, New Delhi, First Edition, 2009.

2 Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

Reference Books :

1 Heinz Heisler, Advance Vehicle Technology, Butterworth-Heinemann, London, Second Edition, 2002.

2 Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.

3 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.

4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU903 **Course name : AUTOMOTIVE VEHICLE TECHNOLOGY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify the construction and working of various types of automobile engines.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Evaluate the significance of clutch and transmission system.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	Illustrate the types of axle, suspension and classification of steering system.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	Discuss the various vehicle control systems.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	Demonstrate the various new generation vehicles.	3	3	3	-	-	-	-	-	-	-	-	-	-	-
	Average	**3**	**3**	**3**	**-**	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU904	**AUTOMOTIVE SAFETY** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Explain the automotive safety and its importance.*	*Understand*
CO2:	*Analyze the safety concepts.*	*Understand*
CO3:	*Illustrate the various safety equipment functions and importance*	*Understand*
CO4:	*Identify the various crash test and impact test mechanics.*	*Understand*
CO5:	*Examine the function of warning and avoidance systems.*	*Understand*

UNIT - I INTRODUCTION [09]

Evolution of automotive safety - Active safety: driving safety, conditional safety, perceptibility safety, operating safety - passive safety: exterior safety, interior safety, safety sandwich construction – NCAP.

UNIT - II SAFETY CONCEPTS [09]

Design of the body for safety -Energy equation - engine location - deceleration of vehicle inside passenger compartment - deceleration on impact with stationary and movable obstacle.

UNIT - III SAFETY EQUIPMENTS [09]

Seat belt - regulations, automatic seat belt tightener system - collapsible steering column - tiltable steering wheel – air bags - electronic system for activating air bags - bumper design for safety - Collision warning system - Central Locking system - Child safety.

UNIT - IV CRASH AND IMPACT MECHANICS [09]

Design of crash crumple zones - Behavior of specific body structures in crash testing - Roll over crash tests – Regulatory requirements for crash testing & testing procedure - vehicle impacts- Side and Frontal Pole Impact.

UNIT - V COMFORT AND CONVENIENCE SYSTEM [09]

Steering and mirror adjustment - central locking system - Garage door opening system - tyre pressure control system - rain sensor system - environment information system.

Total = 45 Periods

Text Books :

1 Ljubo Vlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.

2 Robert Bosch GmbH, Safety, Comfort and Convenience Systems, John Wiley & Sons, New Delhi, Third edition, 2007

Reference Books :

1 Bosch, Automotive Hand Book, SAE International, New York, Eighth Edition, 2011.

2 Vivek D. Bhise, Ergonomics in the automotive design process. CRC Press, New York, 2012.

3 Ronald K Jurgen, Automotive Electronics Handbook, Tata McGraw-Hill Inc., New York, Second Edition, 1999.

4 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU904 **Course name : AUTOMOTIVE SAFETY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Explain the automotive safety and its importance.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	Analyze the safety concepts.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Illustrate the various safety equipment functions and importance	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Identify the various crash test and impact test mechanics.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Examine the function of warning and avoidance systems.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	-	-	-	-	-	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20AU905	**HYBRID VEHICLES** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Summarize the electric and hybrid vehicle operation and architectures.*	*Understand*
CO2:	*Explain the different subsystems of hybrid and electric vehicle*	*Understand*
CO3:	*Demonstrate the energy requirement for vehicles*	*Understand*
CO4:	*Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicle*	*Understand*
CO5:	*Design and develop the systems of hybrid and electric vehicles*	*Understand*

UNIT - I NEED FOR ALTERNATIVE SYSTEM [09]

Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles.

UNIT - II SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES [09]

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT - III ENERGY SOURCES [09]

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride – Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT - IV MOTORS AND CONTROLLERS [09]

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT - V DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES [09]

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems, performance of electrical vehicles.

Total = 45 Periods

Text Books :

1 Iqbal Husain, Electric and Hybrid Vehicles-Design Fundamentals, CRC Press, New York, Second Edition, 2010.

2 Mehrdad Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, Second Edition, 2009.

Reference Books :

1 James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.

2 Lino Guzzella, Vehicle Propulsion Systems, Springer-Verlag Berlin, Heidelberg, Third Edition, 2013

3 Ron HodKinson, Light Weight Electric/ Hybrid Vehicle Design, Butterworth Heinemann Publication, London, 2001

4 Ronald K Jurgen, Electric and Hybrid – Electric Vehicles, SAE International, New York, First Edition, 2011.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU905 **Course name : HYBRID VEHICLES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Summarize the electric and hybrid vehicle operation and architectures.	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO2	Explain the different subsystems of hybrid and electric vehicle	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	Demonstrate the energy requirement for vehicles	3	3	3	-	-	-	3	-	-	-	-	-	-	-
CO4	Model and simulate the vehicle characteristics, operating modes, and performance parameters of the vehicles.	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO5	Design and develop the systems of hybrid and electric vehicles.	3	2	2	-	-	-	3	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU906	**OFF HIGHWAY VEHICLES** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the construction and requirement of off road vehicles.*	*Understand*
CO2:	*Explain the different types of earth moving machines and explain the different sub systems.*	*Understand*
CO3:	*Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.*	*Understand*
CO4:	*Discuss the construction and working principle of farm equipment, military and combat vehicles.*	*Understand*
CO5:	*Explain the vehicle systems and features.*	*Understand*

UNIT - I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES [09]

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi-axle vehicles.

UNIT - II EARTH MOVING MACHINES [09]

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNIT - III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS [09]

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT - IV FARM EQUIPMENT, MILITARY AND COMBAT VEHICLES [09]

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT - V VEHICLE SYSTEMS AND FEATURES [09]

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper.

Total = 45 Periods

Text Books :

1 Robert L. Peurifoy, Clifford J. Schexnayder, Construction, planning, equipment and methods, Tata McGraw Hill Publishing company Ltd, New Delhi, Ninth Edition, 2018.

2 Nakra C.P., Farm machines and equipment, Dhanparai Publishing company, New Delhi, First Edition, 2003.

Reference Books :

1 Wong.J.Y. Theory of Ground Vehicles, John Wiley & Sons, New York, Fifth Edition, 2022.

2 Ageikin S., Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd., New Delhi, First Edition,1988

3 Heinz Heisler, Vehicle and Engine Technology, , SAE International, New York, Second Edition, 1999

4 Sean Bennet and Ian Andrew Norman, Heavy Duty Truck systems, Delmar Cengage learning, New York, Fifth Edition, 2011.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU906 **Course name : OFF HIGHWAY VEHICLES**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the construction and requirement of off road vehicles.	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO2	Explain the different types of earth moving machines and explain the different sub systems.	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	Describe the specifications, functions, merits and demerits of different types and subsystems of scrappers, graders and ditchers.	3	3	3	-	-	-	3	3	-	-	-	-	-	-
CO4	Discuss the construction and working principle of farm equipment, military and combat vehicles.	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO5	Explain the vehicle systems and features.	3	2	2	-	-	-	3	-	-	-	-	-	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

		L	T	P	C
20AU907	**MODERN AND INTELLIGENT VEHICLE SYSTEM** (Open Elective)	3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Identify the various systems involved in driver support systems and their working principle.*	*Understand*
CO2:	*Familiarize with global positioning systems, geographical information systems and navigation systems.*	*Understand*
CO3:	*Comprehend the constructional and working features of safety systems and security systems.*	*Understand*
CO4:	*Recognize about the various comfort systems.*	*Understand*
CO5:	*Explain the various adaptive control systems.*	*Understand*

UNIT - I DRIVER ASSISTANCE SYSYTEMS [09]

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, vehicle status monitoring and automated highway systems.

UNIT - II TELEMATICS [09]

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition and application of Internet of Things (IoT) in automotive industry.

UNIT - III SAFETY SYSTEMS AND SECURITY SYSTEMS [09]

Airbags, seat belt tightening system, collision avoidance and warning systems, child lock, antilock braking systems, Anti-theft technologies, smart card system and number plate coding.

UNIT - IV COMFORT SYSTEMS [09]

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column and power windows.

UNIT - V ADAPTIVE CONTROL SYSTEMS [09]

Adaptive cruise control, adaptive noise control, anti spin regulation, traction control systems and cylinder cut off technology and autonomous driving.

Total = 45 Periods

Text Books :

1 Ljubo Vlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, First Edition, 2001.

2 Ronald K Jurgen, Navigation and Intelligent Transportation Systems – Progress in Technology, Automotive Electronics Series, SAE, New York, First Edition, 1998.

Reference Books :

1 Richard Bishop, Intelligent Vehicle Technology and Trends, Artech House, London, First Edition, 2005.

2 William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

3 Robert Bosch, Automotive Handbook, Bently Publishers, Cambridge, Tenth Edition, 2018.

4 Robert Bosch, Bosch Automotive Electrics and Automotive Electronics, Springer Vieweg Wiesbaden, Switzerland, Fifth Edition, 2013.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU907 **Course name : MODERN AND INTELLIGENT VEHICLE SYSTEM**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify the various systems involved in driver support systems and their working principle.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO2	Familiarize with global positioning systems, geographical information systems and navigation systems.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO3	Comprehend the constructional and working features of safety systems and security systems	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO4	Recognize about the various comfort systems.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
CO5	Explain the various adaptive control systems.	3	3	3	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**3**	**-**	-	-	-	-	-	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

20AU908	**VEHICLE MAINTENANCE** (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: -

Course Outcomes : On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Describe the importance, types and requirements of vehicle maintenance and related records and schedules.*	*Understand*
CO2:	*Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.*	*Understand*
CO3:	*Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.*	*Understand*
CO4:	*Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.*	*Understand*
CO5:	*Describe the maintenance procedures of electrical systems. .*	*Understand*

UNIT - I MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS [09]

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re-boring machine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop.

UNIT - II ENGINE REPAIR AND OVERHAULING [09]

Dismantling of engine and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system - lubrication system. Engine trouble shooting chart.

UNIT - III MAINTENANCE, REPAIR AND OVERHAULING OF THE CHASSIS [09]

Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems.

UNIT - IV MAINTENANCE AND REPAIR OF VEHICLE BODY [09]

Body panel tools for repairing. Tinkering and painting. Use of soldering, metalloid paste. Tyre maintenance, metallic, plastics

UNIT - V MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEMS [09]

Care, maintenance, testing and troubleshooting of battery, starter motor, dynamo, alternator and regulator. Transistorized regulator problems.

Total = 45 Periods

Text Books :

1 John E. Dolce, Analytical Fleet Maintenance Management, SAE International, New York, Third Edition, 2009.

2 James D. Halderman, Advanced Engine Performance Diagnosis, Pearson Education, New Delhi, Seventh Edition, 2019.

Reference Books :

1 Bosch Automotive Handbook, SAE International, New York, Tenth Edition, 2018

2 Willam H. Crouse and Donald L. Anglin, Automotive Mechanics, Tata McGraw Hill Publishing Company, New Delhi, Tenth Edition, 2007.

3 Service Manuals from different vehicle manufacturers.

4 Judge. A.N, Motor vehicle engine servicing, Pitman Paper pack, London, Third Edition, 1969.

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020

Course code : 20AU908 **Course name : VEHICLE MAINTENANCE**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Describe the importance, types and requirements of vehicle maintenance and related records and schedules.	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO3	Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO5	Describe the maintenance procedures of electrical systems.	3	3	2	-	-	-	-	-	-	-	-	3	-	-
	Average	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20AUV01	**AUTOMOTIVE STYLING**	1	0	0	1

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Categorize and study related to automotive Styling.	*Understand*
CO2:	To develop an automotive vehicle model.	*Understand*

AUTOMOTIVE STYLING**:**

- The styling process – Working environment and structure.
- Product planning – Concept sketching and package related sketching.
- Full sized tape drawing – Clay modelling.
- Vehicle interior ergonomics, ergonomics system design, Technical requirements.
- Design for Failure Mode Effects Analysis, Design Review, Vehicle Review

Total : 15 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Course code : 20AUV01 **Regulation : R2020**
Course name : AUTOMOTIVE STYLING

CO	**Course Outcomes**	**Programme Outcomes**													
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	Categorize and study related to automotive Styling.	2	-	-	-	2	-	-	-	-	-	-	-	2	-
CO2	To develop an automotive vehicle model.	2	-	-	-	2	-	-	-	-	-	-	-	-	-
	Average	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20AUV02	**VEHICLE SERVICE MANAGEMENT**	**1**	**0**	**0**	**1**

Prerequisite: -

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Understand the operation of successful service firms.*	*Understand*
CO2:	*Know the service growth and expansion in automotive industry*	*Understand*

Service Marketing - Services economy - Service Design And Delivery - Service life cycle, service core process - Parts Management - parts marketing - Business Planning - SoP's for process compliance

Total : 15 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Course code : 20AUV02 **Regulation : R2020**
Course name : VEHICLE SERVICE MANAGEMENT

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the operation of successful service firms.	2	-	-	-	2	-	-	-	-	-	-	-	-	-
CO2	Know the service growth and expansion in automotive industry	2	-	-	-	2	-	-	-	-	-	-	-	-	-
	Average	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20AUV03	**ACCIDENT AND INSURANCE SURVEY**	**1**	**0**	**0**	**1**

Prerequisite: -

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Perceive the principles of insurance.*	*Understand*
CO2:	*Know the accident survey assessment and insurance renewal.*	*Understand*

Principles of general insurance applicable to Motor vehicles – roles and responsibilities of IRDAI - clauses in the insurance proposal - third party claim settlement - Survey assessment - accident investigation report – loss assessment – accidental repair assessment parameters – insurance renewal – insurance claims - micro project.

Total : 15 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Regulation : R2020
Course code : 20AUV03 **Course name : ACCIDENT AND INSURANCE SURVEY**

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Perceive the principles of insurance.	-	-	-	-	-	3	-	2	2	-	-	-	-	-
CO2	Know the accident survey assessment and insurance renewal.	-	-	-	-	-	3	-	2	2	-	-	-	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20AUV04	**LOGISTIC MANAGEMENT**	**1**	**0**	**0**	**1**

Prerequisite: -

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*Spell out the distribution channels and outsourcing.*	*Understand*
CO2:	*Know the performance measurement and costs.*	*Understand*

Introduction definition and scope of logistics – Functions & objectives - Distribution channels and Outsourcing logistics - Transportation and packaging - Performance measurement and costs - Current trends.

Total : 15 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Course code : 20AUV04 **Regulation : R2020**
Course name : LOGISTIC MANAGEMENT

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Spell out the distribution channels and outsourcing.	-	-	-	-	-	2	1	-	3	2	-	-	-	-
CO2	Know the performance measurement and costs.	-	-	-	-	-	2	1	-	3	2	-	-	-	-
	Average	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**3**	**2**	**-**	**-**	**-**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20AUV05	**ELECTRONIIC ENGINE MANAGEMENT SYSTEM**	**1**	**0**	**0**	**1**

Prerequisite: -

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*List out the electronic system engine management.*	*Understand*
CO2:	*Perceive the applications of electronic systems.*	*Understand*

Introduction to modern control strategies like Fuzzy logic and adaptive control - Mono point, Multi point and Direct injection systems - Electronic spark timing and control - Ignition timing calculation and Injection duration calculation - Vehicle security systems - On board diagnostics - Collision avoidance radar warning system

Total : 15 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Course code : 20AUV05 **Regulation : R2020**
Course name : ELECTRONIIC ENGINE MANAGEMENT SYSTEM

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	List out the electronic system engine management.	-	-	-	-	-	-	1	-	-	-	-	-	2	-
CO2	Perceive the applications of electronic systems.	-	-	-	-	-	-	1	-	-	-	-	-	2	-
	Average	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20AUV06	**INSTRUMENTATION AND CONTROL SYSTEMS IN AUTOMOBILE ENGINEERING**	1	0	0	1

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	Spell out the systems available to control the vehicle.	*Understand*
CO2:	Perceive to measure and manage the performance of a vehicle.	*Understand*

Introduction to Instrumentation and Control Engineering - Automotive Systems – Engine Instrumentation - Intelligent Systems – Assistance and Automated Features – Smart Features – Modern Instrumentation Systems – Monitoring systems – RFID.

Total : 15 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Course code : 20AUV06 **Regulation : R2020**
Course name : INSTRUMENTATION AND CONTROL SYSTEMS IN AUTOMOBILE ENGINEERING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Spell out the systems available to control the vehicle.	3	-	-	-	3	-	-	-	-	-	-	-	1	1
CO2	Perceive to measure and manage the performance of a vehicle.	3	-	-	-	3	-	-	-	-	-	-	-	1	1
	Average	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

VALUE ADDED COURSE

		L	T	P	C
20AUV07	**TRACOR AND FARM EQUIPMENT**	1	0	0	1

Prerequisite: Nil

Course Outcomes: On successful completion of the course, the student will be able to		***Cognitive Level***
CO1:	*List out the farm equipment.*	*Understand*
CO2:	*Perceive safety procedures and maintenance of the farm equipment.*	*Understand*

Farm mechanization in India – benefits and constraints - Classification of tractors – main components of tractor - Tillage – objectives – soil dynamics in tillage and traction – furrows terminology – methods of ploughing - Plant protection equipment - Earth moving machineries – Safety operation and maintenance of farm machineries

Total : 15 Periods

K.S.R. COLLEGE OG ENGINEERING, TIRUCHENGODE – 637 215
DEPARTMET OF AUTOMOBILE ENGINEERING
CO-PO MAPPING

Course code : 20AUV07 **Regulation : R2020**
Course name : TRACOR AND FARM EQUIPMENT

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	List out the farm equipment.	1	-	-	-	3	-	-	-	-	-	-	-	1	1
CO2	Perceive safety procedures and maintenance of the farm equipment.	1	-	-	-	3	-	-	-	-	-	-	-	1	1
	Average	**1**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)