

B.E. – Automobile Engineering

CURRICULUM & SYLLABI

Regulation 2020

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



K.S.R. College of Engineering


(Autonomous)

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

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	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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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		

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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		

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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								
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SEMESTER - VII										
Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P		C	CA	ES
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	Speciali- zation	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	Speciali- zation	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
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
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		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		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

S3 – Design

S5 – Management

S2 –Automobile Engineering

S4 –Manufacturing Engineering

LIST OF VALUE ADDED COURSES

Sl.No.	Course Name	Number of Hours	Offered by Internal / External
1	Business English Certification	15	Internal / External
2	Other Linguistic Learning like German, Japanese, etc.	15	Internal / External
3	Automotive Styling	15	Internal / External
4	Vehicle Service Management	15	Internal / External
5	Online Course Certification from edX/ Coursera / NPTEL, etc.	15	Internal/ External
6	Accident and Insurance Survey	15	Internal / External
7	Logistic Management	15	Internal / External
8	Electronic Engine Management System	15	Internal / External
9	Navigation and Guidance Systems	15	Internal / External
10	Instrumentation and Control in Automobile Engineering	15	Internal/ External
11	Course on Intellectual Property Rights	15	Internal / External
12	Tractor and Farm Equipment	15	Internal / External

OPEN ELECTIVE COURSES

Open Elective courses offered by other branches

Sl.No.	Course Code	Course Name	Special ization	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	Special ization	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
55.	20ME906	Sensors and Transducers	ME	OEC	3	0	0	3	40	60	100

B.E. - Automobile Engineering												
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	Special ization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P		C	CA	ES
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

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

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

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SEMESTER - I

20EN151

TECHNICAL ENGLISH – I
(common to all branches)

L	T	P	C
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 Communication, 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

CO PO MAPPING

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

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High)

Course Faculty

Module Coordinator

Chairman BoS / S & H

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

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SEMESTER – I

20MA151

ENGINEERING MATHEMATICS – I

(Common to All Branches)

L	T	P	C
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 – Involute and Evolute.

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 parallelepiped 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 Publications, Eighth Edition, 2012.
- 4 Narayanan.S and Manicavachagom Pillai. T.K. – Calculus vol I and Vol II, S.chand & Co. Sixth Edition, 2014.

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / S & H

SEMESTER – I**ENGINEERING PHYSICS**

(Common to All Branches)

20PH051

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, CO₂ 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, ninth 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, ninth edition, Cengage Learning, USA, 2013.
- 4 Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, New Delhi, sixth Edition, 2010.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	<i>Describe the impact of engineering solutions in the constructional and designing environment.</i>	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO2	<i>Categorize the types of laser and utilize it for specific application based on their desirable requisite.</i>	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO3	<i>Utilize the conceived concepts and techniques for synthesizing novel crystals with enhanced multifunctional properties.</i>	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO4	<i>Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems</i>	3	3	-	-	2	-	-	1	-	2	-	2	-	-
CO5	<i>Comprehend the fundamental ideas of optoelectronic materials and to fabricate it for the potential applications.</i>	3	3	-	-	2	-	-	1	-	2	-	2	-	-
Average		3	3	-	-	2	-	-	1	-	2	-	2	-	-

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

Course Faculty

Module Coordinator

Chairman BoS / S & H

SEMESTER - I**20ME144****ENGINEERING DRAWING**
(Common to AU, ME & SF)

L	T	P	C
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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BOS / Mech

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

R 2020

SEMESTER - I

20MC151

INDUCTION PROGRAMMING

(Common to All Branches)

L	T	P	C
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.

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / S & H

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

R 2020

SEMESTER - I

20PH028

PHYSICS 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:	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, twelfth 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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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)

Course Faculty

Module Coordinator

Chairman BoS / S & H

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

R 2020

SEMESTER - I

20AU026

COMPUTER AIDED DRAWING LABORATORY

(Common To AU & ME)

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:	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 mixer, 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

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / AE

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

- CO1: Prepare green sand mould for simple patterns and carpentry components with simple joints.
 CO2: Perform welding practice to join simple structures.
 CO3: Practice simple operations in lathe and drilling machine.

Cognitive Level

Creating
 Applying
 Understanding

GROUP A (CIVIL & MECHANICAL)

LIST OF EXPERIMENTS

- Study of fitting, smithy, plastic moulding and glass cutting.
- Prepare a mould using solid/split patterns in Foundry.
- Make Lap joint / Butt joint / T joint from the given wooden pieces using carpentry tools.
- Make a Butt joint / Lap joint / Tee joints using arc / gas welding equipment.
- Perform simple Facing and Turning operation using Centre Lathe.
- 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. |

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BOS / Mech

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

R 2020

SEMESTER – I

20GE028

GROUP B (ELECTRICAL & ELECTRONICS)
(Common to all Branches)

L	T	P	C
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**CO PO MAPPING**

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)

Course Faculty**Module Coordinator****Chairman BoS / EEE**

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

R 2020

SEMESTER - II

20EN251

TECHNICAL ENGLISH – II
(common to all branches)

L	T	P	C
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

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / S & H

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

R 2020

SEMESTER – II

20MA241

ENGINEERING MATHEMATICS – II
(COMMON TO AU, CE, ME & SF)

L	T	P	C
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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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)

Course Faculty

Module Coordinator

Chairman BoS / S & H

SEMESTER – II

20CH051	ENGINEERING CHEMISTRY (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:	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 MoS₂; 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 [CoCl₄]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 its 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.

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / S & H

SEMESTER – II**20CS241****PYTHON PROGRAMMING**
(Common to AU, CE, EE, EC, ME & SF)

L	T	P	C
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.codecademy.com and <https://codingbat.com/python>

CO-PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / CSE

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

R 2020

SEMESTER – II

20EE041	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
	(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 circuit 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.

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / EEE

SEMESTER – II

20AU231	FUNDAMENTALS OF ENGINEERING MECHANICS	L	T	P	C
	(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 Hibbeler. 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – II

CHEMISTRY LABORATORY

(Common To All Branches)

20CH028

L	T	P	C
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, BaCl₂ Vs. Na₂SO₄.
4. Estimation of Ferrous ion by Potentiometry – Fe²⁺ Vs K₂Cr₂O₇.
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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / S & H

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

R 2020

SEMESTER – II

20CS227	PYTHON PROGRAMMING LABORATORY	L	T	P	C
	(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

CO-PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / CSE

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

R 2020

SEMESTER - II**20GE051****HERITAGE OF TAMILS**

(common to all branches)

L	T	P	C
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, Yath and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT - III FOLK AND MARTIAL ARTS**[03]**

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyilattam, 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) (Published by International Institute of Tamil Studies).
- 3 Keeladi – 'Sangam City Civilization 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)

CO-PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / S & H

SEMESTER - II

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

முன்கூட்டிய துறைசார் அறிவு : தேவை இல்லை

பாடம் கற்றத்தின் விளைவுகள்: பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள் அறிவாற்றல் நிலை

- C01: தமிழ்மொழியின் செந்ததன்மை மற்றும் இலக்கியம் குறித்த தெரிதல் புரிதல்
- C02: தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக் கருவிகள் குறித்த தெளிவு புரிதல்
- C03: தமிழர்களின் நாட்டுப் புரைக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த தெளிவு புரிதல்
- C04: தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககாலவணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள். புரிதல்
- C05: 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 செவ்விலயக்கியங்கள் - 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, ஓயிலாட்டம், தோல்பாவைக் 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 அச்ச 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 பொருறை - 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).

CO-PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / S & H

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

R 2020

SEMESTER - III

20MA341

STATISTICS AND NUMERICAL METHODS

(COMMON TO B.E. AU, ME & SF)

L	T	P	C
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, Ninth 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.

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / S&H

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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

SEMESTER – III**20AU313****MECHANICS OF MATERIALS**

L	T	P	C
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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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 tools, machine moulding, special moulding processes – CO₂ 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.

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 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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – III

20AU315

AUTOMOTIVE CHASSIS

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 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.

CO PO MAPPING

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

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – III

ENVIRONMENTAL SCIENCE AND ENGINEERING

20MC052

(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.

CO PO MAPPING

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

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

Course Faculty

Module Coordinator

Chairman BoS / S&H

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

R 2020

SEMESTER - III

20AU321 FLUID MECHANICS AND MECHANICS OF MATERIALS LABORATORY

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:	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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

SEMESTER - III**20AU322****AUTOMOTIVE MANUFACTURING TECHNOLOGY LABORATORY**

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:	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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - III

20HR351

CAREER DEVELOPMENT SKILLS – I

(Common to All Branches)

L	T	P	C
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

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	<i>Have competent knowledge on grammar with an understanding of its basic rules.</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO2	<i>Communicate effectively and enhance interpersonal skills with renewed self – confidence</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO3	<i>Construct sentence in English and make correction</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO4	<i>Perform oral communication in any formal situation</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
CO5	<i>Develop their LSRW skills.</i>	-	-	-	-	1	-	-	-	3	3	-	3	-	-
Average		-	-	-	-	1	-	-	-	3	3	-	3	-	-

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

Course Faculty

Module Coordinator

Chairman BoS / S&H

K.S.R. COLLEGE OF ENGINEERING (Autonomous)					R 2020			
SEMESTER - III								
20GE052	TAMILS AND TECHNOLOGY (Common to All Branches)				L	T	P	C
					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 beads – 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 Civilization 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)							

CO-PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / S & H

SEMESTER - III

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

முன் கூட்டிய துறைசார் அறிவு : தேவை இல்லை

பாடம் கற்றத்தின் விளைவுகள் : பாடத்தை வெற்றிகரமாக கற்று முடித்த பின்பு, மாணவர்களால் முடியும் விளைவுகள் அறிவாற்றல் நிலை

CO1:	சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பாணைவனைதல் தொழில் நுட்பம் குறித்து கற்றுணர்தல்	புரிதல்
CO2:	சங்ககாலத் தமிழர்களின் கட்டிட தொழில் நுட்பம் கட்டுமான பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்து அறிவு	புரிதல்
CO3:	சங்ககாலத் தமிழர்களின் உலோகத் தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு	புரிதல்
CO4:	சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு	புரிதல்
CO5:	நவீன அறிவியல் தமிழ் மற்றும் கன்னி தமிழ் குறித்த புரிந்துகொள்ளும் மற்றும் பயன்படுத்தும்	பகுப்பாய்வு

அலகு - I நெசவு மற்றும் பாணைத் தொழில்நுட்பம் [03]

சங்ககாலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் கருப்பு சிவப்பு பாண்டங்கள்- பாண்டங்களில் 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-சோழர்காலகுமிழித்தாம்பின் 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 கல்வியியல் பணிகள் கழகம்)
- 2 கணினித்தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

Reference Books :

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

CO-PO MAPPING

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 விளக்கும் 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)

Course Faculty

Module Coordinator

Chairman BoS / S & H

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

R 2020

SEMESTER - IV

20AU411	ENGINEERING THERMODYNAMICS AND HEAT TRANSFER	L	T	P	C
	(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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

SEMESTER - IV

20AU412

AUTOMOTIVE ENGINES

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:	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]**

Carburetors- 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

SEMESTER - IV

20AU413

MATERIAL SCIENCE AND METALLURGY

L	T	P	C
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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	<i>Explain alloys and phase diagram, iron-iron carbide diagram and steel classification.</i>	3	3	2	-	-	-	-	-	2	-	-	-	3	-
CO2	<i>Describe isothermal transformation, continuous cooling diagrams and different heat treatment processes.</i>	3	3	2	-	-	-	-	-	2	-	-	-	2	-
CO3	<i>Identify the different polymer, ceramics and composites and their uses in engineering field.</i>	2	2	-	-	-	-	-	-	2	-	-	-	2	-
CO4	<i>Recognize and select the suitable materials for various automotive components.</i>	3	2	-	-	-	-	-	-	2	-	-	-	-	2
CO5	<i>Summarize the mechanism of plastic deformation and testing mechanical properties.</i>	2	2	-	-	-	-	-	-	2	-	-	-	-	-
Average		3	2	2	-	-	-	-	-	2	-	-	-	2	2

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

Course Faculty

Module Coordinator

Chairman BoS / AE

SEMESTER - IV**20AU414****MECHANICS OF MACHINES**

L	T	P	C
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, Kutzbach 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 epicyclic 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - IV

20AU415

AUTOMOTIVE ELECTRICAL ENGINEERING

L	T	P	C
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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - IV

20AU416

AUTOMOTIVE FUELS AND LUBRICANTS

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: 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - IV

20AU421

AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY

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: 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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - IV

20AU422

AUTOMOTIVE COMPONENTS LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: -**Course Outcomes : On successful completion of the course, the student will be able to**

CO1: Dismantle and assemble the SI and CI engines.

CO2: Recognize the different fuel feed systems, vehicle frames of light and heavy vehicles.

CO3: Acquire the knowledge of two and three wheelers and chassis layouts.

CO4: Examine the working of differential, clutch and drive shaft.

CO5: Describe the working principle of steering system and gear boxes of automotive systems.

Cognitive Level

Understand

Understand

Understand

Understand

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

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	<i>Dismantle and assemble the SI and CI engines.</i>	3	-	3	-	-	3	3	2	-	-	-	-	-	3
CO2	<i>Recognize the different fuel feed systems, vehicle frames of light and heavy vehicles.</i>	3	-	3	-	-	2	-	2	-	-	-	-	-	2
CO3	<i>Acquire the knowledge of two and three wheelers and chassis layouts.</i>	3	-	3	-	-	3	3	3	2	-	-	-	-	3
CO4	<i>Examine the working of differential, clutch and drive shaft.</i>	3	-	3	-	-	3	2	2	-	-	-	-	2	-
CO5	<i>Describe the working principle of steering system and gear boxes of automotive systems.</i>	3	-	3	-	-	2	-	2	-	-	-	-	-	2
Average		3	-	3	-	-	3	3	2	2	-	-	-	2	3

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

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - IV

20HR412

CAREER DEVELOPMENT SKILLS - II

L	T	P	C
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

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Speak and write appropriately by understanding verbal and logical reasoning</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO2	<i>Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO3	<i>Enhance their skills on quantitative aptitude</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO4	<i>Speak and write appropriately by understanding and applying the basic grammatical rules</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
CO5	<i>Critically evaluate problems related to quantitative aptitude</i>	-	-	-	-	-	-	-	-	2	3	-	3	2	2
Average		-	-	-	-	-	-	-	-	2	3	-	3	2	2

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

Course Faculty

Module Coordinator

Chairman BoS / S&H

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

R 2020

SEMESTER - V

20HS051	UNIVERSAL HUMAN VALUES AND UNDERSTANDING HARMONY (Common To All Branches)	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 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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Explain the basic concepts of value education.</i>	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO2	<i>Distinguish between the self and the body, implement the meaning of Harmony in the Co– existence of Self and the Body.</i>	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO3	<i>Explain the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships.</i>	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO4	<i>Describe the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.</i>	-	-	-	-	-	1	1	3	3	-	1	3	-	-
CO5	<i>Explain the ethical and unethical practices in work environment.</i>	-	-	-	-	-	1	1	3	3	-	1	3	-	-
Round off Average		-	-	-	-	-	1	1	3	3	-	1	3	-	-

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

Course Faculty**Module Coordinator****Chairman BoS / MBA**

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

R 2020

SEMESTER - V

20AU512

AUTOMOTIVE TRANSMISSION

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 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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the constructional and working principle of various types of clutch.</i>	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO2	<i>Outline the constructional and working principle of various types of gearbox.</i>	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO3	<i>Illustrate the working principle of fluid coupling and torque converter and its performance characteristics.</i>	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO4	<i>Demonstrate the working principle of various types of hydrostatic and electric drives.</i>	3	-	-	3	3	-	-	-	-	2	2	-	2	3
CO5	<i>Explain the various types of automatic transmission used in automobile vehicles.</i>	3	-	-	3	3	-	-	-	-	2	2	-	2	3
Average		3	-	-	3	3	-	-	-	-	2	2	-	2	3

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

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - V

20AU513	DESIGN OF MACHINE ELEMENTS	L	T	P	C
	(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, 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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	<i>Examine the influence of steady and variable stresses in machine components.</i>	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO2	<i>Select the suitable shaft and coupling for a particular application.</i>	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO3	<i>Identify the basic design concepts of temporary and permanent joints.</i>	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO4	<i>Find and identify suitable springs and understand the design concepts of flywheels.</i>	3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO5	<i>Select the suitable bearings for engineering applications.</i>	3	3	3	3	-	-	-	-	-	-	-	3	2	-
Average		3	3	3	3	-	-	-	-	-	-	-	3	2	

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

Course Faculty

Module Coordinator

Chairman BoS / AE

SEMESTER - V**20AU514****VEHICLE BODY 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: 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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - V

20AU515

AUTOMOTIVE ELECTRONICS

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: 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 diode 1N4728A 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

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Recall the fundamentals of electronic components.</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	<i>Illustrate the design of regulated power supply for the given specification</i>	2	-	3	-	3	-	-	-	-	-	-	-	-	3
CO3	<i>Construct the digital circuit using logic gates for the given logical operation.</i>	2	-	2	-	2	-	-	-	-	-	-	-	-	-
CO4	<i>Familiarize with electronic component functions involved in automotive electronic circuits</i>	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Explain the working principle of application specific Electronic control unit.</i>	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Average		2	-	2	-	2	-	-	-	-	-	-	-	-	2

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

Course Faculty

Module Coordinator

Chairman BoS /AE

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

R 2020

SEMESTER - V

20AU521 AUTOMOTIVE COMPONENTS DESIGN AND MODELING LABORATORY

L	T	P	C
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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS /AE

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

R 2020

SEMESTER - V

20AU522

AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

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:	Comprehend the working and troubleshooting of battery, starting motor and alternator	Understand
CO2:	Demonstrate and diagnose the ignition system, electrical wiring, 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

CO PO MAPPING

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, 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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - V

20HR513

CAREER DEVELOPMENT SKILLS - III

L	T	P	C
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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / S&H

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

R 2020

SEMESTER - VI

20AU611

AUTOMOTIVE ENGINE COMPONENTS DESIGN

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 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. Sundararamamoorthy 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VI

20AU612

AUTOMOTIVE POLLUTION AND CONTROL

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 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, NO_x, 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, NO_x, 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, Chemiluminescent, 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 Abatement, 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VI

20AU613

FINITE ELEMENT ANALYSIS

L	T	P	C
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.
 CO2: Solve one dimensional problem using the concepts of Finite Element Analysis.
 CO3: Employ the concepts of FEA to solve two dimensional problems.
 CO4: Apply the FEA techniques to solve structural and heat transfer problems.
 CO5: Analyze the dynamic problems using Isoparametric formulations.

Understand
 Apply
 Apply
 Apply
 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 AnalysisII, 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VI

20AU621

VEHICLE COMPONENTS DESIGN AND ANALYSIS LABORATORY

L	T	P	C
0	0	3	1

Prerequisite: -**Course Outcomes : On successful completion of the course, the student will be able to**

- CO1: Carryout structural analysis of chassis frame and connecting rod.
 CO2: Conduct thermal analysis of piston and modal analysis of aerofoil profile housing.
 CO3: Perform stress analysis of leaf spring and composite structure.
 CO4: Simulate four bar mechanism and cam and follower.
 CO5: Accomplish couple field analysis of brake disc and crash test analysis.

Cognitive Level

Analyze
 Analyze
 Analyze
 Analyze
 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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VI

20AU622

ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY

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:	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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VI

20HR614

CAREER DEVELOPMENT SKILLS - IV

L	T	P	C
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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Employ critical thinking in personal interviews type situations.</i>	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO2	<i>Understand the Quantitative Aptitude problems in geometry.</i>	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO3	<i>Understand the data interpretation and analysis by using various graphs.</i>	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO4	<i>Enhance the skills in resume writing and presentation.</i>	-	-	-	-	2	-	-	-	1	3	-	2	-	-
CO5	<i>Enhance the comprehension Skills in core subjects.</i>	3	-	-	-	2	-	-	-	1	3	-	2	-	-
Average		1	-	-	-	2	-	-	-	1	3	-	2	-	-

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

Course Faculty

Module Coordinator

Chairman BoS / S&H

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

R 2020

SEMESTER - VII

20AU711

VEHICLE DYNAMICS

L	T	P	C
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 – Muro 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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VII

20AU712

ELECTRIC AND HYBRID 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: 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. 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 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VII

20AU713

VEHICLE MAINTENANCE AND TESTING

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 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VII

20AU721

VEHICLE MAINTENANCE AND RECONDITIONING LABORATORY

L	T	P	C
0	0	3	1

Prerequisite:-**Course Outcomes :** On successful completion of the course, the student will be able to

CO1: Acquire the basic knowledge on vehicle maintenance shop layout, tools and equipment.

CO2: Become familiar with engine tuning and head light beam alignment.

CO3: Carry out the wheel balancing.

CO4: Perform wheel alignment and calibration of FIP.

CO5: Accomplish seating of valve and cylinder reboring.

Cognitive Level

Understand

Apply

Apply

Apply

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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VII

20AU722

INDUSTRIAL TRAINING AND SEMINAR

L	T	P	C
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:

- The students have to undergo practical industrial training for two weeks in recognized industrial establishments during their vacation periods.
- At the end of the training they have to submit a report with following information:
 - Profile of Industry
 - Product range
 - Organization structure
 - Plant layout
 - Processes / Machines / Equipment / Devices
 - Details of the training undergone
 - Learning points
- The student will prepare a presentation individually about the industrial training for 15 minutes duration.
- 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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER - VII

20AU723

PROJECT WORK I

L	T	P	C
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**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)

Course Faculty**Module Coordinator****Chairman BoS / AE**

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

R 2020

SEMESTER – VI (Professional Elective – I)

20AU661

AUTOMOTIVE AIR CONDITIONING

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: Recognize the components of automobile air conditioning system and its operation
 CO2: Know the control methods of automobile air conditioner and heating system
 CO3: Impart knowledge about refrigerants and its handling system
 CO4: Familiarize with air routing, temperature control and handling system
 CO5: Provide maintenance and service of air conditioning system

Understand
 Understand
 Understand
 Understand
 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

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VI (Professional Elective – I)

20AU622

ALTERNATIVE FUELS AND ENERGY SYSTEMS

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 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 - CO₂ and H₂S 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 Krahel, 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, Yimin Gao, Stefano Longo and Kambiz Ebrahimi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, CRC Press; 3rd edition, 2018.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VI (Professional Elective – I)

20AU663

AUTONOMOUS VEHICLE TECHNOLOGY

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: 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. LjuboVlagic, 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VI (Professional Elective – I)

20AU664

TYRE TECHNOLOGY

L	T	P	C
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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VI (Professional Elective – I)

20AU665

AUTOMOTIVE AERODYNAMICS

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 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VI (Professional Elective – I)

20AU666

COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
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, 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-ε) 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – II)

20AU761

ADVANCED THEORY OF I.C. ENGINES

L	T	P	C
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 THEOREY OF COMBUSTION [09]

Combustion reactions and stoichiometry, 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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – II)

20AU762

AUTOMOTIVE VEHICLE SAFETY

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 safety concepts in relation to the vehicle body
 CO2: Elucidate the safety systems available for passenger
 CO3: Recognize about the Collision avoiding systems
 CO4: Understand the Comfort conditions for a vehicle driver
 CO5: Analyze human response inside the vehicle due to barrier impacts.

Understand
 Understand
 Understand
 Understand
 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. JullianHappian-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".

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – II)

20AU763

TWO AND THREE WHEELERS

L	T	P	C
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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – II)

20AU764	DESIGN OF CHASSIS COMPONENTS	L	T	P	C
	(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 Avern, Automobile Chassis Design, Illife Book Co., 2001.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – II)

20AU765

INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

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 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 Servoing 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 effector 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. Groover Mikell .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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – II)

20AU766

BATTERY TECHNOLOGY

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 suitable Li-Ion battery cells for use in electric vehicles.
 CO2: Demonstrate the assembly of battery systems for electric vehicles.
 CO3: Identify battery management system.
 CO4: Summarize the requirements of battery systems for automobile.
 CO5: Analyze the cost benefits of battery sub systems and recycling.

Understand
 Understand
 Understand
 Understand
 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 Automotive – 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 ApplicationsII, Springer, August2018, ISBN 978-3-662-53069-6
2. Masataka Wakihara 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-Ion Batteries in Electric Drive VehiclesII, John Wiley and Sons, 2015 ISBN 978-1-118-41478-1
2. John G. Hayes and G. AbasGoodarzi, —Electric PowertrainII, First Edition, John Wileyand Sons, 2018, ISBN:9781119063667
3. James Larminie and John Lowry, —Electric Vehicle Technology ExplainedII, John Wiley and Sons, 2018,ISBN 978-81-265-5670-8
4. Sandeep Dhameja, Electric Vehicle Battery Systems, Newnes publication, 2001.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – III)

20AU767

COMBUSTION THERMODYNAMICS AND HEAT TRANSFER

L	T	P	C
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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – III)

20AU768

VEHICLE CONTROL SYSTEMS

L	T	P	C
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 Farid Golnaraghi, 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

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – III)

20AU769

INTELLIGENT VEHICLES TECHNOLOGY

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 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – III)

20AU771

COMPUTER SIMULATION OF I.C. ENGINE PROCESSES

L	T	P	C
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. ShleyCampbel, 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 Combustion Engines Processes - McGraw-Hill Publishing Co., - 1992.
2. Heywood J.B, Internal Combustion Engine Fundamentals, Tata McGraw Hill Education., New York, 201
3. Robert Bosch, Automotive Hand book, Eighth Edition, 2011.
4. Gunnar Stiesch, Modeling Engine Spray and Combustion Processes, Springer Berlin, Heidelberg, 2010.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – III)

20AU772

PRODUCT LIFE CYCLE MANAGEMENT

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 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. ISBN
2. John Stark, "Product Lifecycle Management: 21st Century Paradigm for Product Realization", Springer Publisher, 2011 (2nd Edition).

Reference Books :

1. AnttiSaaksvuori, Anselmilmonen, Product Life Cycle Management - Springer, 1st Edition (Nov.5, 2008)
2. IvicaCrnkovic, Ulf Asklund and AnnitaPerssonDahlqvist, "Implementing and Integrating Product Data Management and Software Configuration Management", Artech House Publishers, 2013.
3. International Journal of Product Lifecycle Management, Inderscience Publishers

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

SEMESTER – VII (Professional Elective – III)

20AU773

ADDITIVE MANUFACTURING

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 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	<i>Provide basic platform knowledge of automobile engineering</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Explain the working principal of petrol and diesel engines</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Interpret the method of power transmission unit</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Built knowledge of steering and brake</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Illustrate the knowledge of automotive electrical systems and functioning</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
Average		3	3	2	-	-	-	-	-	-	-	-	-	-	-

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

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

20AU902

AUTOMOTIVE ENGINE TECHNOLOGY
(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:	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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	<i>Illustrate the fundamental concepts and functions of an automotive engine and working cycles</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	<i>Explain the combustion phenomena in SI engines.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	<i>Identify the CI engines injection, ignition and combustion phenomena</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	<i>Outline the emission control techniques.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	<i>Demonstrate the measurement techniques and emission standards.</i>	3	3	2	-	-	-	-	-	-	-	-	-	-	-
Average		3	3	2	-	-	-	-	-	-	-	-	-	-	-

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

Course Faculty

Module Coordinator

Chairman BoS / AE

K.S.R. COLLEGE OF ENGINEERING (Autonomous)**R 2020****20AU903****AUTOMOTIVE VEHICLE TECHNOLOGY**

(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 the construction and working of various types of automobile engines.
 CO2: Evaluate the significance of clutch and transmission system.
 CO3: Illustrate the types of axle, suspension and classification of steering system.
 CO4: Discuss the various vehicle control systems.
 CO5: Demonstrate the various new generation vehicles.

Understand
 Understand
 Understand
 Understand
 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 :**

- David A. Crolla, Automotive Engineering – Powertrain, Chassis system and Vehicle body, Butterworth-Heinemann, New Delhi, First Edition, 2009.
- Ganesan. V, Internal Combustion Engines, Tata McGraw-Hill Publishing Co., New Delhi, Fourth Edition, 2012.

Reference Books :

- Heinz Heisler, Advance Vehicle Technology, Butterworth-Heinemann, London, Second Edition, 2002.
- Mathur M.L. and Sharma R.P, A Course in Internal Combustion Engines, Dhanpat Rai and sons, New Delhi, Second Edition, 2016.
- James Larminie and John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons, New York, Second Edition, 2012.
- William B Ribbens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth edition, 2017.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

20AU904

AUTOMOTIVE SAFETY

(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 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

20AU906

OFF HIGHWAY 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: 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 scrapers, 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, scrapers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNIT - III SCRAPERS, GRADERS, SHOVELS AND DITCHERS [09]

Scrapers, elevating graders, motor graders, self powered scrapers 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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the construction and requirement of off road vehicles.</i>	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO2	<i>Explain the different types of earth moving machines and explain the different sub systems.</i>	3	3	2	-	-	-	3	-	-	-	-	-	-	-
CO3	<i>Describe the specifications, functions, merits and demerits of different types and subsystems of scrapers, graders and ditchers.</i>	3	3	3	-	-	-	3	3	-	-	-	-	-	-
CO4	<i>Discuss the construction and working principle of farm equipment, military and combat vehicles.</i>	3	3	2	-	-	-	3	3	-	-	-	-	-	-
CO5	<i>Explain the vehicle systems and features.</i>	3	2	2	-	-	-	3	-	-	-	-	-	-	-
Average		3	3	2	-	-	-	3	3	-	-	-	-	-	-

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

Course Faculty

Module Coordinator

Chairman BoS / AE

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

R 2020

20AU907	MODERN AND INTELLIGENT VEHICLE SYSTEM (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 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 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 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.

CO PO MAPPING

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)

Course Faculty

Module Coordinator

Chairman BoS / AE

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.

CO PO MAPPING

CO	Course Outcomes	Programme Outcomes													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	<i>Describe the importance, types and requirements of vehicle maintenance and related records and schedules.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	<i>Practice the engine overhauling, reconditioning; methods, procedures, tools of power plants, ignition system, cooling system and other engine components.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO3	<i>Demonstrate the maintenance procedures of clutch, gear box, propeller shaft and steering systems.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO4	<i>Demonstrate the construction, testing, fault diagnosis and maintenance of body panel and body tinkering.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
CO5	<i>Describe the maintenance procedures of electrical systems.</i>	3	3	2	-	-	-	-	-	-	-	-	3	-	-
Average		3	3	2	-	-	-	-	-	-	-	-	3	-	-

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

Course Faculty

Module Coordinator

Chairman BoS / AE