HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)

COIMBATORE 641 032

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

H C E T

DEPARTMENT OF AUTOMOBILE ENGINEERING

REGULATION 2016

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

COIMBATORE - 641032

VISION OF THE INSTITUTION

IV1: To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values

MISSION OF THE INSTITUTION

IM1: To provide academic excellence in technical education through novel teaching methods

IM2: To empower students with creative skills and leadership qualities

IM3: To produce dedicated professionals with social responsibility

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

COIMBATORE - 641032

DEPARTMENT OF AUTOMOBILE ENGINEERING

VISION OF THE DEPARTMENT

DV1: To produce globally competent automobile engineers with technical expertise, innovative outlook and leadership skills to serve the society with moral values

MISSION OF THE DEPARTMENT

DM1: To create professionals with the ability to design, develop and progress with the latest technology in automotive sector

DM2: To inculcate creativity, innovation, leadership and entrepreneurship qualities required for the automotive industry

DM3: To foster social responsibility and ethical behaviour for the welfare of the society

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The graduates will be able to:

PEO1: Apply analytical and computational techniques to address the challenges in automotive industry

PEO2: Utilize their innovation, leadership skills and entrepreneurial skills to excel in their profession

PEO3: Exhibit professionalism, team spirit and pursue lifelong learning with social concern to achieve career and organizational goals

PROGRAMME SPECIFIC OUTCOMES (PSOs)

The graduates will be able to:

PSO1: Apply their technical knowledge and software proficiency with practical and social perspectives to succeed in the automotive sector.

PSO2: Solve technical challenges and produce realistic outcomes in engine management, transmission system, vehicle structure, hybrid and EV technology.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

PROGRAM OUTCOMES(PO) - DEFINED BY AICTE

PO's	Attributes	Description
PO 1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis	Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	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.
PO 4	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.
PO 5	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.
PO 6	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.
PO 7	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.
PO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	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.
PO 11	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.
PO 12	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.

REGULATION – 2016

B.E. AUTOMOBILE ENGINEERING

I TO VIII SEMESTER CURRICULUM AND SYLLABI

SEMESTER I

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16MA1101	Engineering Mathematics-I	HS	3	1	0	4	25	75	100
2	16PH1101	Engineering Physics	BS	3	0	0	3	25	75	100
3	16CY1101	Engineering Chemistry	BS	3	0	0	3	25	75	100
4	16HE1101R	Essential English for Engineers – I	HS	3	1	0	4	50	50	100
5	16GE1101	Computer Programming	ES	3	0	0	3	25	75	100
6	16GE1102	Engineering Graphics	ES	2	0	4	4	25	75	100
PRACTICAL										
7	16PS1001	Physical Sciences Laboratory - I	BS	0	0	2	1	50	50	100
8	16GE1001	Computer Programming Laboratory	ES	0	0	4	2	50	50	100
9	16GE1002	Engineering Practices Laboratory	ES	0	0	4	2	50	50	100
10	16GE1003	Value Added Course – I	EEC	0	0	2	1	0	100	100
Total :				**17**	2	**16**	**27**			**1000**

SEMESTER II

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16MA2102	Engineering Mathematics-II	HS	3	1	0	4	25	75	100
2	16PH2102	Physics of Materials	BS	3	0	0	3	25	75	100
3	16CY2102	Environmental Sciences	BS	3	0	0	3	25	75	100
4	16HE2102R	Essential English for Engineers - II	HS	3	1	0	4	50	50	100
5	16GE2101	Engineering Mechanics	ES	3	1	0	4	25	75	100

6	16EE2202	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
PRACTICAL										
7	16PS2001	Physical Sciences Laboratory - II	BS	0	0	2	1	50	50	100
8	16ME2001	Computer Aided Drafting Laboratory	ES	0	0	4	2	50	50	100
9	16GE2001	Value Added Course – II	EEC	0	0	2	1	0	100	100
Total :				**18**	**3**	**8**	**25**			**900**

SEMESTER III

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16MA3103	Fourier Analysis and Statistics	BS	3	1	0	4	25	75	100
2	16AU3201	Manufacturing Technology	PC	3	0	0	3	25	75	100
3	16AU3202	Engineering Thermodynamics	PC	3	1	0	4	25	75	100
4	16AU3203	Automotive Engines	PC	3	0	0	3	25	75	100
5	16AU3204	Strength of Materials	PC	3	0	0	3	25	75	100
6	16AU3205	Engineering Design and Drawing	PC	2	0	4	4	25	75	100
PRACTICAL										
7	16AU3001	Manufacturing Technology Laboratory	PC	0	0	4	2	50	50	100
8	16AU3002	Strength of Materials Laboratory	PC	0	0	4	2	50	50	100
9	16AU3701	Internship Training / Inplant Training	PC	0	0	0	2	0	100	100
Total				**17**	**2**	**11**	**27**			**900**

SEMESTER IV

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16MA4107	Numerical Methods	BS	3	1	0	4	25	75	100
2	16AU4201	Automotive Materials and Metallurgy	PC	3	0	0	3	25	75	100
3	16AU4202	Mechanics of Machines	PC	3	1	0	4	25	75	100
4	16AU4203	Thermal and Fluid Engineering	PC	3	0	0	3	25	75	100

5	16AU4204	Automotive Chassis	PC	3	0	0	3	25	75	100
6	16AU4205	Automotive Electrical and Electronics	PC	3	0	0	3	25	75	100
PRACTICAL										
7	16AU4001	Automotive Components Laboratory	PC	0	0	4	2	50	50	100
8	16AU4002	Thermal and Fluid Engineering Laboratory	PC	0	0	4	2	50	50	100
9	16AU4003	Automotive Electrical and Electronics Laboratory	PC	0	0	4	2	50	50	100
Total				**18**	**2**	**12**	**26**			**900**

SEMESTER V

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16AU5201	Vehicle Design and Data Characteristics	PC	3	0	0	3	25	75	100
2	16AU5202	Automotive Transmission	PC	3	0	0	3	25	75	100
3	16AU5203	Automotive Fuels and Lubricants	PC	3	0	0	3	25	75	100
4	16AU5204	Design of Machine Elements	PC	3	0	0	3	25	75	100
5	16AU5205	Automotive Engine Components Design	PC	3	0	0	3	25	75	100
6	16AU53xx	**Professional Elective - I**	PE	3	0	0	3	25	75	100
PRACTICAL										
7	16AU5001	Computer Aided Engine and Chassis Design Laboratory	PC	0	0	4	2	50	50	100
8	16AU5002	Automotive Fuels and Lubricants Laboratory	PC	0	0	4	2	50	50	100
Total				**18**	**0**	**8**	**22**			**800**

SEMESTER VI

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	16AU6201	Finite Element Analysis	PC	3	0	0	3	25	75	100
2	16AU6202	Automotive Chassis Components Design	PC	3	0	0	3	25	75	100
3	16AU6203	Vehicle Dynamics	PC	3	0	0	3	25	75	100
4	16AU6204	Two and Three Wheeler Technology	PC	3	0	0	3	25	75	100

5	16AU63XX	**Professional Elective – II**	PE	3	0	0	3	25	75	100
6	16XX64XX	**Open Elective – I**	OE	3	0	0	3	25	75	100
		PRACTICAL								
7	16AU6001	Two and Three Wheelers Laboratory	PC	0	0	4	2	50	50	100
8	16AU6002	Finite Element Analysis Laboratory	PC	0	0	4	2	50	50	100
9	16AU6801	Mini Project	EEC	0	0	6	3	50	50	100
		Total		**18**	**0**	**14**	**25**			**900**

SEMESTER VII

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	16AU7201	Engine and Vehicle Management Systems	PC	3	0	0	3	25	75	100
2	16AU7202	Professional Ethics	PC	3	0	0	3	25	75	100
3	16AU73XX	**Professional Elective – III**	PE	3	0	0	3	25	75	100
4	16AU73XX	**Professional Elective - IV**	PE	3	0	0	3	25	75	100
5	16XX74XX	**Open Elective – II**	OE	3	0	0	3	25	75	100
		PRACTICAL								
6	16AU7001	Engine Performance and Emission Testing Laboratory	PC	0	0	4	2	50	50	100
7	16AU7002	Vehicle Maintenance Laboratory	PC	0	0	4	2	50	50	100
		Total		**15**	**0**	**8**	**19**			**700**

SEMESTER VIII

S.No.	Course Code	Course Title	Course Category	L	T	P	C	CIA	ESE	TOTAL
		THEORY								
1	16AU83XX	**Professional Elective – V**	PE	3	0	0	3	25	75	100
2	16AU83XX	**Professional Elective - VI**	PE	3	0	0	3	25	75	100
		PRACTICAL								
3	16AU8901	Project Work	EEC	0	0	20	10	100	100	200

Total		**6**	**0**	**20**	**16**			**400**

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I									
1	16AU5301	Fundamentals of Computational Fluid Dynamics	3	0	0	3	25	75	100
2	16AU5302	Automotive Air – Conditioning	3	0	0	3	25	75	100
3	16AU5303	Alternative Fuels and Energy System	3	0	0	3	25	75	100
4	16AU5304	Noise, Vibration and Harshness	3	0	0	3	25	75	100
5	16AU5305	Fuel Cell Technology	3	0	0	3	25	75	100
6	16AU5306	Metrology and Instrumentation	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II									
1	16AU6301	Combustion Engineering	3	0	0	3	25	75	100
2	16AU6302	Rapid Prototyping, Tooling and Manufacturing	3	0	0	3	25	75	100
3	16AU6303	Robotics	3	0	0	3	25	75	100
4	16AU6304	Automotive Composite Materials	3	0	0	3	25	75	100
5	16AU6305	Manufacturing of Automotive Components	3	0	0	3	25	75	100
6	16AU6306	Computer Integrated Manufacturing Systems	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE III									
1	16AU7301	Design of Jigs, Fixtures and Press Tools	3	0	0	3	25	75	100
2	16AU7302	Entrepreneurship Development	3	0	0	3	25	75	100
3	16AU7303	Automotive Emission and Pollution Control	3	0	0	3	25	75	100
4	16AU7304	Advanced Theory of IC Engines	3	0	0	3	25	75	100
5	16AU7305	Vehicle Dealership Management	3	0	0	3	25	75	100
6	16AU7306	Operation Research	3	0	0	3	25	75	100

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE IV									
1	16AU7307	Automotive Sensor and Embedded Systems	3	0	0	3	25	75	100
2	16AU7308	Hydraulics and Pneumatics	3	0	0	3	25	75	100
3	16AU7309	Total Quality Management	3	0	0	3	25	75	100
4	16AU7310	Non Destructive Testing and Materials	3	0	0	3	25	75	100
5	16AU7311	Microprocessor Application in Automobiles	3	0	0	3	25	75	100
6	16AU7312	Vehicle Body Engineering	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE V									
1	16AU8301	Design for Manufacture and Assembly	3	0	0	3	25	75	100
2	16AU8302	Vehicle Concept Design and Styling	3	0	0	3	25	75	100
3	16AU8303	Off Road Vehicles	3	0	0	3	25	75	100
4	16AU8304	Engine Auxiliary Systems	3	0	0	3	25	75	100
5	16AU8305	Vehicle Trouble shooting and Maintenance	3	0	0	3	25	75	100
6	16AU8306	Unconventional Machining Processes	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE VI									
1	16AU8307	Supercharging and Scavenging	3	0	0	3	25	75	100
2	16AU8308	Reliability Concepts in Engineering	3	0	0	3	25	75	100
3	16AU8309	Principles of Management	3	0	0	3	25	75	100
4	16AU8310	New Generation and Hybrid Vehicles	3	0	0	3	25	75	100
5	16AU8311	Product Design and Development	3	0	0	3	25	75	100
6	16AU8312	Vehicle Transport Management	3	0	0	3	25	75	100

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
OPEN ELECTIVES(OE)									
1	16AU6401	Basics of Automobile Engineering	3	0	0	3	25	75	100
2	16AU7401	Automotive Safety	3	0	0	3	25	75	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	**Total**
Credits	27	25	27	26	22	25	19	16	**187**

Total Credits: 187

SEMESTER-WISE CREDIT DISTRIBUTION

S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	8	8	-		-		-	-	**11**
2	BSC	7	7	4	4	-	-	-	-	**20**
3	ESC	11	9		-	-	-	-	-	**15**
4	PCC	-	-	23	22	19	16	10	6	**64**
5	PEC	-	-	-	-	3	3	6	-	**18**
6	OEC	-	-	-	-	-	3	3	-	**12**
7	EEC	1	1				3		10	**25**
Total		**27**	**25**	**27**	**26**	**22**	**25**	**19**	**16**	**187**

PROGRAMME ARTICULATION MATRIX:

S.No	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	16MA1101	Engineering Mathematics-I	3.0	3.0	3.0	2.0	2.0	3.0	2.0					2.0	2.0	2.0
2	16PH1101	Engineering Physics	3.0	3.0	1.0	3.0	2.0	2.0	2.0			2.0			2.0	2.0
3	16CY1101	Engineering Chemistry	3.0	2.0	2.0	2.0	2.0	3.0	3.0			3.0		2.0	1.0	1.0
4	16HE1101R	Essential English for Engineers I	1.0	1.0	1.0	2.0		2.0	2.0			3.0		3.0	1.0	
5	16GE1102	Engineering Graphics	3.0	2.0	3.0		3.0					3.0		2.0	2.0	2.0
6	16GE1103	Problem solving and python programming	3.0	3.0	2.0	1.0	3.0	3.0			2.0	2.0		3.0	3.0	2.0
7	16PS1001	Physical Sciences Laboratory - I	2.0	1.0	2.0	2.0		2.0	3.0	2.0		3.0		3.0	2.0	2.0
8	16GE1002	Engineering Practices Laboratory	2.0	1.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0		3.0	2.0	2.0
9	16GE1004	Problem Solving and Python Programming Laboratory	3.0	3.0	3.0	3.0	3.0	3.0	3.0		2.0	3.0		3.0	3.0	3.0
10	16MA2102	Engineering Mathematics-II	3.0	3.0	3.0	2.0	3.0							2.0	2.0	2.0
11	16PH2102	Physics of Materials	3.0	3.0	2.0	2.0	3.0	2.0	2.0			3.0			2.0	3.0

12	16CY2102	Environmental Sciences	2.0	1.0	2.0			2.0	3.0	3.0		3.0		2.0	2.0	2.0
13	16HE2102R	Essential English for Engineers II	2.0	2.0	2.0	1.0	1.0	2.0				3.0		3.0	2.0	2.0
14	16GE2101	Engineering Mechanics	3.0	3.0	3.0	2.0		3.0	3.0			3.0		2.0	2.0	2.0
15	16EE2202	Basics of Electrical and Electronics Engineering	3.0	3.0	2.0	3.0	3.0	3.0	3.0			3.0		2.0	3.0	3.0
16	16PS2001	Physical Sciences Laboratory II	2.0	1.0	2.0	1.0		2.0	2.0	2.0	2.0	3.0		1.0	2.0	2.0
17	16ME2001	Computer Aided Drafting Laboratory	3.0	3.0	3.0	3.0	3.0	3.0	2.0		2.0	2.0		3.0	3.0	3.0
18	16MA3103	Fourier Analysis and Statistics	3.0	3.0	3.0	2.0	2.0	2.0						3.0	3.0	3.0
19	16AU3201	Manufacturing Technology	3.0	2.0	2.0	3.0	2.0	2.0	2.0			3.0		3.0	2.0	3.0
20	16AU3202	Engineering Thermodynamics	3.0	3.0	2.0	3.0	2.0		2.0			2.0		2.0	3.0	3.0
21	16AU3203	Automotive Engines	3.0	3.0	2.0	3.0	3.0	3.0	3.0			2.0		3.0	3.0	3.0
22	16AU3204	Strength of Materials	3.0	3.0	3.0	2.0						2.0		2.0	2.0	3.0
23	16AU3205	Engineering Design and Drawing	3.0	3.0	3.0	3.0	2.0					3.0		3.0	3.0	2.0
24	16AU3001	Manufacturing Technology Laboratory	2.0	1.0	2.0	2.0		2.0	3.0	3.0	2.0	3.0		3.0	3.0	3.0

25	16AU3002	Strength of Materials Laboratory	3.0	3.0	2.0	2.0					2.0	3.0		2.0	3.0	3.0
26	16MA4107	Numerical Methods	3.0	3.0	3.0	2.0	2.0	2.0						3.0	3.0	3.0
27	16AU4201	Automotive Materials and Metallurgy	3.0	2.0	2.0	2.0	2.0	2.0	2.0			2.0		3.0	3.0	2.0
28	16AU4202	Mechanics of Machines	3.0	3.0	3.0	2.0	3.0	3.0				3.0		1.0	2.0	3.0
29	16AU4203	Thermal and Fluid Engineering	3.0	3.0	2.0	2.0		2.0	2.0			1.0		2.0	3.0	3.0
30	16AU4204	Automotive Chassis	3.0	3.0	2.0	2.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
31	16AU4205	Automotive Electrical and Electronics	3.0	3.0	3.0	2.0	2.0	3.0	3.0			2.0		3.0	2.0	3.0
32	16AU4001	Automotive Components Laboratory	3.0	2.0	2.0	2.0	2.0	2.0	3.0			3.0		3.0	3.0	3.0
33	16AU4002	Thermal and Fluid Engineering Laboratory	3.0	3.0	3.0	3.0	2.0	2.0				3.0		2.0	2.0	2.0
34	16AU4003	Automotive Electrical and Electronics Laboratory	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0		3.0		3.0	3.0	3.0
35	16AU5201	Vehicle Design and Data Characteristics	3.0	3.0	3.0	3.0	2.0	3.0				2.0		2.0	2.0	3.0
36	16AU5202	Automotive Transmission	3.0	3.0	3.0	2.0	3.0	3.0	3.0			3.0		2.0	2.0	3.0
37	16AU5203	Automotive Fuels and Lubricants	3.0	3.0	2.0	3.0	2.0	2.0	3.0	2.0		3.0		2.0	3.0	2.0

38	16AU5204	Design of Machine Elements	3.0	3.0	3.0	3.0		3.0	2.0			2.0		2.0	3.0	3.0
39	16AU5205	Automotive Engine Components Design	3.0	3.0	3.0	2.0	3.0	3.0	2.0					3.0	3.0	2.0
40	16AU5302	Automotive Air Conditioning	3.0	3.0	3.0	1.0	2.0	3.0	3.0			3.0		1.0	3.0	3.0
41	16AU5001	Computer Aided Engine and Chassis Design Laboratory	3.0	3.0	3.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	3.0
42	16AU5002	Automotive Fuels and Lubricants Laboratory	3.0	3.0	2.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	2.0
43	16AU6201	Finite Element Analysis	3.0	3.0	3.0	3.0	2.0					2.0			2.0	3.0
44	16AU6202	Automotive Chassis Components Design	3.0	3.0	3.0	1.0		3.0	3.0			2.0		2.0	3.0	3.0
45	16AU6203	Vehicle Dynamics	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
46	16AU6204	Two and Three Wheeler Technology	3.0	3.0	2.0	3.0	1.0	3.0	3.0			2.0		3.0	3.0	3.0
47	16AU6303	Robotics	2.0	3.0	2.0	2.0	2.0	3.0	3.0			3.0		3.0	3.0	3.0
48	16AU6001	Two and Three Wheelers Laboratory	3.0	3.0	3.0	3.0	2.0	3.0	3.0			3.0		3.0	3.0	3.0
49	16AU6002	Finite Element Analysis Laboratory	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
50	16AU6801	Mini Project	3.0	3.0	2.0	3.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0

51	16AU7201	Engine and Vehicle Management Systems	3.0	3.0	2.0	2.0	3.0	3.0	2.0			2.0		3.0	3.0	3.0
52	16AU7202	Professional Ethics						2.0	2.0	3.0	3.0	3.0	3.0	2.0	1.0	1.0
53	16AU7302	Entrepreneurship Development	2.0	2.0	2.0	2.0	2.0			2.0		2.0		3.0	2.0	1.0
54	16AU7312	Vehicle Body Engineering	3.0	2.0	2.0	3.0	3.0	2.0				3.0		3.0	3.0	2.0
55	16AU7001	Engine Performance and Emission Testing Laboratory	3.0	2.0	3.0	3.0	2.0	3.0	3.0			1.0		3.0	3.0	3.0
56	16AU7002	Vehicle Maintenance Laboratory	3.0	3.0	2.0	3.0		3.0	3.0	2.0				3.0	3.0	3.0
57	16AU7701	Internship Training / Inplant Training	3.0	2.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0
58	16AU8306	Unconventional Machining	3.0	3.0	3.0	1.0	3.0	2.0	2.0			2.0		3.0	3.0	2.0
59	16AU8312	Vehicle Transport Management	3.0	2.0	1.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	2.0
60	16AU8901	Project Work	3.0	3.0	3.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	16AU5301	Fundamentals of Computational Fluid Dynamics	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
61	16AU5302	Automotive Air – Conditioning	3.0	3.0	2.0	3.0	1.0	3.0	3.0			2.0		3.0	3.0	3.0
62	16AU5303	Alternative Fuels and Energy System	2.0	3.0	2.0	2.0	2.0	3.0	3.0			3.0		3.0	3.0	3.0

63	16AU5304	Noise, Vibration and Harshness	3.0	3.0	3.0	3.0	2.0	3.0	3.0			3.0		3.0	3.0	3.0
64	16AU5305	Fuel Cell Technology	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
65	16AU5306	Metrology and Instrumentation	3.0	3.0	2.0	3.0	2.0	2.0	3.0	2.0		3.0		2.0	3.0	2.0
66	16AU6301	Combustion Engineering	3.0	3.0	3.0	1.0	3.0	2.0	2.0			2.0		3.0	3.0	2.0
67	16AU6302	Rapid Prototyping, Tooling and Manufacturing	3.0	3.0	2.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	2.0
68	16AU6303	Robotics	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
69	16AU6304	Automotive Composite Materials	3.0	3.0	3.0	3.0	2.0					2.0			2.0	3.0
70	16AU6305	Manufacturing of Automotive Components	3.0	3.0	3.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
71	16AU6306	Computer Integrated Manufacturing Systems	3.0	3.0	3.0	2.0	2.0	3.0	3.0			2.0		3.0	2.0	3.0
72	16AU7301	Design of Jigs, Fixtures and Press Tools	3.0	3.0	2.0	2.0	3.0	3.0	2.0			2.0		3.0	3.0	3.0
73	16AU7302	Entrepreneurship Development	3.0	3.0	3.0	1.0	3.0	2.0	2.0			2.0		3.0	3.0	2.0
74	16AU7303	Automotive Emission and Pollution Control	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0		3.0		3.0	3.0	3.0
75	16AU7304	Advanced Theory of IC Engines	3.0	3.0	2.0	2.0	3.0	3.0	2.0			2.0		3.0	3.0	3.0

76	16AU7305	Vehicle Dealership Management	3.0	3.0	3.0	1.0	3.0	2.0	2.0			2.0		3.0	3.0	2.0
77	16AU7306	Operation Research	3.0	3.0	2.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	2.0
78	16AU7307	Automotive Sensor and Embedded Systems	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
79	16AU7308	Hydraulics and Pneumatics	3.0	3.0	3.0	2.0	2.0	3.0	3.0			2.0		3.0	2.0	3.0
80	16AU7309	Total Quality Management	3.0	3.0	2.0	2.0	3.0	3.0	2.0			2.0		3.0	3.0	3.0
81	16AU7310	Non Destructive Testing and Materials	3.0	3.0	3.0	1.0	3.0	2.0	2.0			2.0		3.0	3.0	2.0
82	16AU7311	Microprocessor Application in Automobiles	3.0	3.0	2.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	2.0
83	16AU7312	Vehicle Body Engineering	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
84	16AU8301	Design for Manufacture and Assembly	3.0	3.0	3.0	3.0	2.0					2.0			2.0	3.0
85	16AU8302	Vehicle Concept Design and Styling	3.0	3.0	3.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
86	16AU8303	Off Road Vehicles	3.0	3.0	3.0	2.0	2.0	3.0	3.0			2.0		3.0	2.0	3.0
87	16AU8304	Engine Auxiliary Systems	3.0	3.0	2.0	2.0	3.0	3.0	2.0			2.0		3.0	3.0	3.0
88	16AU8305	Vehicle Trouble shooting and Maintenance	3.0	3.0	3.0	1.0	3.0	2.0	2.0			2.0		3.0	3.0	2.0

89	16AU8306	Unconventional Machining Processes	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0		3.0		3.0	3.0	3.0
90	16AU8307	Supercharging and Scavenging	3.0	3.0	2.0	2.0	3.0	3.0	2.0			2.0		3.0	3.0	3.0
91	16AU8308	Reliability Concepts in Engineering	3.0	3.0	3.0	1.0	3.0	2.0	2.0			2.0		3.0	3.0	2.0
92	16AU8309	Principles of Management	3.0	3.0	2.0	3.0	3.0	3.0	3.0			3.0		3.0	3.0	2.0
93	16AU8310	New Generation and Hybrid Vehicles	3.0	3.0	3.0	3.0	2.0	3.0	3.0			2.0		3.0	3.0	3.0
94	16AU8311	Product Design and Development	3.0	3.0	2.0	3.0	3.0	3.0	3.0	2.0		3.0		3.0	3.0	3.0
95	16AU8312	Vehicle Transport Management	3.0	3.0	2.0	2.0	3.0	3.0	2.0			2.0		3.0	3.0	3.0

16MA1101	ENGINEERING MATHEMATICS – I (COMMON TO ALL BRANCHES)	L	T	P	C
		3	1	0	4

Course Objectives

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Find curvature, evolutes and envelopes using the concept of differentiation.
3. Solve ordinary differential equations of certain types using Wronskian technique.
4. Familiarize the functions of several variables which are needed in many branches of engineering.
5. Learn the concept of double and triple integrals.

UNIT I MATRICES (12)

Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley - Hamilton Theorem (excluding proof) – Orthogonal matrices – Diagonalization of matrices by orthogonal transformation–Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS (12)

Curvature in cartesian co-ordinates – Radius and Centre of curvature - Circle of curvature – Involutes and Evolutes(parabola, ellipse, cycloid, asteroid) – Envelopes - single parameter and two parameter family of curves.

UNIT III ORDINARY DIFFERENTIAL EQUATIONS (12)

Second and higher order linear differential equations with constant coefficients and with RHS of the form e^{ax} , x^n, sinax or cosax , $e^{ax}f(x)$ and $xf(x)$ where $f(x)$ is sinbx or cosbx – Method of variation of parameters – Linear differential equations with variable coefficients (Euler's equation).

UNIT IV FUNCTIONS OF SEVERAL VARIABLES (12)

Total differentiation (excluding implicit functions) - Partial derivatives of composite functions - Taylor's series for functions of two variables- Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers – Jacobians.

UNIT V MULTIPLE INTEGRALS (12)

Double integrals in Cartesian coordinates – Change of order of integration – Area enclosed by the plane curves (excluding surface area) – Triple integrals in Cartesian co-ordinates – Volume of solids using Cartesian co-ordinates.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibration modes.

CO2: Apply the concept of differentiation to find the radius, centre and circle of curvature of any curve

CO3: Develop sound knowledge of techniques in solving ordinary differential equations that model engineering problems

CO4: Identify the maximum and minimum values of surfaces.

CO5: Computation of area of a region in simpler way by changing the order of integration and evaluation of triple integrals to compute volume of three dimensional solid structures.

Text Books

T1 Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.

T2 Veerarajan T, "Engineering Mathematics–I", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

References

R1 Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.

R2 Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

R3 Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

R4 Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol I, Second Edition, Pearson publishing,

R5 Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	2	2	1	1	1	1	1	1	2	2	2
CO 2	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO 3	3	3	3	3	3	1	1	1	1	1	1	2	1	2
CO 4	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO 5	3	3	3	2	3	1	1	1	1	1	1	2	2	2
AVG	3	3	3	2.6	2.8	1	1	1	1	1	1	2	1.8	1.6

16PH1101	ENGINEERING PHYSICS (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

Course Objectives

1. Illustrate the fundamental knowledge in mechanical properties of matter and thermal physics.
2. Gain knowledge about laser and their applications.
3. Conversant with principles of optical fiber, types and applications of optical fiber.
4. Discuss the architectural acoustics and applications of Ultrasonics.
5. Extend dual nature of matter and the Necessity of quantum mechanics to explore the behavior of sub atomic particles.

UNIT I PROPERTIES OF MATTER AND THERMAL PHYSICS (9)

Elasticity – Hooke's law – Stress-strain diagram - Relation between three modulii of elasticity (qualitative) — Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending – I-shaped girder. Modes of heat transfer – Thermal conductivity – Newton's law of cooling - Lee's disc method - Conduction through compound media (series and parallel).

UNIT II LASER AND APPLICATIONS (9)

Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO2 laser, Semiconductor lasers:(homojunction and heterojunction) – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.

UNIT III FIBER OPTICS AND APPLICATIONS (9)

Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication link –Fiber optic sensors – Temperature and displacement sensors.

UNIT IV ACOUSTICS AND ULTRASONICS (9)

Classification of sound – Weber–Fechner law – Sabine's formula (no derivation) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulse echo system.

UNIT V QUANTUM PHYSICS AND APPLICATIONS (9)

Black body radiation – Planck's theory (derivation) –Compton effect experimental verification only - Matter waves – Physical significance of wave function – Schroedinger's wave equations – Time independent and time dependent wave equations –Particle in a box (One dimensional) – Scanning electron microscope – Transmission electron microscope.

Course Outcomes

At the end of this course students will be able to:

CO1: Enhance the fundamental knowledge in Properties of Matter and Thermal Physics.
CO2: ULearn the advanced technology of LASER in the field of Engineering and medicine.
CO3: Exposed the fundamental knowledge of Optical fiber in the field of communication Engineering.
CO4: Learn the production of ultrasonics and its applications in NDT.
CO5: Impart the fundamental knowledge on Quantum Physics.

Text Books

T1 Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
T2 Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications(P)Ltd., New Delhi, 2013.

References

R1 Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2010.
R2 M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2014.
R3 Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2013.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	1	1	2	2	1
CO 2	3	3	1	1	2	1	1	1	1	1	1	2	2	1
CO 3	3	2	1	2	2	1	1	1	1	1	1	2	2	1
CO 4	3	2	3	2	3	1	1	1	1	1	1	2	2	1
CO 5	3	2	3	2	2	2	1	1	1	1	1	2	2	1
AVG	3	2.2	2	1.6	2	1.2	1	1	1	1	1	2	2	1

16CY1101	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

Course Objectives

1. The student should be conversant with boiler feed water requirements, related problems and water treatment techniques.
2. The student should be conversant with the principles of polymer chemistry and engineering applications of polymers and composites
3. The student should be conversant with the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
4. To acquaint the student with important concepts of spectroscopy and its applications.
5. To acquaint the students with the basics of nano materials, their properties and applications

UNIT I WATER TECHNOLOGY (9)

Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, calculations, estimation of hardness of water – EDTA method - scales and sludges – boiler corrosion – priming and foaming – caustic embrittlement; Conditioning methods of hard water – External conditioning - demineralization process- Internal conditioning - domestic water treatment: screening, sedimentation, coagulation, filtration, disinfection – chlorine – UV method; desalination: definition, reverse osmosis.

UNIT II POLYMER & COMPOSITES (9)

Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Teflon – moulding of plastics (extrusion and compression); rubber: vulcanization of rubber, synthetic rubber – butyl rubber, SBR; composites: definition, types of composites – polymer matrix composites – FRP.

UNIT III ENERGY SOURCES AND STORAGE DEVICES (9)

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.

UNIT IV ANALYTICAL TECHNIQUES (9)

Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – interferences - estimation of nickel by atomic absorption spectroscopy.

UNIT V NANOMATERIALS (9)

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: definition, carbon nanotubes (CNT), types of carbon nano tubes – single walled and multi walled carbon nanotubes – synthesis of carbon nanotubes: chemical vapour deposition – laser ablation – arc-discharge method; properties of CNT: mechanical, electrical, thermal and optical properties; applications of carbon nanotubes in chemical field, medicinal field, mechanical field and current applications.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Illustration of the basic parameters of water, different water softening processes and effect of hard water in industries.

CO2: Knowledge on basic properties and application of various polymers and composites as an engineering material.

CO3: Summarize the various energy sources and energy storage devices

CO4: Analyze various analytical skills in handling various machines, instruments, apart from Learning the mechanism involved.

CO5: Describe the basic properties and application of nanomaterials.

Text Books

T1 P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2015).

T2 O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

References

R1 B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

R2 B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2005).

R3 S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2010).

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	2	1	1	1	1	1	1	1	1	1
CO 2	3	2	2	1	2	1	1	1	1	1	1	1	1	1
CO 3	3	2	2	1	2	1	1	1	1	1	1	1	1	1
CO 4	3	2	2	2	2	1	1	1	1	1	1	1	1	1
CO 5	3	2	2	1	2	1	1	1	1	1	1	1	1	1
AVG	3	2	2	1.2	2	1	1	1	1	1	1	1	1	1

16HE1101R	ESSENTIAL ENGLISH FOR ENGINEERS – I (COMMON TO ALL BRANCHES)	L	T	P	C
		3	1	0	4

Course Objectives

1. It fulfills the necessary skills needed in today's global workplaces.
2. Student will be able to interpret and illustrate formal communication.
3. It empowers students in choosing right lexical techniques for effective presentation
4. It equips the learner to analyze and list out things in logical order
5. The learner develops the ability to create and integrate ideas in a professional way.

UNIT I **(12)**

Getting to know people – Introduction – Talking about jobs (Present Simple) – Talking about working conditions(Adverb of Frequency) - Talking about company history and structure (Past simple, Prepositions of Time) – Talking about company activities (Connectors of addition and contrast, Present Continuous) – Focus on language – Parts of Speech – Gerund and Infinitives – Instruction-**General Vocabulary**.

UNIT II **(12)**

Vocabulary practice – (Telephoning Leaving and taking messages) – requests and obligation – Describing trends (Adjectives and Adverbs) – Talking about company performance (present perfect and past simple, Reasons and consequences) – Reading Test Practice Describing products Dimensions, (Comparatives and Superlatives, Question formation) – Talking about product development (Sequencing words, Present continuous and going to) – Articles – Prepositions- Synonyms – Antonyms- Recommendations-**Interpretation of a chart**.

UNIT III **(12)**

Talking about business equipment (Giving Instruction) – Letter Phrases- Writing Test Practice- Talking about facilities(Asking for and giving direction)- Presentation on a general topic -Talking about traffic and transport(making predictions)-**Discussion on current affairs**– Tenses- Present –Past-Future-Forms of verbs- Word techniques-Formation-Prefixes-Suffixes.

UNIT IV **(12)**

Talking about conference arrangement(checking and confirming) – Talking about a conference before, after, when, until etc. – Listening Test Practice- talking about production process – passive- Talking about quality control Conditional 1 (real) (Making suggestions) – Itinery- Jumbled sentences- Paragraph writing- Essay writing – Checklist- Letter to Inviting Dignitaries – Accepting invitation- Declining Invitation.

UNIT V **(12)**

Talking about call centers, insurance and changes in working practices (future possibility/probability)- Talking about banking- Speaking Test practice – Talking about delivery services (preposition of Time)- Talking about trading (Tense review)- Talking about recruitment conditional 2 (hypothetical) – talking about job applications (indirect questions) – Reading, Writing and Listening Test – Job application Letter and Resume Writing- Permission letters.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:
Recognize different parts of speech for better usage.
Interpret and illustrate formal communication
Choosing right lexical techniques for effective presentation.
Analyze and list out things in logical order.
Create and integrate ideas in a professional way.

Text Books

Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

References

Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.
Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO 2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO 3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO 4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO 5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Avg	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16GE1101	COMPUTER PROGRAMMING (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

Course Objectives

1. Learn the fundamentals of computers.
2. Learn the basics of C programming

UNIT I BASICS OF COMPUTER (9)

Generation and Classification of Computers- Basic Organization of a Computer –Input and Output Devices–Hardware and Software definitions- Categories of Software- Number System Conversion. Need for logical analysis and thinking – Algorithm -Pseudo code – Flow Chart.

UNIT II BASICS OF 'C' PROGRAMMING (9)

Fundamentals of ' C' programming – Structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types –Expressions using operators in 'C' – Managing Input and Output operations-Decision making-Branching and Looping-Case study.

UNIT III ARRAYS AND STRINGS (9)

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String Library functions – String Arrays. Matrix operations-Addition-Subtraction-Multiplication-Transpose-Case study.

UNIT IV FUNCTIONS AND POINTERS (9)

Function – definition – Declaration – Types of Function definition – call by value-call by reference- Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays-Case study.

UNIT V STRUCTURES AND UNIONS (9)

Structure- data type – definition – declaration –Nesting of structure - Union – Storage classes, Pre-processor directives-Case study.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Use computers at user level, including operating systems, programming environments and differentiate between basic concepts of computer hardware and software.
CO2: Analyze problems, design and implementing algorithmic solutions.
CO3: Use data representation for the fundamental data types, read, Learn and trace the execution of programs written in C language.
CO4: Write the C code using a modular approach and recursive concepts.
CO5: Explain the use of pointers, Structures and union.

Text Books

T1 Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
T2 Dr.N.Sengottaiyan and K.Ramya, "Fundamentals of Computer Programming",Cengage Learning (India) Pvt. Ltd.,2016.

References

R1 Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.
R2 Balagurusamy"Programming in ANSI C", 6th Edition ,Tata McGraw-Hill,
R3 M.Rajaram and P.Uma maheswari, "Computer Programming with C" Dorling Kindersley (India) Pvt. Ltd., Education in South Asia, 2014.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	1	1	1	1	1	1	2	2	3	3
CO 2	3	3	2	1	1	1	1	1	1	1	1	2	2	3
CO 3	3	3	2	1	1	1	1	1	1	1	1	2	2	3
CO 4	3	3	1	1	1	1	1	1	1	1	1	2	2	3
CO 5	3	1	1	1	1	1	1	1	1	1	1	1	2	1
AVG	3	2.6	1.4	1	1	1	1	1	1	1	1	1.8	2.2	2.6

16GE1102	ENGINEERING GRAPHICS (COMMON TO ALL BRANCHES)	L	T	P	C
		2	0	4	4

Course Objectives

1. To provide drafting skills for communicating the Engineering concepts and ideas.
2. To expose to BIS and International standards related to engineering drawings.

UNIT I PLANE CURVES (15)

Importance of engineering drawing, drafting instruments, drawing sheets – layout and folding, Lettering and dimensioning, BIS standards and scales. Geometrical constructions, Construction of ellipse, parabola and Hyperbola by eccentricity method, construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II PROJECTIONS OF POINTS, LINES AND PLANE SURFACES (15)

Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).

UNIT III PROJECTIONS OF SOLIDS (15)

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane and objects inclined to both the planes by rotating object method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES (15)

Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids. Intersection of solids-cylinder vs cylinder.

UNIT V ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS (15)

Isometric views and projections of simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Perspective projection of solids in simple position using visual ray method.

TOTAL: 75 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Draw the orthographic and isometric views of regular solid objects including sectional views.

CO2: Recognize the International Standards in Engineering Drawing practices.

Text Books

T1 K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th Edition New Age International Publishers, New delhi 2016.

T2 K.V.Natarajan, "A textbook of Engineering Graphics", Dhanalaksmi Publishers, Chennai.

References

R1 Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited,New Delhi 2008.

R2 K. R. Gopalakrishnan, "Engineering Drawing" (Vol. I & II), Subhas Publications, Bangalore, 1998.

R3 M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson Education, India, 2005.

R4 N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University press, India 2015.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO 2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO 3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO 4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO 5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
AVG	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

16PS1001	PHYSICAL SCIENCES LABORATORY – I (COMMON TO ALL BRANCHES)	L	T	P	C
		0	0	2	1

Course Objectives

1. Evaluate the particle size of micro particles and acceptance angle of fibres.
2. Employ instrumental method to determine Young's modulus of a beam of metals.
3. Apply the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum

Expt. No.	Description of the Experiments
1.	Determination of Wavelength, and particle size using Laser.
2.	Determination of acceptance angle and numerical aperature in an optical fiber.
3.	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4.	Determination of wavelength of mercury spectrum – spectrometer grating.
5.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
6.	Determination of Young's modulus by Non uniform bending method
7.	Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
8.	Post office box Measurement of an unknown resistance

TOTAL: 30 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Point out the particle size of micro particles and acceptance angle of fibres using diode laser.

CO2: Assess the Young's modulus of a beam using non uniform bending methods.

CO3: Illustrate the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum Using spectrometer.

CO4: Identify the velocity of ultrasonic's in the given liquid.

CO5: Illustrate phenomena of thermal conductivity of a bad conductor.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO 2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO 3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO 4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO 5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
AVG	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

16GE1001	COMPUTER PROGRAMING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1. Be familiar with Microsoft office software
2. Be familiar with the basic concepts of writing a program.
3. Be exposed to role of constants, variables, identifiers, operators and other building blocks of C Language.
4. Be familiar with the use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
5. Be familiar with the concept of Array and pointers dealing with memory management.
6. Be exposed to Structures and unions

Expt. No. **Description of the Experiments**

1. **Word Processing:**
    1. Document creation, Text manipulation with Scientific notations
    2. Table creation, Table formatting and conversion
    3. Mail merge and Letter preparation.
    4. Flow Chart
2. **Spread Sheet:**
    1. Chart - Line, XY, Bar and Pie.
    2. Formula - formula editor.
    3. Spread sheet - inclusion of object, picture and graphics, protecting the document and sheet.
    4. Sorting and Import / Export features.
3. **Basic C programming:**
    1. C program using I/O Statements
    2. C program using arithmetic operations
    3. Decision making statement & Looping Concepts
        - Designing a simple arithmetic calculator. (Use switch statement)
        - Performing the following operations: (Use loop statement)
        - Generate Pascal's triangle.
        - Construct a Pyramid of numbers.
4. **Arrays and Strings**
    1. C program using one dimensional arrays.
    2. C program using two dimensional arrays.
    3. C program using string functions.
5. **Functions and pointers**
    1. Perform the following operations: (Use recursive functions)
        i. Find the factorial of a given integer.
        ii. Find the GCD (Greatest Common Divisor) of two given integers.
        iii. Solve Towers of Hanoi problem.
    2. Program to swap two numbers using pointers - call by reference.
6. **Structures and Unions**
    1. C Program using Structures
    2. C Program using Unions

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Use office packages for documentation and presentation
CO2: Implement program using control structures
CO3: Handle arrays and strings

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO 2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO 3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO 4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO 5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
AVG	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

16GE1002	ENGINEERING PRACTICES LABORATORY (COMMON TO ALL BRANCHES)	L	T	P	C
		0	0	4	2

Course Objectives

1. To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

S. NO	DESCRIPTION OF THE EXPERIMENTS	TOTAL PRACTICAL HOURS
	I CIVIL ENGINEERING PRACTICE	
	Study of plumbing and carpentry components of Residential and Industrial buildings.	
	(A) PLUMBING WORKS:	
1	Study on pipe joints, its location and functions: Valves, taps, couplings, unions, reducers, elbows in household fittings.	
2	Study of pipe connection requirements for pumps.	
3	Preparation of plumbing line sketches for water supply and sewage works.	
	Hands-on-exercise:	9
4	➢ Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.	
5	Demonstration of plumbing requirements of high-rise buildings.	
	(B) CARPENTRY USING POWER TOOLS ONLY:	
1	Study of the joints in roofs, doors, windows and furniture.	
2	Hands-on-exercise in wood works by sawing, planning and cutting.	
	II MECHANICAL ENGINEERING	
	(A) Welding:	
1	Preparation of arc welding of Butt joints, Lap joints and Tee joints	
	(B) Machining:	
1	Practice on Simple step turning and taper turning	
2	Practice on Drilling Practice	
	(C) Sheet Metal Work:	13
1	Practice on Models– Trays, cone and cylinder.	
	DEMONSTRATION	
	(D) Smithy	
	➢ Smithy operations: Upsetting, swaging, setting down and bending.	
	➢ Demonstration of – Production of hexagonal headed bolt.	
	(E) Gas welding	
	(F) Foundry Tools and operations.	

GROUP B (ELECTRICAL & ELECTRONICS)

S.NO	DESCRIPTION OF THE EXPERIMENTS	TOTAL PRACTICAL HOURS
ELECTRICAL ENGINEERING PRACTICES		
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.	
2	Fluorescent lamp wiring	10
3	Stair case wiring.	
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.	
5	Measurement of energy using single phase energy meter.	
ELECTRONICS ENGINEERING PRACTICES		
1	Study of Electronic components and equipments – Resistors - colour coding	
2	Measurement of DC signal - AC signal parameters (peak-peak, RMS period, frequency) using CRO.	
3	Study of logic gates AND, OR, NOT and NAND .	13
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.	
5	Measurement of average and RMS value of Half wave and Full Wave rectifiers.	

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Fabricate wooden components and pipe connections including plumbing works.
CO2: Fabricate simple weld joints.
CO3: Fabricate electrical and electronics circuits.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	3	1	1	1	1
CO 2	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO 3	3	2	3	1	2	1	1	1	1	2	1	1	1	2
CO 4	3	2	3	1	2	1	1	1	1	2	1	1	2	2
CO 5	3	2	3	1	2	1	1	1	1	2	1	1	2	2
AVG	3	2	2.6	1	1.6	1	1	1	1	2.2	1	1	1.4	1.6

	VALUE ADDED COURSE-I (COMMON TO ALL BRANCHES)	L 0	T 0	P 2	C 1
Topic No.	**Description of the Experiments**				
1.	INTRODUCTION TO AERONAUTICAL ENGINEERING				
2.	LEADERSHIP FOR ENGINEERS				
3.	4G – NETWORK ESSNTIALS				
4.	COMP. SCIENCE ESSENTIALS FOR SOFTWARE DEVELOPMENT				
5.	INTRODUCTION TO ANALYTICS MODELLING				
6.	MATERIAL SCIENCE AND ENGINEERING				
	Total Marks	100			

16 MA2102	ENGINEERING MATHEMATICS – II (COMMON TO ALL BRANCHES)	L	T	P	C
		3	1	0	4

Course Objectives

1. Learn the basics of vector calculus comprising gradient, divergence, Curl and line, surface, volume integrals.
2. Learn analytic functions of complex variables and conformal mappings.
3. Know the basics of residues, complex integration and contour integration.
4. Apply Laplace transform techniques to solve linear differential equations.
5. Know the effective mathematical tools for the solutions of partial differential equations that model several physical problems in mathematical physics

UNIT I VECTOR CALCULUS (12)

Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT II ANALYTIC FUNCTIONS (12)

Analytic function - Cauchy-Riemann equations - sufficient conditions (excluding proof) – Harmonic - conjugate harmonic functions– Construction of analytic functions (Milne-Thompson method) – Conformal mapping: w = z+c, cz, 1/z and bilinear transformation without problems related to the concept of conformal mapping.

UNIT III COMPLEX INTEGRATION (12)

Complex integration – Statements of Cauchy's integral theorem – Taylor's and Laurent's series expansions - Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle.

UNIT IV LAPLACE TRANSFORM (12)

Laplace transform –Basic properties – Transforms of derivatives and integrals of functions - Transforms of unit step function and impulse function – Transform of periodic functions. Inverse Laplace transform - Convolution theorem (with out proof) – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS (12)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions-Solution of standard types of first order partial differential equations of the form f(p,q) = 0, Clairaut's type: z = px + qy + f(p, q) – Lagrange's linear equation- Linear homogeneous partial differential equations of second and higher order with constant coefficient.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Know the gradient, divergence and curl of vectors useful for engineering application like fluid flow, electricity and magnetism.

CO2: Test the analyticity to construct the analytic function and transform complex functions from one plane to another plane graphically.

CO3: Evaluate real and complex integrals over suitable closed paths or contours.

CO4: Know the applications of Laplace transform and its properties and to solve certain linear differential equations using Laplace transform technique.

CO5: Solve the engineering problems using Partial Differential Equations.

Text Books

T1 Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.

T2 Veerarajan T, "Engineering Mathematics–II", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

References

R1 Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi Pub. Pvt. Ltd. 2011.

R2 Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

R3 Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

R4 Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol II, Second Edition, publishing, 2011.

R5 Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	2	2	1	1	1	1	1	1	2	2	2
CO 2	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO 3	3	3	3	3	3	1	1	1	1	1	1	2	1	2
CO 4	3	3	3	3	3	1	1	1	1	1	1	2	2	1
CO 5	3	3	3	2	3	1	1	1	1	1	1	2	2	2
AVG	3	3	3	2.6	2.8	1	1	1	1	1	1	2	1.8	1.6

16PH2102	PHYSICS OF MATERIALS (COMMON TO ALL BRANCHES)	L	T	P	C
		3	0	0	3

Course Objectives

1. Gain knowledge about conducting materials.
2. Provide fundamental knowledge of semiconducting materials which is related to the engineering program
3. Extend the properties of magnetic materials, applications and super conducting materials.
4. Defend the various types of dielectric materials and their uses.
5. Expose the students to smart materials and the basis of nano technology.

UNIT I CONDUCTING MATERIALS (9)

Introduction – Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS (9)

Introduction – Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors –direct and indirect band gap of semiconductors- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC & SUPERCONDUCTING MATERIALS (9)

Magnetic Materials: Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. **Superconducting Materials :** Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC & COMPOSITES MATERIALS (9)

Introduction – Electrical susceptibility – dielectric constant – polarization - electronic, ionic, orientation and space charge polarization –internal field – Claussius – Mosotti relation (derivation) – dielectric loss and dielectric breakdown (qualitative)

Introduction to composites materials – types of composites materials – polymer, metallic and ceramic matrix composites (qualitative). Application in surgery, sports equipment.

UNIT V SMART MATERIALS AND NANOTECHNOLOGY (9)

New Engineering Materials: Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications.

Nano Materials: Synthesis - plasma arcing – Chemical vapour deposition – properties of nanoparicles and applications. – Carbon nano tubes – fabrication – pulsed laser deposition - Chemical vapour deposition - properties & applications.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Illustrate the electrical / thermal conductivity of conducting materials.

CO2: Learn the purpose of the acceptor or donor levels and the band gap of a semiconductor.

CO3: Interpret the basic idea behind the process of magnetism and applications of magnetic materials in every day life

CO4: Identify and compare the various types of dielectric polarization and dielectric breakdown

CO5: Evaluate the properties and applications of various advanced engineering materials and develop the new ideas to synthesis Nanomaterials

Text Books

T1 S.O.Pillai "Solid State Physics" New Age International Publishers, New Delhi – 2011.

T2 Rajendran V "Materials Science" McGraw-Hill Education" New Delhi -2016.

References

R1 William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2014.

R2 Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2016.

R3 Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2013.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	1	1	2	2	1
CO 2	3	3	1	1	2	1	1	1	1	1	1	2	2	1
CO 3	3	2	1	2	2	1	1	1	1	1	1	2	2	1
CO 4	3	2	3	2	3	1	1	1	1	1	1	2	2	1
CO 5	3	2	3	2	2	2	1	1	1	1	1	2	2	1
AVG	3	2.2	2	1.6	2	1.2	1	1	1	1	1	2	2	1

16CY2102	ENVIRONMENTAL SCIENCES (COMMON TO AERO, AUTO, CSE, ECE, EEE, E&I, IT, MECH, MECT)	L	T	P	C
		3	0	0	3

Course Objectives

1. To gain knowledge on the importance of environmental education, ecosystem and biodiversity.
2. To acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. To find and implement scientific, technological, economic and political solutions to environmental problems.
4. To study about the natural resources, exploitation and its conservation
5. To be aware of the national and international concern for environment and its protection.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY (9)

Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION (9)

Definition – causes, effects and control measures of: Air pollution – Air pollution standards – control methods- Water pollution – Water quality parameters- Soil pollution - Marine pollution - Noise pollution- Thermal pollution - Nuclear hazards–role of an individual in prevention of pollution – pollution case studies**.**

UNIT III NATURAL RESOURCES (9)

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and Desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT (9)

From unsustainable to sustainable development – urban problems related to energy- energy conversion – electrical energy calculations- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Current Environmental issues at Country level – management of municipal sewage, municipal solid waste, Hazardous waste and Bio-medical waste – Global issues –Climatic change, Acid rain, greenhouse effect and Ozone layer depletion. Disaster management: floods, earthquake, cyclone and landslides.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT (9)

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Learn the natural environment and its relationships with human activities.

CO2: Characterize and analyze human impacts on the environment

CO3: Apply systems concepts and methodologies to analyze and Learn interactions between social and environmental processes

CO4: Reflect critically about their roles and identities as citizens, consumers and environmental factors in a complex, interconnected world

CO5: Learn and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.

Text Books

T1 Anubha Kaushik and C. P. Kaushik, "Environmental Science and Engineering", Fourth edition, New Age International Publishers, New Delhi, 2014.

T2 Deeksha Dave and S.S.Katewa, "Textbook of Environmental Studies", Second Edition, Cengage Learning, 2012.

References

R1 Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.

R2 G.Tyler Miller, Jr and Scott E. Spoolman "Environmental Science" Thirteenth Edition, Cengage Learning, 2010.

R3 Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	1	1	2	2	1
CO 2	3	3	1	1	2	1	1	1	1	1	1	2	2	1
CO 3	3	2	1	2	2	1	1	1	1	1	1	2	2	1
CO 4	3	2	3	2	3	1	1	1	1	1	1	2	2	1
CO 5	3	2	3	2	2	2	1	1	1	1	1	2	2	1
AVG	3	2.2	2	1.6	2	1.2	1	1	1	1	1	2	2	1

16HE2102R	ESSENTIAL ENGLISH FOR ENGINEERS – II (COMMON TO ALL BRANCHES)	L	T	P	C
		3	1	0	4

Course Objectives

1. The learner will be introduced to global corporate culture and professional communication.
2. It helps the students to focus on organizing professional event and documentation.
3. The student will be able to describe the events and process in an effective way.
4. It trains the student to analyze the problems and to find solution to it.
5. The learner will be familiar with business communication.

UNIT I **(12)**

Introduction- talking about teamwork- Making arrangements- Improving Communication in spoken language – Taking and leaving Voice mail messages (present Tense, Past Tense and Present Perfect) Talking about Business Hotel- (Speaking Activity) Talking about Corporate Hospitality- Formal and Informal Language – Making accepting and declining invitations (Auxiliary Verb, Countable or Uncountable Nouns) – Focus on Language – Definitions and Extended Definitions-**Reading**

UNIT II **(12)**

Talking about orders – Clarity Written Language – Phone and Letter Phrases – Talking about Company Finances – Conditional 1 and 2 – Managing Cash Flow (Intention and Arrangements Conditional 1 and 2) – Talking about Brands and Marketing – Ethical Banking- Talking about Public Relations – Organizing a PR Event – Describing Duties and Responsibilities – (Future Tense and Articles) – Reported Speech – Modal Verbs and Passive, Impersonal Passive Voice-**interpretation of posters or advertisements.**

UNIT III **(12)**

Talking about relocation – Report Phrases – Talking about Similarity and difference- Giving Directions- Asking for Information and Making Suggestions – Talking about Location (Comparatives and Superlatives, Participles) – Talking about Company Performances- Describing Trends – Describing Cause and Effect – Talking about Environmental Impact – Discussing Green Issues – Language of Presentations (Adjectives and Adverbs, Determiners)- Homophones – Homonyms- Acronyms-Abbreviations- British and American words.

UNIT IV **(12)**

Talking about Health and Safety – Expressing Obligation- Discussing Regulations- Talking about personnel Problems – Passives – Talking about Problem at Work (modal Verbs, Passives)- Talking about Expenses Claims- Talking about Air Travel (Relative Pronoun, Indirect Questions) – **E-mail Writing - Note completion-** Transcoding.

UNIT V **(12)**

Talking about staff Benefits- Talking about Appraisal Systems (gerunds and Infinitives, Reported Speech) – Talking about Marketing Disasters – Expressing hypothetical Situations- Talking about entering Foreign Market (Conditional 3, Grammar review) – Letter for calling quotations, Replying for quotations – Placing an order and Complaint and reply to a complaint.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Introduced corporate culture and professional communication.
CO2: It focused on organizing a professional event and its documentation.
CO3: Improved the ability to describe the events and process in an effective way
CO4: Trained to analyze the problems and to find solution to it.
CO5: Practiced to make business communication.

Text Books

T1 Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.

T2 Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

References

R1 Communication Skills for Engineers, Sunitha Misra & C.Murali Krishna, Pearson Publishers

R2 Technical Communication, Daniel G. Riordan, Cengage learning publishers.

R3 Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO 2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO 3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO 4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO 5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Avg	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16GE2101	ENGINEERING MECHANICS (COMMON TO AERO, AUTO, CIVIL, MECH & MECHAT)	L	T	P	C
		3	1	0	4

Course Objectives

1. Learn the vector and scalar representation of forces and moments
2. Learn the static equilibrium of particles and rigid bodies both in two dimensions.
3. Learn the principle of work and energy.
4. Comprehend the effect of friction on equilibrium.
5. Write the dynamic equilibrium equation.

UNIT I BASICS & STATICS OF PARTICLES (12)

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vector representation of forces and moments – Coplanar Forces – Resolution and Composition of forces – 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 and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis– Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS (12)

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – Second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas.

UNIT IV DYNAMICS OF PARTICLES (12)

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies. Co-efficient of restitution.

UNIT V FRICTION (12)

Frictional force – Laws of Coloumb friction – Simple contact friction – Rolling resistance – Wedge friction - Belt friction, Applications of friction.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: To solve engineering problems dealing with force, displacement, velocity and acceleration.
CO2: To analyze the forces in any structure.
CO3: To solve rigid body subjected to dynamic forces.

Text Books

T1 F.P.Beer, and Jr. E.R.Johnston., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).

References

R1 R.C.Hibbeller, and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.

R2 S.Rajasekaran and G.Sankarasubramanian, "Engineering Mechanics Statics and Dynamics", 3rd Editior Publishing House Pvt. Ltd., 2005.

R3 S.S.Bhavikatti, and K.G.Rajashekarappa, "Engineering Mechanics", New Age International (P) Limited Pu 1998.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	1	1	1	2	1	2	3	1	3	1	1
CO 2	3	3	3	1	1	2	1	1	1	3	1	2	1	1
CO 3	3	3	3	1	1	2	1	1	2	3	1	2	1	2
CO 4	3	3	3	1	1	1	1	1	2	3	1	2	1	1
CO 5	3	3	3	1	1	1	1	2	2	3	1	2	1	2
Avg	3	3	3	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

16EE2202	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (COMMON TO AERO, AUTO, CIVIL, MECH & MECHT)	L	T	P	C
		3	0	0	3

Course Objectives

1. To apply the basic laws used in Electrical circuits and the different components.
2. To impart knowledge on construction and working of DC and AC machines
3. To provide knowledge on the fundamentals of semiconductor devices and their applications.
4. To impart knowledge on digital electronics and its principles.
5. To develop block diagrams for satellite and optical fiber communications.

UNIT I ELECTRICAL CIRCUITS AND MEASUREMENTS (9)

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase circuits - Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters, Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MACHINES (9)

Construction, Principle of Operation of DC Generators - EMF Equation - Construction, Principle of Operation of DC shunt and series Motors, Single Phase Transformer - EMF Equation, Single phase capacitor start - capacitor run – Construction, Principle of Operation of Three Phase Induction Motor – Applications - (Qualitative Approach only).

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS (9)

Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor (BJT) – CB, CE, CC Configurations and Characteristics – FET – Characteristics.

UNIT IV DIGITAL ELECTRONICS (9)

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops (RS, JK, T & D), A/D and D/A Conversion (Dual Slope, SAR, Binary-weighted and R-2R).

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING (9)

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations - Satellite and Optical Fibre communications (Block Diagram Approach only).

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Apply the KVL and KCL in Electrical circuits
CO2: Explain the constructional features of AC and DC machines.
CO3: Identify electronics components and use of them to design circuits.
CO4: Use appropriate logic gates in circuit design.
CO5: Construct block diagram and explain satellite and optical Fibre communication systems.

Text Books

T1 Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.
T2 Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic T3:Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.

References

R1 Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
R2 Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
R3 Premkumar N, "Basics of Electrical Engineering", Anuradha Publishers, 2003.
R4 T.Thyagarajan. "Fundamentals of Electrical and Electronics Engineering" Scitech Pub. Pvt Ltd, 2011.

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO 2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO 3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO 4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO 5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Avg	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

		L	T	P	C
16PS2001	**PHYSICAL SCIENCES LABORATORY – II (COMMON TO ALL BRANCHES)**	0	0	2	1

Course Objectives

1. Evaluate the band gap of a semiconductor.
2. Apply the concept of interference and calculate the thickness of thin wire.
3. Acquire the practical skills in Young's modulus by uniform bending method.

Expt. No.	Description of the Experiments
1.	Determination of Young's modulus by uniform bending method
2.	Determination of band gap of a semiconductor
3.	Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4.	Determination of Dispersive power of a prism - Spectrometer
5.	Determination of thickness of a thin wire – Air wedge method
6.	Determination of Rigidity modulus – Torsion pendulum
7.	Magnetic hysteresis experiment.
8.	Calibration of ammeter using potentiometer

TOTAL: 30 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1:	Experiment involving the physical phenomena of the Rigidity modulus of wire.
CO2:	Determine the band gap of a semiconductor and variation of Energy Gap (E_g)with temperature.
CO3:	Assess the Young's modulus of a beam using non uniform bending method.
CO4:	Explain the concept of interference and calculate the thickness of thin wire and other fine objects.
CO5:	Experiment provides a unique opportunity to validate Dispersive power of a prism using

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO 2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO 3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO 4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO 5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Avg	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

		L	T	P	C
16ME2001	**COMPUTER AIDED DRAFTING LABORATORY (COMMON TO MECH, AUTO, AERO & MECHT)**	0	0	4	2

Course Objectives

1. To develop skills on using software for preparing 2D Drawings.
2. To provide the importance of computer aided drawing in engineering society

Concepts and Conventions:

Learn the basic idea of software and its features like draw panel, modify panel, line types, creating dimensions, hatching techniques, layer Creations, text styles, and template drawings, use of Blocks, Design Center, Tool Palettes and Plotting.

LIST OF EXERCISES USING DRAFTING SOFTWARE

1	Study of drafting software– Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon and general multi-line figures.
2	Drawing the conic and special curves.
3	Draw the orthographic projections of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.
4	Draw the symbols of fasteners, weld, rivets, bolts nuts and screws.
5	Drawing Isometric projection of simple objects.
6	Draw the orthographic projections of Bush bearing.
7	Draw the orthographic projections of Oldham's coupling.
8	Draw the orthographic projections of cotter joint.
9	Draw the orthographic projections of simple gate valve.
10	Draw the Plan and Elevation of simple Residential Building.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1:	The students shall be able to use the software package for drafting
CO2:	The students shall be able to create 2D Drawing of Engineering Components
CO3:	The students shall be able to apply basic concepts to develop construction drawing techniques

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	1	1	1	2	1	2	3	1	3	1	1
CO 2	2	2	1	1	1	2	1	1	1	3	1	2	1	1
CO 3	2	2	1	1	1	2	1	1	2	3	1	2	1	2
CO 4	1	1	1	1	1	1	1	1	2	3	1	2	1	1
CO 5	1	1	1	1	1	1	1	2	2	3	1	2	1	2
Avg	1.4	1.4	1.0	1.0	1.0	1.4	1.2	1.2	1.8	3.0	1.0	2.2	1.0	1.4

	VALUE ADDED COURSE-II (COMMON TO ALL BRANCHES)	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Topic No.	Description of the Experiments	
1.	A HANDS ON INTRODUCTION TO ENGINEERING SIMULATIONS	
2.	INTRODUCTION OF STEEL	
3.	ENTERPRENUERSHIP DEVELOPMENT	
4.	DRINKING WATER TREATMENT	
5.	MECHANICAL BEHAVIOUR OF MATERIALS (LINEAR AND ELASTIC)	
6.	FASCINATING WORLD OF ROBOTS AND ROBOTICS	
	Total Marks	100

		L	T	P	C
16MA3103	**FOURIER ANALYSIS AND STATISTICS** (Common to AERO, AUTO, MECH, EEE and E&I)	**3**	**1**	**0**	**4**

Course Objectives

1. To introduce Fourier series analysis which is central to many applications in engineering
2. To solve boundary value problems by applying Fourier series.
3. To acquaint with Fourier transform techniques used in wide variety of situations.
4. To provide the necessary basic concepts of some statistical methods
5. To manipulatedifferent kinds of problems occurring in engineering and technology by applying the design of experiments.

UNIT I FOURIER SERIES (12)

Dirichlet's conditions- General Fourier Series – Odd and Even Functions-
Half range sine and cosineseries – Change of Interval - Parseval"s Identity- Harmonic analysis

UNIT II BOUNDARY VALUE PROBLEMS (12)

Classification – solution of one dimensional wave equation –one dimensional heat equation – steady state solutions of two dimensional heat equations (excluding insulated edges) – Fourier series solution in Cartesian coordinates.

UNIT III FOURIER TRANSFORMS (12)

Fourier Transform Pairs-Fourier sine and cosine transforms-Properties-Transforms of Simple functions – Convolution Theorem – Parseval's identity.

UNIT IV TESTING OF HYPOTHESIS (12)

Large sample test based on Normal distribution for single mean and difference of means, Tests based on t - means and variances (single mean and difference of means) , F distribution - for testing difference of variances , Chi-Square test for Contingency table (Test for Independency) – Goodness of fit

UNIT V DESIGN OF EXPERIMENTS (12)

One way and two way classifications - Completely randomized design – Randomized block design –Latin square design.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Learn the mathematical principles of Fourier series which would provide them the ability to formulate and solve some of the physical problems of engineering.
CO2: Acquire the knowledge of application of Fourier series in solving the heat and wave equations.
CO3: Express the information from discrete data set through numerical differentiation.
CO4: Acquire skills in analyzing statistical methods.
CO5: Have a clear perception of the statistical ideas and demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

Text Books

T1 Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
T2 Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons,2011.

References

R1 C. Roy Wylie " Advance Engineering Mathematics" Louis C. Barret, 6th Edition, McGraw Hill Private Limited, New Delhi 2003.
R2 Kandasamy P., Thilagavathy K. and GunavathyK.,"Engineering Mathematics Volume III", S.Chand& Company Ltd., New Delhi, 1996
R3 Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8thEdition,Pearson Education,Asia,2007.

CO PO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	2	-	-	-	-	-	2	3	1
CO2	3	3	3	2	2	2	-	-	-	-	-	3	2	3
CO3	3	3	3	2	2	2	-	-	-	-	-	2	2	2
CO4	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	2	2	3
Avg	3	2.6	3	1.8	2	2	0	0	0	0	0	2.2	2.2	2.2

3 0 0 3

Course Objectives

1. The objectives of the course are to make the students to Learn the manufacturing concepts of automobile components.
2. To acquire knowledge about various casting methods and for making of cores
3. To develop the knowledge in metal joining and metal cutting process
4. To interpret the students about forming of plastics and metals
5. To get knowledge of powder metallurgy used in automobile applications

UNIT I CASTING (9)

Casting-Patterns-Types-Materials used-allowances-construction-core-core making-casting design considerations-Casting processes-Sand-centrifugal-die-investment-lost foam-gravity-squeeze-shell-Methods of Melting-Crucible melting-cupola operation-casting defects.

UNIT II WELDING (9)

Welding-Classification-Principles of Oxy-acetylene gas welding-A.C metal arc welding-resistance welding-submerged arc welding-tungsten inert gas welding-metal inert gas welding- soldering-brazing-welding defects.

UNIT III MACHINING (9)

Construction, working principles and commonly performed operations in the following machines: Lathe-Shaper-mechanisms-Planer-types-milling machine-types-drilling machine-types-grinding machine-types-Basics of CNC machines.

UNIT IV FORMING AND SHAPING OF PLASTICS (9)

Plastics-types-Characteristics-forming and shaping processes-Moulding of Thermoplastics-Injection moulding-Plunger and screw machines-Blow moulding-Rotational moulding-Film blowing-Extrusion-applications-Thermoforming-Processing of Thermosets-compression moulding-Transfer moulding-Bonding of Thermoplastics-Fusion and solvent methods-Induction and Ultrasonic methods

UNIT V METAL FORMING AND POWDER METALLURGY (9)

Principles-applications of the following processes: Forging, Rolling-Extrusion-Wire drawing-Spinning. Powder metallurgy-Principal steps-advantages-disadvantages powder metallurgy.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: By the end of this course student will be able to get in-depth knowledge of various manufacturing processes
CO2: Students can have capable to select appropriate manufacturing process for a particular Engineering application and their projects.
CO3: Students will get in depth knowledge about metal joining and metal removing process
CO4: Capable of students to do basic manufacturing process
CO5: To learnt about advance manufacturing process

Text Books

T1 Hajra Choudhury, “Elements of Workshop Technology”, Vol-I and Vol-II Asia Publishing House, 1996.
T2 R.K.Jain and S.C.Gupta, “Production Technology”, Hanna Publishers, 1997.
T3 P.C. Sharma, “A text book of production technology”, S. Chand and Company, IV Edition, 2003.
T4 Serope Kalpak jian, and Steven R. Schmid,” Manufacturing Engineering and Technology”, Pearson Education.

References

R1 Ghosh, A., and Malik, A. K., “Manufacturing Science”, Affiliated East west Press Pvt. Ltd., 2008.
R2 Rao PN, “Manufacturing Technology”, 3/e, TMH, New Delhi, 2010.
R3 H.M.T. "Production Technology-Hand Book, Tata McGraw Hill, 1990.

CO PO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	-	2	2	-	-	3	-	3	2	3
CO2	3	1	1	3	2	-	-	-	-	2	-	2	2	3
CO3	3	2	2	2	2	-	-	-	-	2	-	2	2	3
CO4	3	1	1	2	2	2	2	-	-	2	-	2	2	3
CO5	3	1	1	2	2	-	-	-	-	2	-	2	2	3
Avg	3	1.2	1.2	2.4	2	2	0	0	0	0	0	2.2	2	3

16AU3202	ENGINEERING THERMODYNAMICS (COMMON TO AUTO & MECH)	L	T	P	C
		3	1	0	4

Course Objectives

1 To Learn and quantify the energy conversion.
2 To Learn the energy degradation in thermodynamic systems.
3 To Learn the behavior of pure substances and working principle of steam power cycles.
4 To Learn the thermodynamic relations.
5 To Learn the properties of atmospheric air and its applications.

(Use of Standard and approved Steam Tables, Mollier, Compressibility and Psychrometric Charts permitted)

UNIT I BASIC CONCEPTS AND FIRST LAW (9+3)

Basic concepts - concept of continuum, microscopic and macroscopic approach, path and point functions. Intensive and extensive, total and specific quantities, thermodynamic system, equilibrium, state, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT II SECOND LAW AND AVAILABILITY ANALYSIS (9+3)

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases – different processes, principle of increase in entropy-Availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE (9+3)

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater.

UNIT IV IDEAL, REAL AND GASES GAS MIXTURES AND THERMODYNAMIC RELATIONS (9+3)

Properties of Ideal and real gases, Equations of state, Vander Waals equation for ideal and real gases, reduced properties, Compressibility factor, Generalised Compressibility Chart and its use. Gas mixtures – mole and mass fractions, Daltons law, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, ClausiusClapeyron equation.

UNIT V PSYCHROMETRY (9+3)

Psychrometric properties, Property calculations of air vapour mixtures using psychrometric chart and expressions. Psychrometric process: sensible heating and cooling, humidification, dehumidification, adiabatic saturation, adiabatic mixing of two streams. Applications: evaporative coolers, drying, cooling towers etc.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Learn the thermodynamic principles and its applications.
CO2: Quantify the energy conversion in various thermal systems.
CO3: Identify the losses and inefficient components in the thermodynamic system.
CO4: Apply the thermodynamic principles for predicting the properties of steam, gas and gas mixtures.
CO5: Apply the psychrometric principles for design of air conditioning systems.

Text Books

T1 Nag.P.K., “Engineering Thermodynamics”, 4th Edition, Tata McGraw-Hill, New Delhi, 2008.
T2 Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.

References

R1 Holman.J.P., "Thermodynamics", 3rd Edition. McGraw-Hill, 1995.
R2 Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall of India Pvt. Ltd, 2006
R3 Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010.
R4 Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.

Web Resources

W1 *web.iitd.ac.in/~pmvs/courses/mcl141/mcl141-36.ppt*
W2 *https://en.wikibooks.org/wiki/Engineering_Thermodynamics*

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2	3	2	-	-	-	-	2	-	2	3	3
CO2	3	3	2	2	1	-	2	-	-	2	-	2	3	3
CO3	3	3	2	2	2	-	-	-	-	2	-	1	3	3
CO4	3	2	1	2	2	-	-	-	-	2	-	1	3	2
CO5	3	2	1	2	2	-	2	-	-	2	-	1	3	2
AVG	3	2.6	1.6	2.2	1.8	-	2	-	-	2	-	1.4	3	2.6

16AU3203	AUTOMOTIVE ENGINES	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn the fundamentals, principles and functions of an automotive engine and sub-systems.
2 To Learn combustion phenomena in SI and CI engines and factors influencing combustion chamber design.
3 To Learn the modern developments in IC Engines.
4 To acquire knowledge in engine auxiliary systems
5 To know the testing and performance characteristics of an engine.

UNIT I CONSTRUCTION AND OPERATION (9)

Spark ignition (SI) and compression ignition (CI) engines Constructional-Working principles. Two stroke SI and CI engines. Comparison of SI and CI engines and four stroke SI and CI engines. Engine classification-firing order. Otto-diesel and dual cycles-valve and port timing diagram.

UNIT II SI ENGINES (9)

Air fuel ratio–Carburetion–types of Carburetor. Spark plug-Ignition System–battery coil- magneto coil-Electronic type. SI Engines-Combustion-Combustion Chambers-Stages of Combustion–factors affecting flame propagation-Detanotation-variables affecting detanotation. Types of Injection in SI Engines.

UNIT III CI ENGINES (9)

Diesel fuel injection systems-types-Function- fuel pump-Jerk-Distributor-Mechanical and pneumatic Governor-Fuel Injector-Types of nozzle-importance of Swirl, Squish, Turbulence air motion- CI Engines-Combustion–Combustion Chambers-Stages of Combustion-Factors affecting Ignition Delay-Knocking-Types of Injection in CI Engines.

UNIT IV AUXILIARY SYSTEMS (9)

Supercharging and turbo charging-Types-relative merits. Cooling system-types-air and liquid cooling systems-Thermo siphon-forced circulation-pressurized cooling systems–Lubrication System-Requirements-Types-mist-pressure feed-dry and wet sump systems-Properties of lubricants.

UNIT V ENGINE TESTING AND PERFORMANCE (9)

Indicated power-brake power-engine torque-mechanical efficiency-air standard efficiency-brake thermal efficiency-indicated thermal efficiency-relative efficiency-volumetric efficiency-heat balance sheet.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Student should be able to know the fundamental concepts and functions of an automotive engine and sub-systems
CO2: Gain in depth knowledge combustion phenomena
CO3: Learn about modern development of IC Engine
CO4: Engine auxiliary systems were studied for better improving the engine performance
CO5: Apply the knowledge to measure Performance calculation of IC Engine

Text Books

Internal Combustion Engines by V. Ganesan, 2007, Tata McGraw Hill
Ramalingam K.K., “Internal Combustion Engines”, Sci-Tech Publications, 2005

References

Advanced Engine Technology by Heisler, SAE Publication
Edward F. Obert Internal Combustion Engines
H.N. Gupta Fundamentals of Internal Combustion Engines by, PHI
Mathur, M.L., and Sharma, R.P., A Course in Internal Combustion Engines, DhanpatRai and Sons, 2008.
John B. Heywood, “Fundamentals of Internal Combustion Engines” McGraw Hill, 1988

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	3	3	3	3	-	-	2	-	3	2	3
CO2	3	3	2	2	2	2	2	-	-	2	-	2	3	3
CO3	2	2	-	3	3	3	3	-	-	2	-	3	2	3
CO4	2	2	2	2	2	2	2	-	-	2	-	2	2	3
CO5	3	3	2	2	3	2	2	-	-	2	-	2	2	2
AVG	2.6	2.4	2	2.4	2.6	2.4	2.4	-	-	2	-	2.4	2.2	2.8

16AU3204	STRENGTH OF MATERIALS (COMMON TO AUTO & MECH)	L	T	P	C
		3	0	0	3

Course Objectives

1 To study the principles of simple stress, strain and deformation in components
2 To assess stresses and deformations through mathematical models of beams
3 To learn about torsion of components
4 To gain knowledge about deflections on beams
5 To Learn the stress analysis concepts in two dimension objects

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS (9)

Rigid and Deformable bodies – Mechanical Properties – Stress-Strain Curve - Tension, Compression and Shear stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains, Principal Planes & Stresses - Mohr's circle.

UNIT II BEAMS - LOADS AND STRESSES (9)

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 – Transverse shear stresses in beams.

UNIT III TORSION (9)

Formulation-stress and deformation in circular and hollow shafts – Stepped shaft – Deflection in shaft subjected to various boundary conditions–Stresses in helical springs – Deflection of helical springs, Leaf springs.

UNIT IV BEAM DEFLECTION (9)

Double integration method – Macaulay Method – Area moment Method for computation of slopes and deflection in beams – Conjugate beam and Strain Energy problems.

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS (9)

Stresses in Thin cylindrical shell due to internal pressure, Circumferential and Longitudinal stresses and deformation in Thin Cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Apply mathematical knowledge to estimate the deformation behavior of simple structures.
CO2: Calculate shear force and bending moment in different types of beams.
CO3: Determine torsion in shafts and stresses in various types of springs.
CO4: Analyze deflection in various beams.
CO5: Estimate the stresses developed in cylinders and spherical shells.

Text Books

Dr.R.K.Bansal “Text Book of Strength of Materials”, Laxmi Publications, New Delhi,2017.
R.S.Khurmi and N.Khurmi “Strength of Materials”, S.Chand Publications, 2016.

References

Beer F. P. and Johnston R,” Mechanics of Materials”, McGraw-Hill Book Co, Third Edition, 2002
Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co., New Delhi, 1981.
Ryder G.H, “Strength of Materials, Macmillan India Ltd”., Third Edition, 2002
Ray Hulse, Keith Sherwin & Jack Cain, “Solid Mechanics”, Palgrave ANE Books, 2004

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	1	-	-	-	-	-	1	-	2	2	3
CO2	3	3	2	1	-	-	-	-	-	1	-	2	2	2
CO3	2	3	3	3	-	-	-	-	-	2	-	2	2	3
CO4	3	3	2	3	-	-	-	-	-	1	-	2	2	3
CO5	3	3	2	1	-	-	-	-	-	2	-	2	2	2
AVG	2.8	3	2.4	1.8	-	-	-	-	-	1.4	-	2	2	2.6

16AU3205	ENGINEERING DESIGN AND DRAWING	L	T	P	C
		2	0	4	4

Course Objectives

1 To Learn need for the rivet and welded joints
2 To recognize various threaded bolt and fasteners
3 To develop knowledge in select various types of fits, tolerance, hole and shaft basis systems
4 To familiarize students with reading of blue print and production drawing
5 To develop knowledge in machine elements part diagram and assembly

UNIT I RIVET AND WELDED JOINTS (6)

Introduction – Rivet, Riveting, Caulking and Fullering – types heads – chain – Zig Zag rivet – Classification – Welded joints and symbols – Dimensioning method – Edge preparation method – Surface finish - Rules for applying symbol – welding process abbreviations

UNIT II SCREWED FASTENERS AND BOLTED JOINTS (8)

Screw thread nomenclature – Forms of threads – types of thread profile – Designation – Multi-start – Right and Left hand threads – Representation – Bolted joints – Drawing of Square, Hexagonal and both head bolts – Types of Nuts, Bolts, cap, machine and set screws – Locking nuts – Foundation bolts

UNIT III LIMITS, TOLERANCES AND FITS (8)

Limit systems – Deviations – Allowance – Size – Fundamental tolerances – hole and shaft deviations – Placing method - simple problems – Fits – Types of fits – Tolerance representation in drawing – Industry Standards

UNIT IV BLUE PRINT READING AND PRODUCTION DRAWING (6)

Introduction – Blue print reading and practice – Rear tool post – Pump housing – Gear Box cover – Production drawing – Part – Work assembly drawing – Simple examples

UNIT V MANUAL DRAWING PRACTICE (32)

Detailed drawings of following machine parts are given and draw the Elevations / Sectional elevations / Plan / and Side views with dimensioning and bill of materials – Sleeve & Cotter joint – Knuckle joint – Flanged coupling – Universal Coupling – Pulleys – Engine parts – Stuffing Box – Piston - Single plate clutch

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Ability to Learn the various types of joining process
CO2: Able to know the various types of screws and bolts
CO3: Apply the knowledge of fits and tolerance to various applications
CO4: Acquire the knowledge of study of blue print and production drawing
CO5: Construct an assembly drawing with various part drawings of machine components

Text Books

T1 Narayana, K L, Kannaiah, P, Venkata Reddy, K., “Machine Drawing”, New age International Pvt Ltd., 2006.
T2 Gopalakrishna K R, "Machine Drawing", Seventeenth Edition, Subhas Stores, Bangalore, 2007.

References

R1 Bhatt N. D, “Machine Drawing”,Charotar Publishing House, Anand, 1999.
R2 Gill, P S, “A Text book of Machine Drawing”, Kataria& Sons, Delhi, 2017

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	3	2	1	-	-	-	-	3	-	3	3	2
CO2	3	2	3	2	2	-	-	-	-	3	-	2	3	2
CO3	3	3	3	2	1	-	-	-	-	3	-	2	3	2
CO4	3	3	3	3	1	-	-	-	-	3	-	2	3	1
CO5	3	3	3	2	1	-	-	-	-	3	-	3	3	2
AVG	3	2.6	3	2.2	1.2	-	-	-	-	3	-	2.4	3	1.8

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16AU3001	MANUFACTURING TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

2. To expose hands-on training to the students on various machines like lathe, Shaper, planner, Slotter, Milling, Gear hobbing and grinding machines.
3. To develop basic machining concepts
4. To Improve students teamwork and entrepreneurial skills
5. To impart knowledge and measure the dimensional fits and tolerance
6. To Acquire knowledge in machine mechanisms

LIST OF EXPERIMENTS

LATHE PRACTICE

a) Facing, plain turning and step turning
b) Taper turning using compound rest.
c) Taper turning using taper turning attachment
d) Single start V thread, cutting and knurling

DRILLING PRACTICE

a) Drilling 4 or 6 holes at a given pitch circle on a plate
b) Drilling, reaming and tapping

MILLING

a) Plain Milling Exercise
b) Gear Milling Exercise

PLANNING AND SHAPING

a) Machining a V- block (in a Shaper)

GRINDING MACHINE

a) Cylindrical Grinding Exercise
b) Surface Grinding Exercise
c) Taper grinding exercise

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Able to get an idea for making good quality products with good surface finish.
CO2: Capable to do the Application oriented mini projects.
CO3: To get the entrepreneur development skill.
CO4: Able to get knowledge in quality assurance
CO5: Summarize all machine mechanisms by real time exposure.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Lathe	15
2	Drilling Machine	1
3	Milling Machine	2
4	Planning Machine	1
5	Shaping Machine	2
6	Cylindrical Grinding Machine	1
7	Surface Grinding Machine	1
8	CentrelessGrinding Machine	1

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	1	2	2	-	2	3	3	2	3	-	3	3	3
CO2	2	1	2	2	-	1	2	2	2	2	-	2	3	3
CO3	1	-	1	1	-	2	2	2	-	2	-	2	2	2
CO4	1	-	2	2	-	2	2	2	-	2	-	2	2	2
CO5	2	-	2	2	-	2	2	2	2	2	-	2	2	2
AVG	1.8	1	1.8	1.8	-	1.8	2.2	2.2	2	2.2	-	2.2	2.4	2.4

16AU3002 **STRENGTH OF MATERIALS LABORATORY**

L	T	P	C
0	0	4	2

Course Objectives

1 To learn about different testing methods of materials
2 To Learn the methods to determine various mechanical properties
3 To develop knowledge on the effect of heat treatment process on different materials
4 To Learn the effect of stresses for different type of loading
5 To examine the microstructure of different materials

S.No **LIST OF EXPERIMENTS**

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen- Charpy and Izod
5. Deflection test on beams
6. Hardness test on metals - Brinnell and Rockwell Hardness Number
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Tempering- Improvement Mechanical properties Comparison
   (i)Unhardened specimen
   (ii) Quenched Specimen and
   (iii) Quenched and tempered specimen.
   Microscopic Examination of
10. (i) Hardened samples and
    (ii)Hardened and tempered samples.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Ability to perform different destructive testing
CO2: Ability to characteristic materials
CO3: Able to choose materials based upon loading and properties
CO4: Analyze the behaviour of material for various loading
CO5: Classify the material based upon microstructure

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	1
8	Muffle Furnace (800 C)	1

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	2	-	-	-	-	2	3	-	1	3	3
CO2	2	3	2	2	-	-	-	-	3	2	-	2	3	3
CO3	3	2	2	2	-	-	-	-	2	2	-	1	2	2
CO4	3	2	2	2	-	-	-	-	2	2	-	2	2	2
CO5	2	1	1	1	-	-	-	-	1	2	-	1	2	2
AVG	2.6	2.2	2	1.8	-	-	-	-	2	2.2	-	1.4	2.4	2.4

16AU3701	INTERNSHIP TRAINING / INPLANT TRAINING	L	T	P	C
		0	0	0	2

Course Prerequisites	Completion of minimum of three semesters
Course Objectives	Designed to expose the students to industry environment and work there as trainees.
Duration	Undergo industrial training/internship for a period of not exceeding six weeks.
Records to be Maintain	1. Students have to maintain a written record of the assignments, progress and accomplishments. **2.** Students have to submit an individual report along with attendance and training completion certificate from the company at end of the training.
Evaluation	A three member Departmental Committee, constituted by Head of the Department will evaluate the report, conduct viva voce examination and award appropriate grades and the credit points earned will depend on the duration of the industrial training/internship.
Course Outcomes	Acquire knowledge on real time industry expectation, operations and working environment

16MA4107	NUMERICAL METHODS (Common to AERO, AUTO, MECH, EEE & EIE)	L 3	T 1	P 0	C 4

Course Objectives

1. To solve algebraic, transcendental and system of linear equations by using various techniques.
2. To Learn the concepts of interpolation with equal and unequal intervals.
3. Be familiar with the concepts of numerical differentiation and integration of the unknown functions.
4. To Learn the concept of solving Ordinary Differential Equations by applying single and multi step Methods.
5. To appraisethemethods introduced in the solution of ordinary differential equations and partialdifferential equations.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS (12)

Solution of equations –Fixed point iteration: x = g(x) method – Newton- Raphson method – Solution of linear system by Gaussian elimination and Gauss-Jordon method– Iterative method - Gauss- Seidel method.

UNIT II INTERPOLATION (12)

Interpolation: Newton's forward and backward difference formulae - Lagrangian interpolation for unequal intervals – Divided differences for unequal intervals.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION (12)

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method —Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (12)

Single step methods: Taylor series method – Euler and Modified Euler method for first order equation – Fourth order Runge – Kutta method for solving first order equations – Multistep method : Milne's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (12)

Finite difference solution of second order ordinary differential equation – Finite difference Solution of one dimensional heat equation by explicit and implicit methods – One dimensional Wave equation - Two dimensional Hear equations - Laplace and Poisson equations.

TOTAL: 60 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Solve the system of linear algebraic equations representing steady state models and non linear equations arising in the field of engineering.
- CO2: Learn the concept of interpolation in both cases of equal and unequal intervals.
- CO3: Express the information from discrete data set through numerical differentiation and summary information through numerical integration
- CO4: Classify and solve ordinary differential equations and partial differential equations
- CO5: Acquire knowledge of finding the solution of ordinary and partial differential equations which are useful in attempting any engineering problem.

Text Books

- T1 Veerarajan. T.,"Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
- T2 M.K.Jain, S.R.K.Iyengar, R.K.Jain "Numerical Methods for Scientific and Computation", Fifth Edition., Newage International Publishers 2010.

References

- R1 Kreyszig. E,"Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons (Asia) Limited, Singapore 2001.
- R2 Kandasamy P., Thilagavathy K. and GunavathyK.,"Engineering Mathematics Volume III", S.Chand& Company Ltd., New Delhi, 1996.
- R3 Grewal, B.S. and Grewal,J.S. " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

CO PO MAPPING

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	2	2	-	-	-	-	-	2	3	1
CO2	3	3	3	2	2	2	-	-	-	-	-	3	2	3
CO3	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO4	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO5	3	2	3	2	1	1	-	-	-	-	-	2	2	3

16AU4201	AUTOMOTIVE MATERIALS AND METALLURGY	L	T	P	C
		3	0	0	3

Course Objectives

1. To make the students knowledgeable in structure and phase diagram of the materials
2. To acquaint the heat treatment process and its importance
3. To develop the knowledge of how the properties of materials are described technically and how material failure is analyzed
4. To familiarized the students in engineering polymers and ceramics
5. To develop knowledge in various class of materials and their selection relevance to automotive

UNIT I CRYSTAL GEOMETRY AND ALLOYS (9)

Space Lattices, Unit cells, Crystal Structure, Crystal Imperfections: Line defects, Point defects, Surface defects, Geometry and Properties of dislocation. Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic and its reaction - Iron – carbon equilibrium diagram.

UNIT II HEAT TREATMENT (9)

Heat Treatment – Annealing and its types, Normalizing, Hardening, tempering off steel. Isothermal transformation – TTT diagram, CCR – Jominy end quench test - Austempering and Mar-tempering. Surface Heat treatment processes – Carburizing, Nitriding, cyaniding, carbonitriding, flame and induction hardening, vacuum and plasma hardening.

UNIT III MECHANICAL PROPERTIES AND TESTING (9)

Mechanisms of plastic deformation – Types of fracture – ductile and brittle - Testing of materials under tension, compression and shear loads - Griffith theory criterion – Hardness - Brinell, Vickers and Rockwell tests. Impact - lzod and charpy test, fatigue – S-N curve – fatigue limit. creep - stages of creep failure mechanisms – SEM and XRD.

UNIT IV POLYMERS AND CERAMICS (9)

Polymers – types, Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK and PTFE. Engineering Ceramics – Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON – Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V MATERIAL PROCESSING AND SELECTION (9)

Processing of engineering materials – Primary and Secondary processes – Castability, weldability, forgeability and malleability Criteria. Motivation for selection, cost and service requirements –Relationship between materials selection and processing – Case study in materials selection with relevance to automotive components

TOTAL :45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Learn the crystal structure and phase alloys of materials
- CO2: Gain knowledge on heat-treatment process to achieve desired properties of metals and alloys
- CO3: Familiar of determining mechanical properties and their suitability for applications
- CO4: Acquire knowledge on polymer and ceramics for engineering applications
- CO5: Able to Learn the processing and selection for material relevance to automotive

Text Books

- T1 Raghavan, V. “Physical Metallurgy: Principles and Practice”, Phi Learning (2009).
- T2 Dieter, G.E., Mechanical Metallurgy, Mc-Graw Hill, 1987.

References

- R1 Kenneth G.Budinski and Michael K. Budinski, “Engineering Materials”, 4th Indian Reprint, Prentice Hall of India Private Limited, 2002.
- R2 Avner, S.H., “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	1	1	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	1	-	-	-	-	-	-	2	-	1	2	2
CO3	3	1	1	1	1	-	-	-	-	2	-	2	2	2
CO4	3	1	1	-	2	-	-	-	-	2	-	2	2	2
CO5	2	2	2	-	-	1	1	-	-	2	2	-	3	2
AVG	2.8	1.2	1.2	1	1.5	1	1	-	-	2	2	1.667	2.2	2

16AU4202	MECHANICS OF MACHINES (COMMON TO AUTO & AERO)	L	T	P	C
		3	1	0	4

Course Objectives

1 To know different types of inversions in the mechanisms.
2 Study about the working principle gear and gear applications.
3 To know the frictional forces acting and how to resolve the friction
4 Students should analyze the forces acting on various members in a mechanism.
5 To know the importance of balancing and vibration acting on systems.

UNIT I KINEMATIC OF MECHANICS (13)

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.

UNIT II GEARS and GEAR TRAINS (12)

Types of Gears – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – Epicyclic gear trains – automotive transmission gear trains.

UNIT III FRICTION (11)

Sliding and Rolling Friction angle – friction in threads – Friction Drives – Friction clutches – Belt and rope drives – brakes – Tractive resistance.

UNIT IV FORCE ANALYSIS (12)

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members.

Dynamic Force Analysis – Inertia Forces and Inertia Torque – Alembert's principle – Superposition principle – Dynamic Force Analysis in simple machine members.

UNIT V BALANCING AND VIBRATION (12)

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines. Free vibrations – Equations of motion – Natural Frequency – Damped Vibration – bending critical speed of simple shaft – Torsional vibration – Forced vibration – harmonic Forcing – Vibration isolation

TOTAL:60PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Upon completion of this course, the students can design various mechanical components.
CO2: Students have the knowledge on gears and gear trains.
CO3: Students are able to utilize the frictional force into effect
CO4: Students can analyze the forces acting on the mechanism.
CO5: Students are having the ability to balance the forces and vibration in a machine.

Text Books

T1 Ambekar A.G., "Mechanism and Machine Theory" Prentice Hall of India, New Delhi, 2007.
T2 Shigley J.E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", OxfordUniversity Press, 2003.

References

R1 Ghosh.A, and A.K.Mallick, "Theory and Machine", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
R2 Ramamurthi. V, "Mechanisms of Machine", Narosa Publishing House, 2002.
R3 Robert L. Norton, "Design of Machinery", McGraw-Hill, 2004.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	2	2	1	3	3	-	-	-	3	-	1	2	3
CO2	3	3	2	1	3	3	-	-	-	2	-	1	2	2
CO3	2	3	3	3	2	2	-	-	-	2	-	1	2	2
CO4	3	3	2	3	2	2	-	-	-	2	-	1	2	3
CO5	3	3	2	1	2	2	-	-	-	2	-	1	2	2
AVG	2.8	2.8	2.2	1.8	2.4	2.4	-	-	-	2.2	-	1	2	2.4

16AU4203 THERMAL AND FLUID ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives

1 To build up necessary background for Learning the physical 68ehavior of conduction heat transfer.
2 To Learn the application of various convection heat transfer correlations in engineering calculations.
3 To Learn the application of various radiation heat transfer correlations in engineering calculations.
4 To make familiar with calculation of forces in fluid structure interaction
5 To Learn the application of fluid in various engineering requirements

(Use of Standard and approved Steam Tables, Heat and mass transfer data book is permitted)

UNIT I CONDUCTION (9)

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Cylinders and Spherical systems –Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis.

UNIT II CONVECTION (9)

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar and Turbulent Flow – Flow over Bank of tubes –Free Convection – Dimensional Analysis – Flow over Vertical Plate.

UNIT III RADIATION (9)

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation Shape Factor Algebra – Electrical Analogy – Radiation Shields –Introduction to Gas Radiation.

UNIT IV FLUID PROPERTIES AND FLOW CHARACTERISTICS (9)

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity- Flow characteristics– concept of control volume – application of continuity equation, energy equation and momentum equation.

UNIT V FLOW THROUGH CIRCULAR CONDUITS,PUMPS AND TURBINES (9)

Hydraulic and energy gradient – Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes-minor losses – Flow through pipes in series and parallel-Pumps-Working principle-Centrifugal Pumps-Reciprocating Pump-Rotary Pumps–classification-Turbine-Pelton wheel, Francis turbine and Kaplan turbines- working principles – work done by water on the runner – draft tube.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Interpret the knowledge of conduction heat transfer with steady-state and transient problems.
CO2: Identify the heat transfer whether natural and forced convection.
CO3: Interpret the knowledge of radiation heat transfer and their laws
CO4: Summarize the importance of fluid properties and its effects
CO5: Compare the principles of continuity, Momentum and energy as applied to fluid Motions and their applications.

Text Books

T1 Rajput. R.K. “Applied Thermodynamics”, Laxmi Publishing Co., New Delhi, 2007
T2 Holman. J.P. “Heat Transfer”, Tata McGraw –Hill, 2003
T3 Modi P.N. and Seth, S.M. “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi 2004

References

R1 Nag. P..K. “ Heat Transfer”, Tata McGraw-Hill, New Delhi, 2002
R2 Kothandaraman.C.P “Fundamentals of Heat and Mass Transfer” New Age International, New Delhi, 1998
R3 Kumar K. L., “Engineering Fluid Mechanics”, Eurasia Publishing House(p) Ltd., New Delhi 2004

Web Resources

W1 *nptel.ac.in/courses/112106133/*
W2 *www.physicsclassroom.com › Physics Tutorial › Thermal Physics*
W3 *hyperphysics.phy-astr.gsu.edu/hbase/thermo/heatra.html*

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2	3	-	2	2	-	-	1	-	2	3	3
CO2	3	3	2	2	-	2	2	-	-	1	-	1	3	2
CO3	3	3	1	1	-	2	2	-	-	1	-	1	3	3
CO4	3	2	2	2	-	2	2	-	-	1	-	1	3	2
CO5	3	2	1	1	-	1	1	-	-	1	-	2	3	3
AVG	3	2.6	1.6	1.8	-	1.8	1.8	-	-	1	-	1.4	3	2.6

16AU4204	AUTOMOTIVE CHASSIS	L	T	P	C
		3	0	0	3

Course Objectivess

1 To learn the constructional and design features of an automobile chassis and frames.

2 To know about the various functional features of an automotive front axle and steering system.

3 To comprehend the functions of various driveline components.

4 To Learn the constructional features and working of automotive suspension systems.

5 To gain knowledge about the functionality of braking system, wheels, tyres and their constructional details.

UNIT I CHASSIS AND FRAMES (8)

Chassis – basic construction – types of Chassis layout – based on powertrain – Frames – types – various loads acting on vehicle frame – Vehicle body design details.

UNIT II FRONT AXLE AND STEERING SYSTEM (9)

Axle – types of front and stub axles – wheel geometry – true rolling motion – Ackerman's and Davis steering mechanisms – steering linkages – different types of steering gear boxes – slip angle – over steer and under steer – reversible and irreversible steering – power steering.

UNIT III DRIVELINE, FINAL DRIVE AND REAR AXLE (10)

Driveline – thrust effects – torque reactions – side thrust – Propeller shaft – universal joints – final drive – differential – constructional details – functions – types - non slip differential – differential locks – rear axles – construction – types – twist beam rear axle – various loads acting on rear axles.

UNIT IV SUSPENSION SYSTEMS (9)

Suspension systems – need – constructional details and characteristics of single leaf, multi–leaf spring, coil and torsion bar springs – rubber, pneumatic and hydro elastic suspension spring systems – independent suspension system – shock absorbers – radius rods – stabilizer bar.

UNIT V BRAKING SYSTEMS, WHEELS AND TYRES (9)

Brakes – need – classification – drum and disc brakes – hydraulic, mechanical, pneumatic braking systems – power assisted braking system – servo brakes – braking parameters – Wheels – functions – types – balancing – rims – constructional details – types – Tyres – classification – constructional details – maintenance.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Know about the design details of chassis.

CO2: Infer about the principles and working of automotive steering and front axle system.

CO3: Learn about the driveline, final gearing and rear axle system and its troubleshooting.

CO4: Analyze the various design features and parameters of an automotive suspension system.

CO5: Illustrate the problems arising in the braking system, wheels and tyres.

Text Books

T1 Kirpal Singh, "Automobile Engineering – Volume 1", Standard Publishes-Distributors, Delhi, 2012.

T2 R.K. Rajput, "A Textbook of Automobile Engineering", Laxmi Publications Private Limited, 2007.

T3 N.K. Giri, "Automotive Mechanics" Khanna Publishers, New Delhi, 2005.

References

R1 Heldt P.M., "Automotive Chassis" , 2012, Literary Licensing, LLC

R2 Newton Steeds and Garret, "Motor Vehicles" 13th Edition, Butterworth, London, 2005.

R3 Heinz Hazler, "Modern Vehicle Technology", Butterworth, London, 2005.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	2	1	1	2	3	3	-	-	2	-	3	3	2
CO2	3	2	1	1	1	1	1	-	-	1	-	2	3	2
CO3	2	2	1	1	1	2	2	-	-	1	-	3	2	2
CO4	3	3	3	3	3	2	2	-	-	1	-	2	3	3
CO5	2	3	2	3	2	3	3	-	-	1	-	3	2	2
AVG	2.6	2.4	1.6	1.8	1.8	2.2	2.2	-	-	1.2	-	2.6	2.6	2.2

16AU4205	AUTOMOTIVE ELECTRICAL AND ELECTRONICS	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn the fundamentals, operating principles of batteries and starting systems.
2 To Illustrate the functionality of charging and lighting systems.
3 To comprehend the concepts of automotive ignition and injection systems.
4 To know about automotive electronics and working principle of sensors and actuators.
5 To acquire knowledge about intelligent vehicle technologies in safety and comfort.

UNIT I BATTERY AND STARTING SYSTEM (9)

Battery – principle – types – characteristics - rating - efficiency of batteries – tests on battery condition - charging methods - starter motor - principle - construction - characteristics - drive mechanisms – maintenance - starter switches.

UNIT II CHARGING SYSTEM, LIGHTING AND ACCESSORIES (9)

DC generators and alternators their characteristics - cut out - electronic regulators - compensated voltage regulator - Positive & negative earth systems - Vehicle interior and exterior lighting system – headlight design - LED lighting system - anti-dazzling - dashboard instruments – horn - wiper system - trafficators.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM (9)

Ignition system - construction and working of battery coil, magneto and electronic ignition systems - advance mechanisms - spark plugs - constructional details – types - throttle body fuel injection – MPFI - gasoline direct injection - CRDI - engine mapping and on board diagnostics.

UNIT IV SENSORS AND ACTUATORS IN AUTOMOBILES (9)

Speed sensors - pressure sensors: MAP sensor - detonation sensor - temperature sensors: thermistor and thermocouple – O_2 sensor - position sensors: TPS, APP sensor and crankshaft position sensor - MAF sensor - Introduction to automotive Actuators – Solenoids - Operation and application of brushless DC motors, servo and stepper motors - Piezo actuators.

UNIT V MICROPROCESSORS IN CONTROLAND SAFETY SYSTEMS (9)

Introduction to IoT - Cruise control system - electronic suspension system - traction control system - safety: antilock braking system - electronic brake force distribution - electronic stability program - airbag restraint system - collision avoidance system - anti-theft system.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Learn the functions of batteries and charging system.
CO2: Know about the starter circuit and lighting system.
CO3: Organize the fundamentals of automotive ignition and injection systems.
CO4: Make use of the automotive electronics.
CO5: Analyze the safety and vehicle control technologies in modern vehicles.

Text Books

T1 Tom Denton., “Automobile Electrical and Electronics Systems”, Elsevier Butterworth-Heinemann Linacre House, 2004.
T2 Judge. A.W., “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 1992.
T3 Kholi .P.L, “Automotive Electrical Equipment”, Tata McGraw-Hill co ltd, New Delhi,2004

References

R1 Young.A.P.,&Griffiths.L., "Automobile Electrical Equipment", English Language Book Society & New Press, 1990.
R2 Crouse.W.H. “Automobile Electrical Equipment”, McGraw Hill Book Co Inc.NewYork,2005

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	1	2	-	-	3	-	-	2	-	3	2	2
CO2	3	3	3	2	-	-	3	-	-	2	-	3	2	2
CO3	3	3	3	1	2	-	2	-	-	2	-	3	2	3
CO4	3	2	2	2	2	2	2	-	-	2	-	2	2	2
CO5	3	2	3	2	2	3	2	-	-	2	-	2	2	2
AVG	3	2.6	2.4	1.8	2	2.5	2.4	-	-	2	-	2.6	2	2.2

16AU4001	AUTOMOTIVE COMPONENTS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1 To Learn the function petrol and diesel engines
2 To acquire knowledge of fuel supply systems in petrol and diesel engines
3 To study the commercial vehicle frame chassis
4 To Learn the working and function of axles and differentials
5 To Learn the function of clutch and gearbox arrangements

LIST OF EXPERIMENTS

1. Dismantling and study of Multi-cylinder Petrol Engine
2. Assembling of Multi-cylinder Petrol Engine
3. Dismantling and study of Multi-cylinder Diesel Engine
4. Assembling of Multi-cylinder Diesel Engine
5. Study of petrol engine fuel system
6. Study of diesel engine fuel system
7. Study and measurement of light and heavy commercial vehicle frame
8. Study, dismantling and assembling of front and rear axles
9. Study, dismantling and assembling of differential
10. Study, dismantling and assembling of Clutch
11. Study, dismantling and assembling of Gear Box
12. Study of steering system

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Differentiate the function of petrol and diesel engines
CO2: Learn the petrol and diesel fuel supply system functions
CO3: Determine the length, width and other functional parts location on both heavy and light duty vehicle frame
CO4: Acquire knowledge the various parts function in axles and differentials
CO5: Gain knowledge on clutch and gear box arrangements and functions

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Multi Cylinder Petrol Engine	2
2	Multi Cylinder Diesel Engine	2
3	Petrol and Diesel Fuel Systems each	2
4	Heavy Duty Vehicle Chassis Frame	1
5	Light Duty Vehicle Chassis Frame	1
6	Front Axle	2
7	Rear Axle	2
8	Differential	2
9	Clutch and Gear box (Light Duty, Heavy Duty) each	2
10	Steering Systems with different Gearboxes	4

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	1	1	2	-	2	3	-	-	3	-	3	2	2
CO2	2	2	2	2	-	-	3	-	-	3	-	3	3	2
CO3	2	2	2	2	-	-	2	-	-	2	-	2	3	3
CO4	2	2	1	2	2	-	2	-	-	1	-	2	3	3
CO5	2	2	2	1	2	-	2	-	-	2	-	2	2	2
AVG	2.2	1.8	1.6	1.8	2	2	2.4	-	-	2.2	-	2.4	2.6	2.4

16AU4002 THERMAL AND FLUID ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

Course Objectives

1. To study the heat transfer phenomena predict the relevant coefficient using different equipments.
2. To conduct an experiment with the heat transfer coefficient under natural convection and forced convection.
3. To conduct an experiment with the heat exchangers and emissivity surface.
4. To have hands on experience in flow measurements using different devices and also perform calculation related to losses in pipes.
5. To find the performance and characteristics curves of pumps and turbines.

A THERMAL ENGINEERING LABORATORY

1. Determination of Thermal conductivity of composite wall.
2. Heat Transfer on PIN FIN Apparatus
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube
5. Determination of emissivity of a grey surface.
6. Effectiveness of Parallel and counter-flow heat exchanger.

B FLUID MECHANICS & MACHINERY LABORATORY

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturimeter.
3. Determination of friction factor for a given set of pipes.
4. Conducting experiments and drawing the characteristic curves of centrifugal pump.
5. Conducting experiments and drawing the characteristic curves of Pelton wheel.
6. Conducting experiments and drawing the characteristics curves of Francis turbine.
7. Conducting experiments and drawing the characteristic curves of Kaplan turbine

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Utilize the knowledge of heat transfer with different equipments.
CO2: Experiment with the heat transfer coefficient under natural convection and forced convection.
CO3: Design and Construct the heat exchangers and emissivity surface.
CO4: Analyze the measurement equipment for flow measurement.
CO5: Demonstrate the performance of pumps and turbines.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Composite wall apparatus	1 No.
2	Pin-fin Apparatus	1 No.
3	Natural convection-vertical cylinder apparatus	1 No.
4	Forced convection inside tube apparatus	1 No.
5	Emissivity measurement apparatus	1 No.
6	Parallel/counter flow heat exchanger apparatus	1 No.
7	Orifice meter setup	1 No.
8	Venturi meter setup	1 No.
9	Pipe Flow analysis setup	1 No.
10	Centrifugal pump setup	1 No.
11	Pelton wheel setup	1 No.
12	Francis turbine setup	1 No.
13	Kaplan turbine setup	1 No.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	3	3	2	-	-	-	3		1	2	2
CO2	3	3	3	3	2	2	-	-	-	3		1	2	2
CO3	3	3	3	3	1	2	-	-	-	2		2	2	2
CO4	3	3	3	2	1	2	-	-	-	2		1	2	2
CO5	3	3	3	2	2	2	-	-	-	2		2	2	2
AVG	3	3	3	2.6	1.8	2	-	-	-	2.4	-	1.4	2	2

16AU4003 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY

L	T	P	C
0	0	4	2

Course Objectives

1 To do testing and maintenance of batteries, starting motors and generators
2 To perform testing of regulators and cut-outs relays.
3 To diagnose of ignition system faults.
4 To study the automobile electrical wiring system.
5 To gain a wide knowledge in the basic electronic components and circuits.

LIST OF EXPERIMENTS

a. **Electrical Laboratory**

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut – outs
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring

b. **Electronics Laboratory**

1. Study of rectifiers, Logic gates, SCR timer
2. Interfacing of analog sensors like RTD, LVDT, and Load Cell with micro-controller
3. Interfacing of actuators like stepper motor with micro-controller
4. Study of Analog to Digital and Digital to Analog converters
5. Micro Processor programming and interfacing
6. Study and on board diagnosis of Engine Management System
7. Study of Virtual Instrumentation

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

After completion of this course the student will be able to

CO1: Comprehend the working and troubleshooting of battery, regulators and cut-out relays.
CO2: Demonstrate and diagnose the ignition system.
CO3: Interface the sensors and actuators with microcontroller.
CO4: Observe and troubleshoot the automotive electrical circuits and systems.
CO5: Get exposure in the state of the art electronic technologies in testing and controlling of vehicles.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.		S.No.	NAME OF THE EQUIPMENT	QTY.
1	Battery, hydrometer, voltage tester	1 Each		8	IC timer	15
2	Starter motor, regulator, cut-out	1Each		9	Data logger	1
3	Distributor, ignition coil, spark plug	1 Each		10	8085 trainer kit	10
4	Auto electrical wiring system	1		11	ADC interface board	2
5	Rectifiers, filters	15 Each		12	DAC interface board	2
6	Bread board, Logic gates ICs	15 Each		13	Sensors like RTD, Load cell, LVDT	2
7	Amplifier	15		14	Actuators like stepper motor	2

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2	2	1	3	3	2	-	3	1	3	3	3
CO2	3	3	2	3	1	3	3	2	-	2	1	3	2	2
CO3	3	3	2	2	3	2	2	2	-	2	1	3	2	2
CO4	3	3	1	3	3	3	3	2	-	2	1	3	3	3
CO5	3	3	2	3	3	3	3	2	-	2	1	3	3	3
AVG	3	3	1.8	2.6	2.2	2.8	2.8	2	-	2.2	1	3	2.6	2.6

16AU5201	VEHICLE DESIGN AND DATA CHARACTERISTICS	L	T	P	C
		3	0	0	3

Course Objectives

1 To impart knowledge on various parameters considered for design a vehicle
2 To analyze the resistance of vehicle motion
3 To Learn the vehicle performance correlated various parameter performance curves
4 To acquire knowledge in fuel supply systems
5 To determine the vehicle performance with gear ratio

UNIT I VEHICLE DESIGN AND DATA (9)

Assumptions to be made in designing a vehicle - Range of values for Gross Vehicle Weight - Frontal Area - maximum speed - maximum acceleration - gradability in different gears - Basics of Automobile Design.

UNIT II RESISTANCE TO VEHICLE MOTION (9)

Calculation, Tabulation and Plotting of Curves for Air and Rolling Resistances at various vehicle speeds, Calculation and Plotting of Driving force, Power requirement for different loads and acceleration, Maximum Power calculation.

UNIT III PERFORMANCE CURVES (9)

Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity – Derivation of connecting rod length to Crank Radius Ratio - Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

UNIT IV FUEL SYSTEMS (9)

SI engine fuel supply system – types of fuel pumps – Air – fuel requirements – Fuel distribution – Air and Fuel flow in carburetor – Critical velocity – relationship curve for engine speed, fuel and air flows - CI engine fuel supply system – Injector – velocity and work force calculation.

UNIT V GEAR RATIOS (9)

Determination of Gear Ratio, Acceleration and Gradability, Typical Problems on Vehicle performance.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Learn the nature of characterization to design the vehicle
CO2: Able to compute the various resistance concerned during vehicle motion
CO3: Construct the vehicle performance curve based on the vehicle and mechanical parameters
CO4: Learn the functions of fuel supply systems related with gear ratio and acceleration
CO5: Able to Inference gear ratio with vehicle performance

Text Books

T1 Giri. N. K., "Automotive Mechanics", Khanna Publishers, New Delhi, 2015
T2 Heldt, P.M., "High Speed Combustion Engines", Oxford and I.B.H. Publishing Co., Kolkata, 2015.

References

R1 Gupta. R.B., "Automobile Engineering", SathyaPrakashan, 8 edu., 2016.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	3	3	1	1	-	-	-	-	1	-	1	2	3
CO2	3	3	2	1	1	1	-	-	-	1	-	1	2	2
CO3	2	3	3	3	1	-	-	-	-	1	-	1	2	2
CO4	3	3	2	3	2	2	-	-	-	1	-	1	2	3
CO5	3	3	2	1	1	1	-	-	-	1	-	1	2	2
AVG	2.8	3	2.4	1.8	1.2	1.333	-	-	-	1	-	1	2	2.4

16AU5202	AUTOMOTIVE TRANSMISSION	L	T	P	C
		3	0	0	3

Objective

1 To compare types of Clutches and Gear Box, its principle and applications.
2 To Learn the construction, principle and the concept of Fluid Coupling & Torque Convertor
3 To define the various transmission and drive line units of automobiles
4 To demonstrate the various types of hydrostatic and electric drives
5 To list out the applications of automatic transmission

UNIT I CLUTCH AND GEAR BOX (9)

Requirement of transmission system –Types of clutches–Principle & Construction of Single plate, Diaphragm, Multi Plate, Centrifugal ,Semi-Centrifugal and Dual Clutch–Gear box–Construction and operation–Sliding mesh, Constant mesh and Synchromesh gearboxes– Determination of gearratios, Tractive effort, Engine speed & Power and acceleration.

UNIT II FLUID COUPLING AND TORQUE CONVERTORS (9)

Fluid coupling-Principle-Constructional details–Torque capacity–Performance characteristics–Reduction of drag torque in fluid coupling–Torque converter-Principle-constructional details, performance characteristics–Multistage torque converters and Polyphase torque converters.

UNIT III EPICYCLIC GEARBOXES (9)

Principle of Planetary gear trains - Wilson Gear box – Cotal electromagnetic transmission - Hydraulic control system for Automatic Transmission.

UNIT IV HYDROSTATIC AND ELECTRIC DRIVE (9)

Hydrostatic drive- Various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive– constructionand working of typical Janny hydrostatic drive–Electric drive-types- Principle of early and modifiedWard Leonard Control system-Advantages & limitations

UNIT V AUTOMATIC TRANSMISSION APPLICATIONS (9)

Automatic transmission– merits and demerits–Four speed longitudinally mounted automatic transmission– Chevrolet turbo glide transmission–ZF gear box–Electronically Controlled Transmission– CVT-Types, Operation

TOTAL:45 PERIODS

Outcomes

At the end of this course students will be able to:

1 Classify the constructional, working principle of various types of manual and automotive transmission of an automobile.
2 Explain the advantages of automatic transmission over the conventional systems
3 Build a proper transmission system for a vehicle
4 Identify and solve problems related to transmission system.
5 Summarize the application of automatic transmission in automobile industry

Text Books

1 Heldt,P.M., Torque converters, Chilton Book Co., 1962.
2 Newton and Steeds, Motor vehicles, Illiffe Publishers, 1985.
3 Judge, A.W., Modern Transmission systems, Chapman and Hall Ltd., 1990

References

1 SAE Transactions 900550 & 930910.
2 Hydrostatic transmissions for vehicle applications, I Mech E Conference, 1981-88.
3 Crouse,W.H., Anglin,D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1976.
4 Heinz Heisler, Advance vehicle Technology, Butterworth-Heinemann.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	3	2	3	2	3	-	-	3	-	2	2	3
CO2	3	2	3	2	3	2	2	-	-	3	-	2	2	3
CO3	3	3	2	-	3	3	3	-	-	2	-	2	2	3
CO4	3	3	2	-	2	2	2	-	-	2	-	1	2	3
CO5	3	3	2	-	3	2	2	-	-	2	-	1	2	3
AVG	3	2.6	2.4	2	2.8	2.2	2.4	-	-	2.4	-	1.6	2	3

16AU5203	AUTOMOTIVE FUELS AND LUBRICANTS	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn the manufacture of fuels and lubricants for the design and operation of the I.C engines.
2 To Learn the different types of lubrication used in the automotive fuels and lubricants
3 To summarize the properties, additives and mechanism of lubricants.
4 To study the combustion characteristics of fuels in I.C. Engines
5 To Illustrate the combustion and fuel rating.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS (9)

Fuels-Structure of petroleum-refining process-Thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending- Manufacture of lubricating oil base stocks and finished automotive lubricants.

UNIT II THEORY OF LUBRICATION (9)

Engine friction- Introduction- Mechanical efficiency-Mechanical friction-Blow by losses-Pumping loss-factors affecting mechanical friction- Lubrication-function-mechanism -hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication-Lubrication of engine components.

UNIT III LUBRICANTS (9)

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.

UNIT IV COMBUSTION OF FUELS (9)

Stoichiometry - calculation of theoretically correct air required for combustion of liquid and gaseous fuels-volumetric and gravimetric analysis of the dry products of combustion-mass of dry gas per kg of fuel burnt- mass of carbon in the exhaust gas-mass of carbon burnt to carbon-monoxide per kg of fuel-heat loss due to incomplete combustion- exhaust gas analysis by Orsat apparatus.

UNIT V COMBUSTION AND FUEL RATING (9)

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements-CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Gain knowledge on the importance and manufacturing methods in fuels and lubricants
CO2: Utilize the importance of theory of lubrication.
CO3: Summarize the properties, additives and mechanism of lubricants.
CO4: Show the combustion characteristics of fuels in IC engine
CO5: Inference the combustion of fuels and fuel rating in IC engines

Text Books

T1 Ganesan.V, “Internal Combustion Engineering”, Tata McGraw-Hill Publishing Co., 2003.
T2 Mathur. M.L., Sharma. R.P. “A course in internal combustion engines”, Dhanpatrai publication, 2003.
T3 Obert.E.F “Internal Combustion Engineering and Air Pollution”, International book Co., 1988.

References

R1 Brame, J.S.S. and King, J.G. – "Fuels Solids, Liquids, Gaseous". Edward Arnold, 1961
R2 Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965
R3 Hobson, G.D. &Pohl.W "Modern Petroleum Technology", 1974
R4 Lansdown. A.R., Lubrication, "A practical guide to lubricant selection", Pergamon press, 1982.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	3	2	-	3	2	-	3	-	2	2	2
CO2	2	3	2	2	2	-	2	-	-	2	-	1	3	2
CO3	3	3	2	2	2	2	2	2	-	2	-	2	3	2
CO4	2	2	1	2	-	-	2	-	-	2	-	2	2	2
CO5	2	2	2	2	2	-	2	-	-	2	-	2	2	2
AVG	2.2	2.4	1.8	2.2	2	2	2.2	2	-	2.2	-	1.8	2.4	2

16AU5204	DESIGN OF MACHINE ELEMENTS (COMMON TO AUTO & MECH)	C	T	P	C
		3	0	0	3

Note: (Use of P S G Design Data Book is permitted in the University examination)

Course Objectives

1. To Learn the design function in mechanical engineering, different steps involved in designing and the relation of design activity with manufacturing activity.
2. To know the different types of failure modes and criteria.
3. To Learn the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
4. To gain design knowledge of the different types of elements used in the machine design process, for e.g. Shafts, couplings etc. and will be able to design these elements for each application.
5. To learn to use catalogues and standard machine components

UNIT I STEADY STRESSES IN MACHINE MEMBERS (9)

Introduction to the design process - factors influencing machine design - calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame - theories of failure – Design based on strength and stiffness – stress concentration.

UNIT II VARIABLE STRESSES IN MACHINE MEMBERS (8)

Variable stresses - Soderberg, Gerber and Goodman methods for combination of stresses and their application in design problems.

UNIT III DESIGN OF COUPLINGS AND SHAFTS (10)

Design and drawings of couplings – Rigid – Flexible, Design of solid & hollow shaft on strength and rigidity basis with steady loading subjected to pure torsion. Design of shafts carrying pulleys & gears (Combined loading).

UNIT IV DESIGN OF SPRINGS AND FLYWHEEL (9)

Various types of springs, optimization of helical springs, Leaf springs –Flywheels considering stresses in rims and arms for engines and punching machines

UNIT V DESIGN OFBEARINGS (9)

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfield Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Demonstrate the fundamentals of stress analysis, theories of failure and material science in the design of machine components.
- CO2: Identify proper assumptions with respect to material, factor of safety, static and dynamic loads for various machine components
- CO3: To analyze the stress and strain of mechanical components and Learn, identify and quantify failure modes for mechanical part.
- CO4: Ability to design mechanical system for fluctuating loads
- CO5: Enable the students to have high ethical standards in terms of team work to be a good design engineer.

Text Books

- T1 Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
- T2 Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

References

- R1 Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
- R2 Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
- R3 Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	2	3	3	-	3	3	-	-	2		2	3	2
CO2	3	2	3	2	-	2	2		-	1	-	2	3	2
CO3	3	3	2	3	-	2	-	-	-	2		2	3	3
CO4	3	3	2	2	-	2	2		-	1		2	3	3
CO5	3	3	1	2	-	2	1	-	-	2	-	1	3	3
AVG	3	2.6	2.2	2.4	-	2.2	2	-	-	1.6	-	1.8	3	2.6

16AU5205	AUTOMOTIVE ENGINE COMPONENTS DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

1. To build the students Learn the design concepts of various engine Components like cylinder, piston, connecting rod, crankshaft, flywheels and valve mechanisms.
2. To Learn the energy conversion of the engine
3. To develop the students familiar in balancing of rotating masses.
4. To make the students to Learn the motion study of rotating components
5. To make the students to design the engine Components according to engineering materials and its relative condition

UNIT I INTRODUCTION (9)

Engineering materials-Introduction endurance limit-notch sensitivity-Tolerances and fits –types-design considerations for interference fits-surface finish-surface roughness-Rankine's formula- Tetmajer's formula-Johnson formula-design of pushrods.

UNIT II DESIGN OF CYLINDER, PISTON AND CONNECTING ROD (9)

Cylinder and piston-material-design of cylinder-piston-piston pin-piston rings-piston failures- lubrication of piston assembly. Connecting rod-Material-determining minimum length of connecting rod- design of small end-shank-big end-cap bolts.

UNIT III DESIGN OF CRANKSHAFT (9)

Balancing of I.C. engines-firing order-Materials-design of crankshaft under bending and twisting-balancing weight calculations-development of short and long crank arms-Front and rear end details.

UNIT IV DESIGN OF FLYWHEELS (9)

Determination of the mass of a flywheel for a given co- efficient of speed fluctuation-Engine flywheel-stresses on the rim of the flywheels-Design of hubs-arms-turning moment diagram.

UNIT V DESIGN OF VALVES AND VALVE TRAIN (9)

Design aspects of intake & exhaust manifolds-inlet & exhaust valves-valve springs-tappets-valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.

TOTAL:45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

Course Outcomes

At the end of this course students will be able to:

- CO1: Upon completion of the course, students will be able to impart knowledge in automotive Engine components design and its principles
- CO2: Students can have capable of design of engine components according to various load conditions.
- CO3: At the end of the course the students will develop their own ideas as engine design
- CO4: Able to balance the engine
- CO5: At the end of the course the students will command over automotive engines design

Text Books

T1 Khurmi. R.S. & Gupta. J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001

References

R1 Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 2005.

R2 Giri.N.K, "Automobile Mechanics", Khanna Publishers, New Delhi, 2007.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	3	3	2	3	3	2	-	-	-	-	3	3	2
CO2	3	3	3	2	3	2	2	-	-	-	-	2	3	2
CO3	3	3	3	2	3	2	2	-	-	-	-	2	3	2
CO4	3	3	3	1	2	2	2	-	-	-	-	3	3	2
CO5	3	3	3	1	2	2	1	-	-	-	-	2	2	2
AVG	3	3	3	1.6	2.6	2.2	1.8	-	-	-	-	2.4	2.8	2

16AU5001	COMPUTER AIDED ENGINE AND CHASSIS DESIGN LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1 To familiarize the students to use modeling software to model engine components, chassis components
2 To apply the basic design knowledge for designing the engine and chassis components
3 Students able to study and Learn the loads and stresses acting on the engine components
4 To make the students know about balancing of the rotating components
5 Able to make assembly and simulation of the engine components

LIST OF EXPERIMENTS

Engine Design

1. Design and drawing of piston, Piston pin and piston rings and drawing of these components.
2. Design of connecting rod small end and big end, shank design, design of big end cap, bolts and drawing of the connecting rod assembly
3. Design of crankshaft and balancing weight calculations
4. Design and drawing of flywheel including the development of ring gear teeth
5. Design and drawing of the inlet and exhaust valves.
6. Design of cam and camshaft, cam profile generation, drawing of cam and camshaft.
7. Design of combustion chamber.

Chassis Design

1. Complete design of clutch components.
2. Assembly drawing of clutch using drafting software.
3. Design of propeller shaft
4. Assembly drawing of gear box using drafting software
5. Layout of gear box and gear ratio calculation
6. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings
7. Design aspects of final drive

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Ability to use the drafting and modeling software for automobile components design
CO2: Able to know the engine components design calculation
CO3: Students can have capable of selection of material and standard components according to the design aspects
CO4: Students able to validate the design concepts with relative subjects
CO5: Forecast the faults by means of simulation of assembly

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Computer nodes	15 Nos.
2	Drafting and Modelling Software's	15 licenses each

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	3	3	2	3	3	3	-	-	2	-	2	3	3
CO2	3	3	3	2	2	3	2	-	-	2	-	2	2	2
CO3	3	2	3	2	2	2	3	-	-	3	-	1	2	2
CO4	3	2	3	3	3	2	2	-	-	2	-	3	3	3
CO5	3	3	3	3	3	2	2	-	-	2	-	3	3	3
AVG	3	2.6	3	2.4	2.6	2.4	2.4	-	-	2.2	-	2.2	2.6	2.6

16AU5002	AUTOMOTIVE FUELS AND LUBRICANTS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1 To do independent experiments to find out the properties of fuels and lubricants
2 To grasp the importance of viscosity in the fuels and lubricants
3 To be familiar with the calorific value of liquids and gaseous fuels.
4 To conduct experiment on carbon, copper residue and ash content test
5 To conduct experiment on drop point and mechanical penetration test of grease.

LIST OF EXPERIMENTS

1. Study of International and National standards for fuels and lubricants.
2. Study of Octane and Cetane Number of fuels.
3. ASTM distillation test of liquid fuels
4. Aniline Point test of diesel
5. Calorific value of liquid fuel.
6. Calorific value of gaseous fuel.
7. Reid vapour pressure test.
8. Flash and Fire points of petrol and diesel.
9. Copper strip Corrosion Test
10. Cloud & Pour point Test.
11. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
12. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
13. Ash content and Carbon Residue Test
14. Drop point of grease and mechanical penetration in grease.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Develop to produce high focused independent practical skill on fuels and lubricants.
CO2: Identify how they can be involved in doing experiments
CO3: Construct an in-depth analysis related with any fuel / lubricant.
CO4: Describe how the temperature and friction can influence the properties of fuels and lubricants
CO5: Experiment with the properties of grease.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Flash and fire point apparatus (for Petrol)	1
2	Aniline point Apparatus	1
3	Reid vapor pressure test Apparatus	1
4	Bomb and Gas Calorimeters	1
5	Carbon Residue Test Apparatus	1
6	Copper Strip Corrosion Test Apparatus	1
7	Cloud and Pour point Apparatus	1
8	Redwood Viscometer	1
9	Saybolt Viscometer	1
10	ASTM distillation test Apparatus	1
11	Ash content Test Apparatus	1
12	Drop point and penetration Apparatusfor grease	1

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	3	2	3	3	3	3	-	-	3	-	3	3	2
CO2	2	2	2	2	3	2	2	-	-	3	-	3	3	2
CO3	3	2	2	3	3	2	2	-	-	3	-	2	3	2
CO4	2	3	2	3	3	3	2	-	-	2	-	2	2	2
CO5	1	3	1	3	2	3	2	-	-	2	-	2	2	2
AVG	2.2	2.6	1.8	2.8	2.8	2.6	2.2	-	-	2.6	-	2.4	2.6	2

16AU6201	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives

1. To equip the students with the Finite Element Analysis fundamentals.
2. To enable the students to formulate the design problems into FEA.
3. To introduce basic aspects of finite element technology, including domain discretization, polynomial interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.
4. To develop proficiency in the application of the finite element method (modeling, analysis, and interpretation of results) to realistic engineering problems through the use of a major commercial general – purpose finite element code.
5. To enable the students to Solve Fluid Structure Interaction problems.

UNIT I INTRODUCTION (9)

Historical background – Matrix approach – Application to the continuum – Discretization – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method.

UNIT II ONE DIMENSIONAL PROBLEMS (9)

Finite element modeling – Coordinates and shape functions- Potential energy approach – Galerkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT III TWO DIMENSIONAL AND ISOPARAMETRIC ELEMENT PROBLEMS (9)

Introduction – Finite element modeling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galerkin approach - Stress calculation – Temperature effects – The four node quadrilateral – Shape functions – Element stiffness matrix and force vector –lagrangean and serendipity elements– Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.

UNIT IV AXISYMMETRIC CONTINUUM (9)

Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs.

UNIT V APPLICATIONS IN HEAT TRANSFER AND FLUID MECHANICS (9)

Finite Element formulation of One-dimensional and Two-dimensional steady state heat conduction problems with convection - Simplex elements only. Finite Element formulation of inviscid and incompressible flow – Potential function formulation – Stream function formulation

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Identify mathematical model for solution of common engineering problems.
- CO2: Formulate simple problems into finite elements.
- CO3: Solve structural, thermal, fluid flow problems.
- CO4: Use professional-level finite element software to solve engineering problems in Solid mechanics, fluid mechanics and heat transfer.
- CO5: Derive element matrix equation by different methods by applying basic laws inmechanics andIntegration by parts.

Text Books

- T1 Reddy. J.N., “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2006
- T2 Seshu.P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
- T3 Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butterworth Heinemann, 2011.

References

- R1 Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002.
- R2 Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.
- R3 Chandrupatla&Belagundu, “Introduction to Finite Elements in Engineering”,3rd Edition,Prentice 1990.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	3	3	3	2	-	-	-	-	2	-	-	2	3
CO2	2	3	3	3	2	-	-	-	-	2	-	-	2	2
CO3	2	2	3	3	2	-	-	-	-	1	-	-	2	3
CO4	3	3	2	3	2	-	-	-	-	1	-	-	2	3
CO5	3	3	2	2	1	-	-	-	-	2	-	-	2	2
AVG	2.4	2.8	2.6	2.8	1.8	-	-	-	-	1.6	-	-	2	2.6

16AU6202	AUTOMOTIVE CHASSIS COMPONENTS DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

1. To comprehend the design features of automobile chassis components and suspension systems.
2. To Learn the design parameters of automotive front axle and steering systems.
3. To inspect the functionality of driveline components, rear axle and transmission systems along with the various forces, reactions and moments.
4. To interpret the various types of clutches and gearboxes with the design principles
5. To analyze the practical problems normally arising with design of braking system components.

UNIT I VEHICLE FRAME AND SUSPENSION (9)

Study of Loads, Moments and Stresses on Frame Members - Design of Frame for Passenger and Commercial Vehicles – Suspension system – functions - Design of Leaf Springs - Coil Springs -Torsion Bar Springs.

UNIT II FRONT AXLE AND STEERING SYSTEMS (9)

Analysis of loads, moments and stresses at different sections of front axle - determination of bearing loads at kingpin bearings - wheel spindle bearings - choice of bearings – steering system – functions - determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

UNIT III DRIVE LINE AND REAL AXLE (9)

Design of propeller shaft - Design details of final drive gearing - Design details of full floating, semi-floating and three quarter floating rear shafts - rear axle housings - design aspects of final drive.

UNIT IV CLUTCH AND GEAR BOX (9)

Clutch - design of single plate, multi-plate and cone clutch - torque capacity of clutch - design of clutch components – Gearbox – functions - gear train calculations - layout of gearboxes - Design of gearboxes.

UNIT V BRAKING SYSTEM (9)

Brakes – Function - stopping time and distance - weight transfer during braking - brake actuating mechanisms: mechanical, hydraulic and pneumatic - disc and drum brakes - design of brake shoes and friction pads.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Examine the design features of automotive layout and functionality of suspension systems.
- CO2: Criticize about the constructional features and principles of automotive steering and front axle systems.
- CO3: Design the driveline system with rear axle.
- CO4: Analyze the various design features and parameters while designing the automotive transmission systems.
- CO5: Assess the various factors to be considered while designing the braking system.

Text Books

T1 Giri, N.K., “Automobile Mechanics”, Khanna publishers, New Delhi, VIII edition 2015.
T2 Khurmi. R.S. & Gupta. J.K., “A textbook of Machine Design”, Eurasia Publishing House (Pvt) Ltd, 2005.

References

T1 Heldt, P.M., “Automotive Chassis”, Chilton Book Co., 2012.
T2 Dean Averns, “Automobile Chassis Design”, Illife Book Co., 2009.

WEB RESOURCES

W1 http://web.iitd.ac.in/~achawla/public_html/736/3-Automotive_chassis-design-v2.pdf - Unit I
W2 http://web.iitd.ac.in/~achawla/public_html/736/15-Suspension_systems_and_components_v2.pdf - Unit I
W3 www.carbodydesign.com/ - Unit I

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	1	-	3	3	-	-	2	-	2	2	3
CO2	3	2	3	1	-	1	1	-	-	2	-	1	2	3
CO3	3	3	2	1	-	3	3	-	-	2	-	1	2	2
CO4	3	3	2	1	-	2	2	-	-	2	-	2	3	2
CO5	3	3	2	1	-	2	2	-	-	2	-	2	2	2
AVG	3	2.8	2.4	1	-	2.2	2.2	-	-	2	-	1.6	2.2	2.4

16AU6203	VEHICLE DYNAMICS	L	T	P	C
		3	0	0	3

Course Objective

1 To acquire knowledge of basic concepts of vibration
2 To Learn the fundamentals of tire forces and moments
3 To impart knowledge of vertical dynamics of suspension system
4 To develop the students familiar in longitudinal dynamics and control
5 To learn about the lateral dynamics of vehicle

UNIT I CONCEPT OF VIBRATION (9)

Modeling and Simulation – Global and Vehicle Coordinate System – Free, Forced,Undamped and Damped Vibration – Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor – Transmissibility – Vibration absorber – Vibration measuring instruments Torsionalvibration – Critical speed.

UNIT II TIRES (9)

Tire forces and moments – Tire structure – Longitudinal and Lateral force at various slip angles – RollingResistance, Tractive and cornering property of tire – Performance of tire on wet surface – Ride propertyof tires – Magic formulae tire model – Estimation of tire road friction – Test on Various road surfaces – Tirevibration.

UNIT III VERTICAL DYNAMICS (8)

Human response to vibration – Sources of Vibration – Design and analysis of Passive, Semi-active andActive suspension using Quarter car, half car and full car model – Influence of suspension stiffness – suspension damping and tire stiffness – Control law for LQR – H-Infinite – Skyhook damping – Airsuspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL (9)

Aerodynamic forces and moments – Loaddistribution for threewheeler and four wheeler – Calculation of Maximum acceleration, Reaction forcesfor Different drives – Braking and Driving torque – Prediction of Vehicle performance – ABS, Stabilitycontrol, Traction control.

UNIT V LATERAL DYNAMICS (9)

Steady state handling characteristics – Steady state response to steering input – Testing of handling characteristics – Transient response characteristics – Direction control of vehicles – Roll center, Roll axis,Vehicle under side forces – Stability of vehicle on banked road, during turn – Effect of suspension oncornering.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

1 Students can able to Learn the concepts of vibration
2 Learn about the tire dynamics
3 Built strong fundamental knowledge in vertical and longitudinal dynamics
4 Apply the concepts of lateral dynamics to the vehicle
5 At the end of the course the students will commend over in the dynamics of vehicle

Text Books

1 Wong. J. Y., "Theory of Ground Vehicles", 3rd Edition, Wiley-Interscience, 2001
2 Rajesh Rajamani, "Vehicle Dynamics and Control", 1st edition, Springer, 2005
3 Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc, 1992

References

1 Hans B Pacejka, "Tire and Vehicle Dynamics", 2nd edition, SAE International, 2005
2 Singiresu S. Rao, "Mechanical Vibrations", 5th Edition, Prentice Hall, 2010

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	3	3	2	3	3		-	2	-	2	3	3
CO2	3	3	3	3	2	3	2		-	1	-	2	2	2
CO3	3	3	3	3	2	2	3		-	1	-	1	2	2
CO4	3	3	3	3	2	3	3		-	2	-	3	3	3
CO5	3	3	3	3	2	3	3		-	2	-	3	3	3
AVG	3	3	3	3	2	2.8	2.8	-	-	1.6	-	2.2	2.6	2.6

16AU6204	TWO AND THREE WHEELER TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

1 To know and Learn the constructional details, operating characteristics and regulations of two and three wheelers.
2 To Learn the vehicle design aspects, lubrication, cooling starting system and panel meters.
3 To Demonstrate the transmission and steering system.
4 To acquire a knowledge about brake and suspension system.
5 To know about case studiesin two and three wheelers.

UNIT I INTRODUCTION (9)

Development- Classification and layouts of two wheelers (motorcycles, scooters, mopeds) and Three wheelers - applications & capacity – goods & passengers - study of technical specification of Two & Three wheelers. Frames - Types of frame-construction- loads- design consideration-materials- Three wheeler-body- layout- RTO regulations.

UNIT II THE POWER UNIT (9)

Design considerations for two wheeler and three wheeler – Three wheeler - power plants - special systems requirements for lubrication - cooling-starting -. Panel meters and controls on handle bar

UNIT III TRANSMISSION AND STEERING SYSTEM (9)

Transmission Systems -Clutch – special requirements-types- need of primary reduction- selection of transmission - gear transmission- gear shift mechanism-belt transmission-automatic transmission (Continuous Variable Transmission - CVT,Epicyclic)- final drive & differential for three wheeler- wheel drive arrangement-Steering-Steering geometry-steering column construction- steering system for three wheelers.

UNIT IV BRAKE AND SUSPENSION SYSTEM (9)

Brake-Wheel and Tyres-Design consideration of brake-types of brakes – disc and drum- braking mechanism – mechanical, hydraulic and servo- wheel types - spokes, disc, split, special tyre requirements for two & three wheelers-Suspension requirements- design considerations- trailing & leading link- swinging arm- springs and shock absorbers.

UNIT V TWO & THREE WHEELERS – CASE STUDY (9)

Case study of Sports bike- Motor cycles-Scooters- Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance. Recent developments.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Summarize the various subsystem of two and three wheeler and also know how it is different from light motors and heavy motor vehicles.
CO2: Dissect familiar with maintenance procedures of engine cooling system, lubrication system, starting system and servicing of dash board instrument.
CO3: Organize the Transmission and Steering System of two wheelers.
CO4: Rephrase the Brake, suspension and shock absorber of two wheelers.
CO5: Summarize the various subsystem of two and three wheeler and also know how it is different from light motors and heavy motor vehicles.

Text Books

T1 Gaetano Cocco, “Motorcycle Design and Technology”, Giorgio Nada Editore (April 1, 2013)

References

R1 Mick Walker, “Motorcycle: Evolution, design and Passion”, Johns Hopkins, 2006
R2 Marshall Cavensih, “Encyclopedia of Motor cycling, 20 volumes”, New York and London,1989
R3 John Robinson, “Service Manuals of Manufacturers of Indian Two & Three wheelers.
R4 Motorcycle Tuning: Chasis”, Butterworth-Heinemann, 2001
R5 Ramalingam. K. K., "Two Wheelers", Scitech publications, Chennai,2009

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	2	1	3	-	3	3	-	-	2	-	3	3	2
CO2	3	2	-	3	-	3	2	-	-	2	-	3	2	2
CO3	3	2	2	3	-	2	2	-	-	2	-	2	3	2
CO4	2	3	3	3	1	2	2	-	-	2	-	2	3	2
CO5	3	3	2	2	1	2	2	-	-	2	-	2	3	3
AVG	2.8	2.4	2	2.8	1	2.4	2.2	-	-	2	-	2.4	2.8	2.2

16AU6001 **TWO AND THREE WHEELERS LABORATORY**

L	T	P	C
0	0	4	2

Course Objectives

1 To conduct performance test of a two wheeler using chassis dynamometer
2 To conduct performance test of a shock absorber and coil spring
3 To dismantle and assemble the two and three wheeler gear box and to find gear ratio
4 To study about the three wheeler chassis frame and power transmission system
5 To study about the three wheeler chassis frame, steering and power transmission systems

LIST OF EXPERIMENTS

1. Performance test of a two wheeler using chassis dynamometer.
2. Performance test on shock absorber
3. Performance test on coil spring.
4. Two wheeler chain test
5. Brake and Clutch adjustment as per specification.
6. Dismantling and assembling of two wheeler gear box and finding gear ratios
7. Dismantling and assembling of three wheeler box and finding gear ratios
8. Three wheeler brake and clutch play adjustment
9. Dismantling and assembling of three wheeler steering system.
10. Study of three wheeler chassis frame and power transmission system

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Simplify the engine components and conduct performance test on two and three wheelers.
CO2: Analyze the various testing procedure of two wheelers using chassis dynamometer
CO3: Identify the performance of Shock Absorber by using shock absorber test rig
CO4: Make use of suitable tools to dismantle & assemble of gearbox of two and three wheelers and drawing of power flow diagram from Input shaft to output shaft
CO5: Make use suitable tools to dismantle & assemble three wheeler steering system and rectifying it.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Two wheeler chassis dynamometer	1
2	Coil spring test rig	1
3	Chain tension test rig	1
4	Shock absorber test rig	1
5	Two-wheeler gearbox	2
6	Two-wheeler clutch	2
7	Three-wheeler brake assembly	2
8	Three-wheeler steering assembly	2
9	Three-wheeler gear box	2

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	3	3	3	2	2	2		3	2	3	2	3	3
CO2	3	3	3	3	2	2	1		3	1	2	2	2	2
CO3	3	3	3	3	2	1	1		1	1	1	1	2	2
CO4	3	3	3	3	2	2	1		2	2	3	3	3	3
CO5	3	3	3	3	2	2	2		2	2	3	3	3	3
AVG	3	3	3	3	2	1.8	1.4	-	2.2	1.6	2.4	2.2	2.6	2.6

16AU6002 **FINITE ELEMENT ANALYSIS LABORATORY**

L	T	P	C
0	0	4	2

Course Objectives

1 To give exposure to software tools needed to analyze engineering problems.
2 To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of Axi – Symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.
10. Dynamic Analysis of Flange.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Upon completion of this course, the Students can model, analyse and simulate experiments to meet real world system and evaluate the performance.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Computer Work Station	15
2	Multi Body Dynamic Software Suitable for Mechanism simulation and analysis	15 Licenses

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	3	3	3	2	2	2		3	2	3	2	3	3
CO2	3	3	3	3	2	2	1		3	1	2	2	2	2
CO3	3	3	3	3	2	1	1		1	1	1	1	2	2
CO4	3	3	3	3	2	2	1		2	2	3	3	3	3
CO5	3	3	3	3	2	2	2		2	2	3	3	3	3
AVG	3	3	3	3	2	1.8	1.4	-	2.2	1.6	2.4	2.2	2.6	2.6

16AU7201	ENGINE AND VEHICLE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives

1. Students able to get exposure in microprocessor architecture and fuzzy logic
2. Learn the fundamental of sensors and actuators.
3. To impart the knowledge of electronics in vehicle and engine management system of IC engines
4. Acquire knowledge of electronically controlled safety systems
5. To build strong base in autotronics

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS (9)

Microprocessor architecture-open and closed loop control strategies-PID control-Look up tables-introduction to modern control strategies like Fuzzy logic-adaptive control. Parameters to be controlled in SI and CI engines and in the other parts of the automobile.

UNIT II SENSORS (9)

Inductive, Hall effect, hot wire, thermistor, piezo electric, piezo resistive based sensors. Throttle position, air mass flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

UNIT III SI ENGINE MANAGEMENT (9)

Three way catalytic converter-conversion efficiency versus lambda. Bosch L-Jetronic and LH-Jetronic management systems. Group and sequential injection-Cold start-warm up phases-idle speed control-acceleration-full load enrichment-deceleration fuel cutoff-Fuel control maps-open loop control fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control-Closed loop control of knock.

UNIT IV CI ENGINE MANAGEMENT (9)

Fuel injection system-parameters affecting combustion-noise and emissions in CI engines-Pilot- main-advanced post injection-retarded post injection-Electronically controlled Unit Injection-common rail fuel injection system-Fuel injector-fuel pump-rail pressure limiter-flow limiter-EGR valves

UNIT V VEHICLE MANAGEMENT SYSTEMS (9)

ABS system-need-working. Electronic control of suspension-Damping control-Electric power steering-Supplementary Restraint System-crash sensor-seat belt tightening-cruise control-Vehicle security systems-alarms-vehicle tracking system-On board diagnostics-Collision avoidance Radar warning system.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: At the end of the course, the student will Learn the micro processor controlled application in automobiles.
CO2: To get in depth knowledge in sensor based vehicle and engine management system for controlling pollution, enhancing safety of the vehicle.
CO3: Students can have capable of finding faults in automotive systems
CO4: Learnt about mapping of ECU
CO5: Develop the autotronics knowledge to their projects

Text Books

T1 William B Ribbens "Learning Automotive Electronics", SAE Publications, 1998
T2 Eric Chowanietz "Automobile Electronics" SAE Publications, 1994

References

R1 Robert Bosch "Diesel Engine Management" SAE Publications, 2006.
R2 Robert Bosch, "Gasoline Engine Management" SAE Publications, 2006.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2	2	3	3	-			2	-	3	3	2
CO2	3	2	2	2	3	3	2			2	-	3	3	2
CO3	2	3	2	2	2	3	-			2	-	2	3	3
CO4	2	3	2	2	2	2	-			2	-	2	3	3
CO5	3	2	2	2	2	3	-			2	-	2	3	3
AVG	2.4	2.4	2	2	2.4	2.8	2	-	-	2	-	2.4	3	2.6

16AU7202 **PROFESSIONAL ETHICS** **L T P C**
3 0 0 3

Course Objectives

1 To Learn the moral problems faced in the corporate setting and wider philosophical frameworks along with social importance.
2 To study the basic issues in Professional Ethics.
3 To have an awareness of doing engineering projects with utmost safety.
4 To appreciate the rights of others and to instill moral, social values and loyalty.
5 To enable the student in their engineering profession to explore the ethical issues in technological society.

UNIT I ENGINEERING ETHICS AND THEORIES (9)

Ethics – definition - moral issues - types of inquiry - morality and issues of morality - Kohlberg and Gilligan's theories - consensus and controversy - professional and professionalism - moral reasoning - ethical theories – virtues - professional responsibility – integrity - self-respect - duty ethics - ethical rights - self-interest – egos - moral obligations.

UNIT II SOCIAL ETHICS AND ENGINEERING AS SOCIAL EXPERIMENTATION (9)

Engineering as social experimentation - codes of ethics - Legal aspects of social ethics - the Challenger case study - Engineers duty to society and environment.

UNIT III SAFETY (9)

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island - Chernobyl case studies - Bhopal gas tragedy.

UNIT IV RESPONSIBILITIES AND RIGHTS OF ENGINEERS (9)

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination.

UNIT V GLOBAL ISSUES AND ENGINEERS AS MANAGERS, CONSULTANTSANDLEADERS (9)

Multinational Corporations – Environmental ethics – computer ethics – weapons development –engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – Engineers as trend setters for global values.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Gain an Learning of the importance of ethics and its importance to the Human Service Profession.
CO2: Demonstrate a beginning knowledge of the Human Service Code of Ethics and the ethical decision making model.
CO3: Behave cautiously in the safety aspect of societal engineering solutions.
CO4: Learn the impact of personal values and ethics on their professional roles and responsibilities.
CO5: Demonstrate a beginning Learning of the relationship between personal values and professional values.

Text Books

T1 Mike Martin and Roland Schinzinger, ―Ethics in Engineering. (2005) McGraw-Hill, New York.
T2 GovindharajanM , Professional Ethics and Human Values, (2013) Prentice Hall India Learning private limited.
T3 Charles D. Fleddermann, ―Engineering Ethics, 2004 (Indian Reprint) Pearson Education Prentice Hall, New Jersey.

References

R1 Charles E. Harris, Michael S. Protchard and Michael J Rabins, ―Engineering Ethics –Concepts and cases, 2000 (Indian Reprint now available) Wadsworth ThompsonLearning, United States.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	-	-	-	-	-	2	2	3	3	2	3	2	1	1
CO2	-	-	-	-	-	2	2	3	2	2	3	2	1	-
CO3	-	-	-	-	-	1	2	3	2	2	3	2	1	-
CO4	-	-	-	-	-	2	2	3	2	2	3	2	1	-
CO5	-	-	-	-	-	2	2	3	3	2	2	1	1	-
AVG	-	-	-	-	-	1.8	2	3	2.4	2	2.8	1.8	1	1

16AU7001	ENGINE PERFORMANCE AND EMISSION TESTING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1 To acquire the basic knowledge of different dynamometers, valve and port timing diagram.
2 To Conduct the Performance and emission Test on the multi cylinder CI and SI engines.
3 To conduct retardation test on IC engine.
4 To conduct heat balance and Morse test on multi cylinder petrol and diesel engines.
5 To Learn the P-Θ and P-V Diagrams.

LIST OF EXPERIMENTS

1. Study of Hydraulic, Electrical and Eddy Current Dynamometers
2. Valve Timing and Port Timing Diagram
3. Performance and Emission Test on Two Wheeler SI Engine
4. Performance and Emission Test On Automotive Multi-Cylinder SI Engine
5. Performance and Emission Test On Automotive Multi-Cylinder CI Engine
6. Retardation Test on I.C. Engines.
7. Heat Balance Test on Automotive Multi-Cylinder SI Engine
8. Heat Balance Test on Automotive Multi-Cylinder CI Engine
9. Morse Test on Multi-Cylinder SI Engine
10. P-Θ and P-V Diagrams for IC Engine with Piezo-Electric Pick Up, Charge Amplifier, Angle Encoder and Pc

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Acquired the basic knowledge of different dynamometers, valve and port timing diagram.
CO2: Experiment with the Performance and emission Test on the multi cylinder CI and SI engines
CO3: Interpret the retardation test on IC engines
CO4: Develop heat balance and Morse test on multi cylinder petrol and diesel engines
CO5: Summarize the P-Θ and P-V Diagrams.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Hydraulic Dynamometer	1
2	Eddy current dynamometer	1
3	Electrical dynamometer	1
4	Single cylinder two stroke cut section Engine	1
5	Single cylinder four stroke cut section Engine	1
6	Two-wheeler engine test rig.	1
7	Automotive multicylinder SI engine test rig with heat balance arrangement	1
8	Automotive multicylinder CI engine test rig with heat balance arrangement	1
9	Emission Measuring Instruments for Petrol & Diesel Engines	1 No. Each
10	Piezo-electric pick up, Charge Amplifier, Angle Encoder and PC	1 Set

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	3	3	2	3	3		-	1		3	3	2
CO2	3	2	3	3	2	3	3		-	1		2	2	3
CO3	3	2	3	3	2	3	2		-	1		3	3	3
CO4	3	2	3	2	2	2	2		-	1		2	2	2
CO5	3	2	3	2	1	2	2		-	1		2	3	3
AVG	3	2	3	2.6	1.8	2.6	2.4	-	-	1	-	2.4	2.6	2.6

16AU7002	VEHICLE MAINTENANCE LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

1 To Learn the complete knowledge of the vehicle maintenance procedures
2 To acquire skills in handling situations where the vehicle is likely to fail
3 To Learn various types of maintenance of vehicles, features and applications
4 To apply the knowledge in servicing vehicle components
5 To analyze the fault in modern engine using engine analyzer

LIST OF EXPERIMENTS

STUDY EXPERIMENTS:

1. Tools and instruments required for maintenance
2. Safety aspects with respect to man, machine and tools
3. General procedures for servicing and maintenance schedule
4. Wheel Alignment procedure

EXPERIMENTS:

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of driveline system
6. Fault diagnosis and service of braking system
7. Fault diagnosis and service of suspension system
8. Fault diagnosis and service of steering system
9. Fault diagnosis and service of electrical system like battery, starting system, charging system, lighting system etc.
10. Fault diagnosis and service of vehicle air conditioning system
11. Practice the following:
    a. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
    b. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
    c. Wheel bearings tightening and adjustment.
    d. Adjustment of head lights beam.
    e. Removal and fitting of tire and tube.
    f. Study and checking of wheel alignment - testing of camber, caster.
    g. Testing kingpin inclination, toe-in and toe-out
    h. Cylinder reboring – checking the cylinder bore, Setting the tool and reboring.
    i. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Able to describe the minor and major tuning of diesel and petrol engines
CO2: Able to dismantle, study, perform corrections and assemble the vehicle systems
CO3: Able to do the wheel alignment procedure and tyre removal procedure etc
CO4: Able to define the procedures of valve grinding, lapping, reboring calibration of fuel injection pump etc
CO5: At the end of the course the students will command over the fault finding, rectifying and maintenance of the automotive systems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	QTY.
1	Engine Analyze	1
2	Cylinder Compression Pressure Gauge	1
3	Vacuum Gauge	1
4	Spark Plug Cleaner and Tester	1
5	Cam Angle and RPM Tester	1
6	Tachometer	1
7	Wheel Alignment Apparatus	1
8	Gas Welding Equipment	1
9	Tyre Remover	1
10	Bearing Puller	1
11	Head Light Alignment Gauge	1
12	Service manuals of Petrol, Diesel Engines	1 Each
13	Cylinder Reboring Machine	1
14	Valve Grinding Machine	1
15	Valve Lapping Machine	1
16	Fuel injection calibration test bench with nozzle tester	1
17	HRD tester, Clamp on meter, Hydrometer	1 Each

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2	2	-	3	2	2	-	-	-	3	2	2
CO2	3	3	2	3	-	3	3	2	-	-	-	2	3	2
CO3	3	3	1	2	-	3	2	2	-	-	-	2	2	3
CO4	3	3	2	2	-	3	2	-	-	-	-	2	2	2
CO5	3	3	2	2	-	2	2	-	-	-	-	2	3	2
AVG	3	3	1.8	2.2	-	2.8	2.2	2	-	-	-	2.2	2.4	2.2

16AU5301	FUNDAMENTALS OF COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
		3	0	0	3

Course Objectives

1. To provide the students with sufficient background to Learn the mathematical representation of the governing equations of fluid flow and heat transfer.
2. To teach students how to express derivatives and differential equations through discretization techniques.
3. To enable the students to solve one and two-dimensional ordinary and partial differential equations using traditional CFD tools.
4. To help the students to Learn the general transformation equations for grid generation
5. To identify the case studies of fluid flow and heat transfer applications.

UNIT I INTRODUCTION (9)

Application areas of CFD- Basic concepts of fluid flow - Governing equations- conservation of mass- momentum and energy – Navier-stokes and energy equation for Newtonian fluid-Mathematical classification of flow – Hyperbolic-parabolic- elliptic and mixed flow types.

UNIT II DISCRETISATION (9)

Finite difference method – Forward- backward and central difference schemes, explicit and implicit methods - Numerical solution for heat transfer and fluid flow problems for steady state and transient conditions-stability analysis and error estimation-Grid generation - Choice of grid- grid oriented velocity components-Cartesian velocity components- staggered and collocated arrangements.

UNIT III CFD TECHNIQUES (9)

Lax - Wendroff technique-MacCormack‘s technique- relaxation technique-ADI technique-pressure correction technique- SIMPLE algorithm- Fluid flow and convection problems – Upwind scheme and stability criteria.

UNIT IV TURBULENCE MODELING (9)

Turbulence energy equation - One-equation model- k-ω model and k- ε model.

UNIT V CASE STUDIES (9)

Modeling and analysis of heat transfer- fluid flow and automobile components using CFD packages.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Summarize the discretisation process of governing equation
- CO2: Rephrase the grid generation and its application
- CO3: Solve the different mathematical modules used in CFD
- CO4: Determine the Turbulence Energy Equation in mathematical form
- CO5: Utilize the model and analyze fluid flow and heat transfer problems using commercial CFD

Text Books

- T1 John D Anderson, ― Computational Fluid Dynamics – The Basics with Applications, McGraw Hill, New York, 1995.
- T2 Muralidhar K and Sundararajan T, ―Computational Fluid Flow and Heat Transfer‖,Narosa Publications, New Delhi, 2003.

References

- R1 Versteeg H.K and Malalasekara W, ―An Introduction to Computational Fluid Dynamics -The Finite Volume Method', Longman, 1995.
- R2 Chung T.J, ―Computational Fluid Dynamics‖, Cambridge University Press, London, 2002.
- R3 David C Wilcox, ―Turbulence Modeling for CFD‖, DCW Industries, Inc, 1993.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU5302	AUTOMOTIVE AIR-CONDITIONING	L	T	P	C
		3	0	0	3

Course Objectives

1. To Learn the fundamentals of air conditioning system
2. To Learn the basic of vehicle air-conditioning system, its components, working principle and control mechanism.
3. To Learn air-conditioning controls, delivery system and refrigerants
4. To Learn the automatic temperature control like sensors and actuators
5. To Infer the system servicing and testing.

UNIT I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS (9)

Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems

UNIT II AUTOMOTIVE COOLING AND HEATING SYSTEM (9)

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system-Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system

UNIT III AIR-CONDITIOING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS (9)

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems-Maintaining drivability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL (9)

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system

UNIT V SYSTEM SERVICING AND TESTING (9)

Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Illustrate the components of the automotive air-conditioning and their fundamentals.
- CO2: Describe the working principles of the components of the automotive air conditioning system
- CO3: Learn air-conditioning controls, delivery system and refrigerants
- CO4: Identify and describe the current developments relating to the automotive air conditioning
- CO5: Infer the system servicing and testing

Text Books

- T1 Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and AirConditioning systems", Classroom Manual, Pearson Prentice Hall, 2004
- T2 Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and AirConditioning systems", Shop Manual, Pearson Prentice Hall, 2004

References

- R1 Mitchell Information Services, Inc., "Mitchell Automatic Heating and Air Conditioning Systems", Prentice Hall Inc., 1989.
- R2 Paul Weisler, "Automotive Air Conditioing", Reston Publishing Co. Inc., 1990.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU5303	ALTERNATIVE FUELS AND ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

1. Students able to know about the types of alternative fuels and energy sources for IC engines.
2. To impart the knowledge in the field of engine modification based on the alternative fuel.
3. To build the students to familiar in electric and hybrid vehicles.
4. To acquire knowledge in the field of production methods of alternative fuels
5. To learn about safety precaution for production and storing of alternative fuels

UNIT I ALCOHOLS AS FUELS (9)

Alternative fuels-Introduction-Need-Availability of different alternative fuels for SI and CI engines-Alcohols as fuels-Production-Properties-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 (9)

Various vegetable oils and their properties-methods of using vegetable oils engines-Blending- preheating-Transesterification-emulsification–Performance-Emission-Combustion Characteristics in diesel engines.

UNIT III HYDROGEN AS ENGINE FUEL (9)

Hydrogen-Production-Combustive properties-Problems associated with hydrogen as fuel-solutions-methods of using hydrogen in SI and CI engines-Performance-emission-combustion analysis in engines-storage-safety aspects.

UNIT IV BIOGAS, NATURAL GAS AND LPG AS FUELS (9)

Biogas, Natural gas and LPG-Production-Properties-CO_2-H_2S scrubbing. Modification required to use in SI and CI Engines-Performance-emission characteristics of Biogas-NG and LPG in SI and CI engines.

UNIT V ELECTRIC, HYBRID AND FUEL CELL VEHICLES (9)

Electric vehicle and Hybrid vehicles-Layout–Advantages and drawbacks-system components- Electronic control system–Different configurations of Hybrid vehicles-Power split device-High energy and power density batteries–Basics of Fuel cell vehicles-Solar powered vehicles.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: On completion of the course, the student will Learn the various alternative fuels available andtheir properties
CO2: Apply knowledge in engine modifications required for performance, combustion, emission characteristics.
CO3: Students will be familiar in alternative sources for propulsion of vehicle
CO4: Develop new alternative source for propulsion of vehicle
CO5: Be familiar in renewable energy resources

Text Books

T1 Dr. G. Devaradjane., Dr. M. Kumaresan., "Automobile Engineering", AMK Publishers, 2013.

T2 AyhanDemirbas, 'Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008,ISBN-13: 9781846289941

References

R1 Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS PressChampaign, Illinois 2005.

R2 Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU5304 **NOISE, VIBRATION AND HARSHNESS** **L T P C**

3 0 0 3

Course Objectives

1 To develop the basic knowledge in vibration and noise
2 Learning the effect of noise for human comfort and environment
3 To gain knowledge on noise and vibration created by the transportation vehicles
4 To interpret the sources of interior transportation noise and vibration
5 To illustrate various methods of vibration and noise measurement

UNIT I FUNDAMENTALS OF ACOUSTICS, NOISE AND VIBRATION (9)

Theory of Sound—Predictions and Measurement – Sound Sources– Sound Propagation in the Atmosphere– Sound Radiation from Structures and their Response–Introduction to Vibration– Vibration of Simple Discrete and Continuous Systems– Random Vibration– Response of Systems to Shock– Passive Damping

UNIT II EFFECT OF NOISE, BLAST, VIBRATION AND SHOCK ONPEOPLE (9)

Noise and Vibration– Effects of Hearing Conservation– Sleep Disturbance due to Transportation Noise Exposure– Noise-Induced Annoyance– Effects of Infrasound– Low-Frequency Noise– Ultrasound– Auditory Hazards of Impulse and Impact Noise– Effects of Intense Noise and Hearing Loss– Effects of Vibration– Effects of Mechanical Shock– Rating Measures– Descriptors– Criteria, and Procedures for Human Response to Noise.

UNIT III TRANSPORTATION NOISE AND VIBRATION – SOURCES,PREDICTION AND CONTROL (9)

Transportation Noise and Vibration Sources– I.C. Engine Noise Prediction and Control—Diesel Engine Exhaust and Intake Noise and Acoustical Design of Mufflers– Tire/Road Noise—Generation, Measurement, and Abatement– Aerodynamic Sound Sources in Vehicles—Prediction and Control– Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

UNIT IV INTERIOR TRANSPORTATION NOISE AND VIBRATION –PREDICTION AND CONTROL (9)

Interior Transportation Noise and Vibration Sources–Bus and Truck– Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors–Prediction and Control.

UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSISEQUIPMENT, SIGNAL PROCESSING AND MEASURINGTECHNIQUES (9)

Noise and Vibration Transducers–Measuring Equipment–Measurements, Signal Acquisition, and Processing– Acoustical Transducer Principles and Types of Microphones—Vibration Transducer–Principles, Types–Sound Level Meters–Noise Dosimeters—Analyzers and Signal Generators–Equipment for Data Acquisition–Noise and Vibration Measurements–Determination of Sound Power Level and Emission Sound Pressure Level–Sound Intensity Measurements– Noise and Vibration Data Analysis–Calibration of Measurement Microphones–Calibration of Shock and Vibration Transducers–Metrology and Traceability of Vibration and Shock Measurements

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Explain the theory and sources of sound.
CO2: Analyze various sources of vibration and methods of damping
CO3: Apply the concept of design of interiors to maintain NVH levels
CO4: Build a transportation vehicle by attaining low noise and vibration levels
CO5: Analyze and choose the methods of vibration and sound for measuring NVH levels

Text Books

T1 Allan G. Piersol ,Thomas L. Paez ―Harris‘ shock and vibration hand book, McGraw-Hill, New Delhi, 2010
T2 Clarence W. de Silva , ―Vibration Monitoring, Testing, and Instrumentation, CRC Press,2007

References

R1 Colin H Hansen ―Learning Active Noise Cancellation, Spon Press, London. 2003
R2 Matthew Harrison ―Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles, Elsevier Butterworth-Heinemann, Burlington, 2004

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU5305	FUEL CELL TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

1 To define the concept, principle and working of fuel cells.
2 To comprehend the process design for fuel cells.
3 To Learn the fuel processing techniques for fuel cells.
4 To evaluate about the performance of various fuel cell components.
5 To analyze the automotive applications of fuel cells.

UNIT I INTRODUCTION TO FUEL CELLS (9)

Fuel cells - introduction – working – types – low, medium and high temperature fuel cells - liquid and methanol types - proton exchange membrane fuel cell - solid oxide - hydrogen fuel cells - thermodynamics and electrochemical kinetics of fuel cells.

UNIT II FUEL CELL PROCESS DESIGN (9)

Fuel cell process design - Main PEM fuel cell components – materials - properties processes – membrane – electrode - gas diffusion layer - Fuel cell operating conditions – pressure – temperature - flow rates – humidity.

UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE (9)

Fuel cell performance characteristics – current - voltage - voltage efficiency - power density - ohmic resistance - kinetic performance - mass transfer effects - membrane electrode assembly components - fuel cell stack – bi polar plate - humidifiers - cooling plates.

UNIT IV FUEL PROCESSING (9)

Hydrogen storage technology - pressure cylinders - carbon fibers – reformer technology – steam reforming - partial oxidation - auto thermal reforming - CO removal - fuel cell technology based on removal.

UNIT V FUEL CELLS FOR AUTOMOTIVE APPLICATIONS (9)

Fuel cells for automotive applications – technology advancements – onboard hydrogen storage – liquid hydrogen - compressed hydrogen – metal hydrides - fuel cell control system – alkaline fuel cell – road map to market.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Summarize the concepts, principle and working of fuel cells.
CO2: Comprehend the process design for fuel cells.
CO3: Assess the fuel processing techniques for fuel cells.
CO4: Gain knowledge about the performance of various fuel cell components.
CO5: Gather ideas about the various automotive applications of fuel cells.

Text Books

T1 Viswanathan B. and ScibiohAulice M, “Fuel Cells: Principles and Applications”, University Press, 2006.
T2 Fuel Cells for automotive applications, R.H.Thring – Professional Engineering publishing UK. 2004.

References

R1 FranoBarbir, “PEM Fuel Cells: Theory and Practice”, Elsevier Academic Press, USA, 2005.
R2 MehrdadEhsani, YiminGao, Sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2004.
R3 Fuel Cell Technology Handbook SAE International GregorHoogers CRC Press, 2003.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU5306	METROLOGY AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn the types of measurement sensors and its associative errors.
2 To know about the variable resistance and inductance sensors.
3 To get a clear knowledge about special sensors used in automotive sector.
4 To acquire knowledge in usage of sensors to measure parameters like pressure, force and torque.
5 To have an exposure in position, temperature and flow sensors.

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS (9)

Sensors: Functions – Classifications - Main technical requirement and trends - Units and standards- Calibration methods - Classification of errors - Error analysis - Limiting error - Probable error - Propagation of error- Odds and uncertainty- principle of transduction- Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs.

UNIT II VARIABLE RESISTANCE AND INDUCTANCE SENSORS (8)

Principle of operation - Construction details - Characteristics and applications of resistive potentiometer - Strain gauges - Resistive thermometers – Thermistors - Piezoresistive sensors - Inductive potentiometer- Variable reluctance transducers - EI pick up and LVDT

UNIT III SPECIAL SENSORS (8)

Variable air gap type - variable area type and variable permittivity type - capacitor microphone Piezoelectric – Magnetostrictive - Hall Effect - semiconductor sensor - digital transducers -Humidity Sensor - rain sensor – climatic condition sensor – solar - light sensor - anti glare sensor.

UNIT IV AUTOMOTIVE PRESSURE AND FORCE/TORQUE SENSOR (10)

Pressure Sensor:

Typical automotive applications - Thick film pressure sensor - Semiconductor pressure sensor-Integrated silicon intake - manifold pressure sensor - Integrated silicon combustion - pressure sensor – Piezo electric sensor - High pressure sensor with metal diaphragm.

Force/Torque Sensor:

Typical automotive applications - Magneto elastic bearing - pin sensor - Magneto elastic tension / compressive - force sensor according to the cross - ductor principle - Basic principle of torque measurement - Stress and Angle measuring torque sensor.

UNIT V AUTOMOTIVE POSITION AND RPM/VELOCITY SENSORS (10)

Position Sensors:- Typical automotive applications - Wiper potentiometers – Short circuiting ring sensor – Half differential sensor- Eddy current pedal travel sensor - Integrated Hall IC's - Hall acceleration sensor - Knock sensors - RPM and Velocity Sensors - Inductive rotational speed sensor - Hall effect sensor

Temperature Sensors:- Typical automotive applications – Sintered - Ceramic resistors - Thin film resistors - Thick film resistors - Monocrystalline silicon semiconductor resistor - Thermopile sensors

Flow Sensors:- Ultrasonic flow sensors - Pitot tube air-flow sensor - Hot wire air - mass flow meter - Micro mechanical hot - film air mass flow meter - Lambda sensor - Imaging sensor - Rain Sensor - Introduction to MEMS

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Comprehend the types of errors, design of limit gauges and various comparative measurements.
CO2: Gain knowledge about the variable resistance and inductance sensors.
CO3: Have an exposure on special sensors and interfacing.
CO4: Acquire knowledge in usage of sensors to measure parameters like pressure, force and torque.
CO5: Get an exposure in position, temperature and flow sensors.

Text Books

T1 Doeblin E.O, "Measurement Systems : Applications and Design", 5th Edition, Tata McGraw-Hill Publishing Co, 2007
T2 Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall, 2001
T3 William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH, 2004

References

R1 Bentley J.P ," Principles of Measurement Systems", 4th Edition, Addision Wesley Longman Ltd., U.K, 2004
R2 Patranabis. D, " Sensors and Transducers", 2nd Edition, Prentice Hall India Ltd, 2003
R3 Murthy D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2007

Web Resources:

W1 nptel.ac.in/courses/112106138/ - Unit I
W2 nptel.ac.in/courses/112106179/ - Unit I
W3 home.iitk.ac.in/~vkjain/Lecture%204-Metrology-F-21-8-14.pdf – Unit I
W4 www.me.iitb.ac.in/~ramesh/courses/ME338/metrology6.pdf- Unit I

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU6301	COMBUSTION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

1. To Learn Types and properties of fuel
2. To Learn basic thermodynamics and kinetics of combustion
3. To Learn Combustion theory of solid, liquid and gaseous fuel.
4. To acquire knowledge about the combustion in furnace
5. To learn about energy transformation in engine.

UNIT I INTRODUCTION (10)

combustion science–fuels and combustion technology-types-characteristics of fuels–proximate and ultimate analysis of fuels-ROM-DMMF-DAF and bone dry basis-Moisture and heating value determination–gross-net hearting values-claorimetry-DuLong's formula for HV estimation-Flue gas analysis-Orsat apparatus.

UNIT II FUEL TYPES (9)

Solid Fuels: Peat-coal-biomass-wood waste-agro fuels-refuse derived solid fuel-testing of solid fuels-Bulk and apparent density-storage-washability-coking and caking coals-Liquefaction of solid fuels.**Liquid Fuels:** Refining-molecular structure-liquid fuel-types-characteristics-fuel quality.**Gaseous Fuels:** Classification and characterization.

UNIT III THERMODYNAMICS AND KINETICS OF COMBUSTION (10)

Properties of mixture-combustion stoichiometry-chemical energy-chemical equilibrium andCriteria-properties of combustion products. First law combustion calculations-adiabatic flametemperature (analytical and graphical methods)-simple second law analysis-Elementary reactions-chain reactions-pre-ignition kinetics-global reactions-kinectics-reaction at solid surface.

UNIT IV COMBUSTION OF SOLID FUELS (7)

Drying-devolatilization-char combustion-Fixed bed combustion-suspension burning-fluidized bed combustion.

UNIT V COMBUSTION OF LIQUID AND GASEOUS FUELS (9)

Spray formation and droplet behavior-oil fired furnace combustion-gas turbine spray combustion-direct and indirect Injection combustion in IC engines-energy balance and furnace efficiency-gas burner-types-pulse combustion furnace-Premixed charge engine combustion-Detonation of gaseous mixtures.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: At the end of the course students will be familiar in the types of fuel and combustion science
CO2: Get in depth knowledge in chemical reactions, thermodynamic and kinetic reaction of the combustion process.
CO3: Learn the fundamentals of combustion process in Internal Combustion engines
CO4: Learn about combustion in furnace
CO5: Built strong fundamental knowledge in energy transformation of engine

Text Books

T1 Kuo, K.K., Principles of Combustion, 2nd Edition, John Wiley and Sons, Inc., 2005.
T2 Annamalai, K and Puri, I.K, Combustion science and Engineering, CRC Press, 2007
T3 Borman, G.L. and Ragland, K.W., Combustion Enginnering, McGrawHill International Editions, 1998.
T4 Samir Sarkar, Fuels and Combustion, 2nd Edition, Orient Longman, 1990

References

R1 Sharma SP and Mohan Chander, Fuels and Combustion, Tata Mcgraw Hill, 1984.
R2 Bhatt, B.I and Vora, S.M., Stoichiometry, 2nd Edition, Tata Mcgraw Hill, 1996
R3 Clive Davis, Calculations in Furnace Technology, Pergamon Press, Oxford, 1970.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU6302 RAPID PROTOTYPING, TOOLING AND MANUFACTURING

L	T	P	C
3	0	0	3

Course Objectives

1 Students to learn and develop the advanced manufacturing techniques in rapid prototyping.
2 To acquire the knowledge about solidification processes.
3 To learn the various powder methodology processes.
4 To Learn the procedures involved in SGC and 3DP.
5 To get exposure in rapid tooling techniques and applications.

UNIT I PRODUCT DEVELOPMENT STAGES (9)

Introduction - Need for time compression in product development - Product development - conceptual design - development - detail design - prototype - tooling.

UNIT II STEREO LITHOGRAPHY AND DIRECT METAL LASER SINTERING (9)

Classification of RP systems - Stereo lithography systems - principle - process parameters – process details - machine details – applications - Direct Metal Laser Sintering (DMLS) system - principle - process parameters - process details - machine details - applications.

UNIT III FUSION DEPOSITION MODELING AND LAMINATED OBJECT MANUFACTURING (9)

Fusion Deposition Modeling - Principle - process parameters - process details - machine details – Applications - Laminated Object Manufacturing - Principle - process parameters - process details - machine details - Applications.

UNIT IV SOLID GROUND CURING (9)

Solid Ground Curing - Principle - process parameters - process details - machine details – Applications - 3-Dimensional printers - Principle - process parameters - process details – machine details – Applications - and other concept modelers like thermo jet printers - Sander‘s model maker - JP system 5 - Object Quadra system.

UNIT V RAPID TOOLING (9)

Laser Engineering Net Shaping (LENS) - Ballistic Particle Manufacturing (BPM) - Principle. Introduction to rapid tooling - direct and indirect method - software for RP - STL files – magics and mimics - application of Rapid prototyping in Medical field.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Learn the advanced manufacturing techniques evolved in rapid manufacturing scenario.
CO2: Access about liquid based solidification processes.
CO3: Gain knowledge in the various powder methodology processes.
CO4: Get exposure on the solid ground curing and 3D printing rapid manufacturing processes.
CO5: Know about the various rapid tooling techniques.

Text Books

T1 Pham, D.T&Dimov.S.S, 2012, Rapid manufacturing: the technologies and applications of Rapid prototyping and Rapid tooling, Springer-Verlag, London.
T2 Ian Gibson, David Rosen and BlentStucker, Additive Manufacturing Technologies, 2nd Edition, Springer.

References

R1 RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
R2 Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010.

Web Resources:

W1 nptel.ac.in/courses/112107078/37 – Unit I
W2 nptel.ac.in/courses/112107077/38 – Unit I, III and V.
W3 nptel.ac.in/courses/112102103/16 – Unit I, II, III and IV.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
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CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU6303	ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn the concept of automation and robotics with its components.
2 To gain the knowledge in various drive systems and end effectors.
3 To study the different sensors used in robot control.
4 To perform motion analysis and its kinematics along with robot programming.
5 To analyze the basics of the industrial applications of robots.

UNIT I FUNDAMENTALS OF ROBOT (8)

Robot – definition – robot anatomy – co-ordinate systems - work envelope - classification – specifications – pitch, yaw and 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 (9)

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor and AC Servo Motors – Features - Applications - Comparison - End Effectors – Grippers – Mechanical, Pneumatic, Hydraulic, Magnetic and Vacuum Grippers; Two Fingered and Three Fingered type - Internal and External Grippers - Selection - Design Considerations.

UNIT III SENSORS AND MACHINE VISION (10)

Sensors - Force sensing - touch and tactile sensors - proximity sensors - non-contact sensors - safety considerations in robotic cell - fail safe hazard sensor systems and compliance mechanism - Machine vision system – camera - frame grabber - sensing and digitizing image data - signal conversion - image storage - lighting techniques - image processing and analysis - data reduction – segmentation - feature extraction - object recognition - other algorithms - applications – Inspection – identification - visual serving - navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING (9)

Forward and inverse kinematics – manipulators with two and three DOF (in 2D), four DOF (in 3D) – DH matrices - deviations and problems – Robot programming - teach pendant programming - lead through programming - robot programming languages – VALprogramming – motion commands - sensor commands - end effector commands and simple programs.

UNIT V APPLICATIONS OF ROBOTS (9)

RGV – AGV - Role of robots in inspection, assembly, material handling, underwater, space and medical fields - Steps involved - Safety Considerations for Robot Operations.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Comprehend the concept of automation and robotics with its components.
CO2: Analyze the various drive systems and end effectors with types of robot motions.
CO3: Study the different sensors used to control the robots.
CO4: Demonstrate the robot kinematics and programming.
CO5: Know the applications of robots in automotive industries.

Text Books

T1 M.P.Groover, ―Industrial Robotics – Technology, Programming and Applications, McGraw-Hill, 2012.
T2 Fu.K.S. Gonzalz.R.C., and Lee C.S.G., ―Robotics Control, Sensing, Vision and Intelligence, McGraw-Hill Book Co., 1987

References

R1 YoramKoren, ―Robotics for Engineers, McGraw-Hill Book Co., 1992

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
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CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU6304	AUTOMOTIVE COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn the types of matrix and reinforcements of composite materials
2 To demonstrate the various methods of manufacturing processes and applications of composite
3 To identify the distribution of reinforcements in the matrix
4 To equip them withknowledge on how tocarry out standard microscopic analysison composites.
5 To discuss the various automobile applications of different composites

UNIT I INTRODUCTION (9)

Definition–Classification based on matrix – Types of Reinforcements -–Constituents–Interfaces and Interphases–Distribution of constituents–Introduction to Nano-composites

UNIT II METAL MATRIX COMPOSITES (9)

Fabrication of MMC– Types of Matrices–Requirements–Selection of constituents–Solid State Methods- Powder Metallurgy, Diffusion Bonding–Liquid state Methods–Stir Casting, Liquid infiltration, Squeeze Casting, Spray Deposition, Electro Plating and Electroforming, Reactive Processing–Vapor Deposition–Synthesis of In situ Composites

UNIT III POLYMER AND CERAMIC MATRIX COMPOSITES (9)

Polymer Matrix Composites –Matrices-Types- Selection of Constituents–Moulding method–Low pressure closed moulding, Pultrusion, Filament windingCeramic matrix composites - Various techniques of vapour deposition–Liquid Phase method and Hot pressing

UNIT IV CHARACTERISATION OF COMPOSITES (9)

Particle/Fibre–Control, Porosity content and Distribution–Interfacial Reaction of Matrix and Reinforcement–Coating of reinforcing component–Microscopic analysis- XRD,SEM,TEM

UNIT V COMPOSITE MATERIALS FOR AUTOMOTIVE INDUSTRY (9)

Automotive Applications-High-Volume Thermoplastic Composite Technology -Development of Low-Cost Carbon Fibre composites - Composite Structures for Crashworthiness-Hybrid Structures Consisting of Sheet Metal and Fibre Reinforced Plastics for Automotive Structures -Case Studies and Designs

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Classify different composite materials based upon their properties
CO2: Able to explain the methods employed in composite fabrication
CO3: Develop expertise on the applicable engineering design of composite
CO4: Identify and explain the types of composite materials and their characteristic features
CO5: Able to Select Material for Automobile Application

Text Books

T1 Krishan K. Chawla, Composite Materials Science and Engineering,ThirdEdition,Springer
T2 K. Srinivasan, Composite Materials, Narosa Publishing House,Reprint 2012

References

R1 DomenicoBrigante New Composite Materials,Selection, Design, and Application, Springer
R2 DE GRUYTER, Metal Matrix Composites, Materials, Manufacturing and Engineering, Springer

Web Sources

W1 http://nptel.ac.in/courses/Webcourse-contents/IISc BANG/Composite%20Materials/Pdf/Lecture_Notes/LNm1.pdf
W2 http://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU6305	MANUFACTURING OF AUTOMOTIVE COMPONENTS	L	T	P	C
		3	0	0	3

Course Objectives

1. To impart knowledge on basic principle and production methods of automotive components
2. To Illustrate the material selection and manufacturing methods for casted engine components
3. To summarize the various methods for material selection and manufacturing methods of forged engine components
4. To demonstrate Material selection and Manufacturing methods for transmission system and vehicle chassis
5. To define the materials and manufacturing methods that are using recently in automobile industry

UNIT I CASTED ENGINE COMPONENTS (9)

Material selection and Manufacturing methods for Piston, Piston rings, Cylinder block, wet and dry liners, Engine head, Oil pan, Carburetors–Thermal barrier coating of Engine head and valves.

UNIT II FORGED ENGINE COMPONENTS (9)

Material selection and Manufacturing methods for Crank shaft, Connecting rod, Cam shaft, valve, Piston pin, Push rod, Rocker arm, tappets, spark plug.

UNIT III TRANSMISSION SYSTEM (9)

Material selection and Manufacturing methods for Clutch – Clutch lining – Gear Box – Gear –Propeller Shaft – Differential – Axle Shaft – Bearing – fasteners – Wheel drum. Methods of Gear manufacture – Gear hobbing and gear shaping machines - gear generation – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT IV VEHICLE CHASSIS (9)

Material selection and manufacturing methods for chassis, dead axle, leaf spring, coil spring and shock absorbers– wheel housing – steering system, Brake shoes, wheel rim, Tyres–Heat treatment procedures.

UNIT V RECENT DEVELOPMENTS (9)

Surface treatment – Plastics – Plastics in Automobile vehicles – Processing of plastics – Emission Control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing – stretch forming of Auto body panels – MMC liners –Selection of materials for Auto components. Use of Robots in Body weldments.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Able to Learn various manufacturing methods for different automobile components
- CO2: Able to select the proper materials for various components of automobile
- CO3: Utilize opportunities and challenges presented with automotive manufacturing in a global environment
- CO4: Identify and explain the vehicle body components that are produced in a specific way to aid vehicle body repairs.
- CO5: Apply and Analyze different materials and manufacturing methods that are used in automotive industry

Text Books

T1 Heldt.P.M, High speed combustion engines, Oxford publishing Co., New York, 1990

References

R1 Kirpal Singh, Automobile Engineering, Vol. I & II, Standard Publishers, New Delhi, 1997.
R2 Newton and steels, the motor vehicle, ELBS, 1990
R3 SeropeKalpakjian and Steven R. Schmid, Manufacturing Processes for Engineering Materials, Fourth Edition – Pearson Education publications – 2003
R4 Gupta K.M. Automobile Engineering Vol.I& II, Umesh Publishers, 2000

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU6306	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

1. To Learn the application of computers in various aspects of Manufacturing ,Design, Process planning, Manufacturing cost, Layout & Material Handling system
2. To demonstrate various manufacturing techniques for improving production.
3. To learn about different manufacturing layouts used in industries
4. To gain knowledge on flexible manufacturing system and automated guided vehicle system applications
5. To Learn the importance of robots in manufacturing sector

UNIT I INTRODUCTION (9)

Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerized elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Manufacturing Control – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL &CAPP (9)

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) -

UNIT III CELLULAR MANUFACTURING (9)

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell

UNIT IV FMS AND AGVS (9)

FMS–Types, Components, Application & Benefits –Planning and Control– Quantitative analysis in FMS –Automated Guided Vehicle System (AGVS) –Applications – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS (9)

Robot - Anatomy and Related Attributes – Classification - Control systems – End Effectors – Sensors –Accuracy and Repeatability – Simple Part Programming – Robot Applications in Automobile industry

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Able to Learn the use of computers in process planning, design and manufacturing.
- CO2: Apply various Manufacturing methods for the improvement of rate of production
- CO3: Design and program a manufacturing layout to improve the rate of production
- CO4: Illustrate the importance of industrial automation
- CO5: Able to design robots for various industrial application

Text Books

- T1 Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing",Prentice Hall of India, 2008.
- T2 Radhakrishnan P, SubramanyanS.andRaju V., "CAD/CAM/CIM", New Age, New Delhi, 2000

References

- R1 Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India,2003.
- R2 Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach"Chapman & Hall, London, 1995.
- R3 Rao. P, N Tewari&T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill, 2000

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU7301	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS (COMMON TO AUTO & MECH)	L	T	P	C
		3	0	0	3

Course Objectives

1 To define the needs and functions of jigs, fixtures and press tools in mass production.
2 To analyze the constructional and design features of various jigs.
3 To know about the usage of fixtures for faster production.
4 To infer the basic concepts of press working terminologies, elements of dies and strip layout.
5 To design the dies based on final components.

UNIT I INTRODUCTION TO TOOL DESIGN (8)

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures – types of Jigs - Types of Fixtures -Mechanical actuation - pneumatic and hydraulic actuation - Analysis of clamping force - Tolerance and error analysis.

UNIT II JIGS (9)

Drill bushes – different types of jigs - plate latch – channel – box – post - angle plate - angular post – turnover - pot jigs - automatic drill jigs - rack and pinion operated - air operated jigs - components - design and development of jigs.

UNIT III FIXTURES (9)

General principles of boring, lathe, milling and broaching fixtures - Grinding, planning and shaping fixtures - assembly, inspection and welding fixtures - Modular fixtures - Design and development of fixtures.

UNIT IV PRESS WORKING TERMINOLOGIES AND DIES (10)

Press working terminology - presses and press accessories - computation of capacities and tonnage requirements - elements of progressive combination and compound dies - die block - die shoe - bolster plate - punch plate - punch holder - guide pins - bushes - strippers – knockouts -stops – pilots - selection of standard die sets - strip lay out - calculations.

UNIT V DESIGN AND DEVELOPMENT OF DIES (9)

Design and development of progressive and compound dies for blanking and piercing operations - bending dies - development - forming and drawing dies – development - design considerations in forging, extrusion, casting and plastic dies.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Infer about the tool design procedures.
CO2: Design different jigs for manufacturing operations.
CO3: Develop the fixture designs for various production components.
CO4: Identify right techniques for press working operations.
CO5: Design the dies for required applications and processes.

Text Books

T1 Edward G Hoffman, Jigs & Fixture Design, Thomson – Delmar Learning, Singapore 5th Edition, 2012.
T2 Donaldson. C, Tool Design, Tata McGraw-Hill, 4th Edition, 2012.
T3 Joshi, P.H., Jigs & Fixtures, 2nd Edition, Tata McGraw-Hill Publishing Company, 2010.

References

R1 Hiram E Grant, 'Jigs and Fixture' Tata McGraw-Hill, New Delhi, 2003.
R2 Fundamentals of Tool Design, CEEE Edition, ASTME, 5th Edition, 2003.
R3 PSG College of Technology, Coimbatore - Design Data Handbook.

Web Resources:

W1 http://www.nitc.ac.in/dept/me/jagadeesha/mev303/CHAPT_INTRODUCTION_TO_JIGS_AND%20FIXTURES.pdf – Unit I, II and III
W2 http://www.ignou.ac.in/upload/jig.pdf - Unit II and III.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	1	1	2	3	3	-	-	3	-	3	3	2
CO2	1	2	-	2	2	3	3	-	-	3	-	2	2	3
CO3	1	2	2	3	2	3	3	-	-	2	-	2	3	2
CO4	2	3	3	1	2	2	3	-	-	2	-	2	3	2
CO5	1	3	2	2	1	1	2	-	-	2	-	2	3	3
AVG	1.4	2.4	2	1.8	1.8	2.4	2.8	-	-	2.4	-	2.2	2.8	2.4

16AU7302	ENTERPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

1 To develop and strengthen entrepreneurial quality.
2 To develop and strengthen the motivation in entrepreneurship development.
3 To impart basic entrepreneurial skills and Learning to run a business efficiently and effectively.
4 To Learn the basic concepts of financing and cost accounting.
5 To Learn the government policy and start up procedure for small scale industries.

UNIT I ENTREPRENEURSHIP (9)

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth- Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION (9)

Major Motives Influencing an Entrepreneur – Achievement Motivation Training-Self Rating- BusinessGames-Thematic Apperception Test – Stress Management-Entrepreneurship Development Programs – Need- Course Objectivess.

UNIT III BUSINESS (9)

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity- Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING (9)

Need – Sources of Finance- Term Loans- Capital Structure-Financial Institution-Management of working Capital-Costing-Break Even Analysis-Taxation – Income Tax-Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS (9)

Sickness in small Business – Concept-Magnitude-Causes and Consequences- Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion-Diversification- Joint Venture-Merger and Sub Contracting.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Upon completion of the course, students will Develop knowledge and skills needed to run a business successfully
CO2: Interpret the motivational concept in entrepreneurship development.
CO3: To impart basic entrepreneurial skills and Learning to run a business efficiently and effectively.
CO4: Summarize the concept of financial and cost accounting
CO5: Compose the business strategy and skills to develop small scale industries.

Text Books

T1 Khanka. S.S, “Entrepreneurial Development” S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.
T2 Donald F Kuratko, “Entrepreneurships – Theory, Process and Practice”, CengageLearning, 2014.

References

R1 1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
R2 Mathew J Manimala, Enterprenuership theory at cross roads: paradigms and praxis”, Dream tech, 2005.
R3 Rajeev Roy, ‘Entrepreneurship’, 2nd Edition, Oxford University Press, 2011.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7303	AUTOMOTIVE EMISSION AND POLLUTION CONTROL	L	T	P	C
		3	0	0	3

Course Objectives

1 To create an awareness on the various environmental pollution aspects and issues.
2 To give a comprehensive insight into the pollution in SI engine.
3 To give a comprehensive insight into the pollution in CI engine
4 To impart knowledge on pollutant formation and control.
5 To impart knowledge on various emission instruments and techniques.

UNIT I INTRODUCTION (9)

Pollutants – sources – formation – effects of pollution on environment - human – transient operational effects on pollution – Regulated – Unregulated emissions -Global warming-Green house effect and effects of engine pollution on environment-National and International emission standards-Bharat stage-Euro stage.

UNIT II EMISSIONS IN SI ENGINE (9)

Chemistry of SI engine combustion – HC and CO formation in SI engines – NO formation in SI engines – Smoke emissions from SI engines – Effect of operating variables on emission formation.

UNIT III EMISSIONS IN CI ENGINE (9)

Basics of diesel combustion – Smoke emission and its types in diesel engines – NOx emission and its types from diesel engines – Particulate emission in diesel engines. Odor, sulfur and Aldehyde emissions from diesel engines – effect of operating variables on emission formation.

UNIT IV CONTROL TECHNIQUES FOR REDUCTION OF EMISSION (9)

Design modifications – Optimization of operating factors – Fuel modification – Evaporative emissioncontrol - Exhaust gas recirculation – SCR – Fumigation – Secondary Air injection – PCV system –Particulate Trap – CCS – Exhaust treatment in SI engines –Thermal reactors – Catalytic converters –Catalysts – Use of unleaded petrol.

UNIT V TEST PROCEDURE, INSTRUMENTATION & EMISSION MEASUREMENT (9)

Test procedures CVS1, CVS3 – Test cycles – IDC – ECE Test cycle – FTP Test cycle – NDIR analyzer – Flame ionization detectors – Chemiluminescent analyzer – Dilution tunnel – Gas chromatograph – Smoke meters –SHED test.

TOTAL :45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Upon the completion of the course, the student will Demonstrate the fundamentals of formation of automobile pollutions in IC Engines.
CO2: Demonstrate the fundamentals of formation of emission in SI Engines.
CO3: Demonstrate the fundamentals of formation of emission in CI Engines.
CO4: The student can Summarize the various pollution control techniques in automotive engines.
CO5: Experiment with the various methods of test procedures in automotive engines.

Text Books

T1 Ramalingam. K.K., "Internal Combustion Engines", Scitech Publications, 2003.
T2 Ganesan,V., "Internal Combustion Engines", Tata McGraw Hill Co., 1994.
T3 SAE Transactions, "Vehicle Emission", 3 volumes, 1982.
T4 Obert,E.F., "Internal Combustion Engines", 1982.

Reference Books

R1 Springer and Patterson, "Engine Emission", Plenum Press, 1990.
R2 Pundir. B.P., " IC Engines Combustion and Emissions" Narosa Publishers, 2010

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7304	ADVANCED THEORY OF IC ENGINES	L	T	P	C
		3	0	0	3

Course Objectives

1. Students able to know about combustion of fuels and engine cycle analysis
2. To Learn the fuel air cycle and their analysis
3. To introduce Governing Equations and gas dynamic models
4. To impart the knowledge in Photographic studies of combustion processes and non convention IC engines
5. Acquiring ability to simulate the various types combustion processes of IC engines.

UNIT I COMBUSTION OF FUELS (9)

Chemical composition and molecular structure of hydrocarbon fuels-Combustion Stoichiometry of hydrocarbon fuels–Chemical energy and heat of reaction calculations–Chemical equilibrium and adiabatic flame temperature calculation-Theory of SI and CI engine combustion–Flame velocity and area of flame front-Fuel spray characteristics–droplet size-depth of penetration-atomization.

UNIT II ENGINE CYCLE ANALYSIS (9)

Ideal air-fuel air cycle-actual cycle analysis-Progressive combustion analysis in SI engines-Parametric studies on work output-efficiency and other engine performance.

UNIT III COMBUSTION MODELLING (9)

Basic concepts of engine simulation–Governing equations-Classification of engine models- Thermodynamic models for Intake and exhaust flow process–Quasi steady flow-Filling and emptying-Gas dynamic Models-Thermodynamic based in cylinder models for SI engine and CIengines.

UNIT IV NON-CONVENTIONAL IC ENGINES (9)

Concept of L.H.R. engine-recent developments-variable compression ratio engine-research. Wankel rotary combustion engine. Dual fuel engine-multi fuel usage in CI engines-performance studies of dual fuel engine. Free piston engine. Stratified charge and lean burn engines . Locomotive and marine engines.

UNIT V COMBUSTION ANALYSIS IN IC ENGINES (9)

Photographic studies of combustion processes–Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe's law analysis for combustion. Calculation of Ignition delay and combustion duration–Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: At the end of the course the students will command over the advancements in IC engines

CO2: Students will be familiar in fuel air cycles and their analysis

CO3: At the end of the course, the student can able to solve Governing Equations and perform combustion analysis with various operating conditions

CO4: Able to be familiar with combustion reactions, stiochiometry and non conventional IC engines

CO5: Able to evaluate performance and emission characteristics of engines

Text Books

T1 Ganesan,V., "Internal combustion engines", Tata McGraw Hill Publishing Co., 1994.

T2 Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press , 1996.

References

R1 Ramalingam. K.K., "Internal combustion engine", scitech publications, Chennai, 2003.

R2 Ganesan,V., "Compute Simulation of Compression Ignition engine process", Universities Press, 1996.

R3 John,B., Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Publishing, 1990.

R4 Benson,R.S., Whitehouse,N.D., "Internal Combustion Engines", Pergamon Press, Oxford, 1979.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7305 VEHICLE DEALERSHIP MANAGEMENT

L	T	P	C
3	0	0	3

Course Objectives

1 To Learn the basic knowledge in the area of vehicle dealership management.
2 To Learn the contemporary showroom and service management.
3 To apply a strategic perspective of the retailing industry.
4 To Learn the parts management and case study in vehicle dealership management.
5 To Analyze the case study of vehicle dealership, service and showroom management

UNIT I DEALERSHIP (9)

Learning Dealership Infrastructure requirements-Furnishing dealership-Preparing dealer manual.

UNIT II SHOWROOM MANAGEMENT (9)

Contemporary show room management-Institutionalizing-structuring and monitoring the sales process-managing the showroom floor and the sales team-Retail developments and industry trends.

UNIT III SERVICE MANAGEMENT (9)

Service management-process and fundamentals- repair order analysis-productivity and Efficiency- scheduling-loading-warranties and service retention.

UNIT IV PARTS MANAGEMENT (9)

Parts management- inventory control- staffing and productivity-ordering parameters-parts marketing- merchandising-retailing and trade activities.

UNIT V CASE STUDY (9)

Applying theory in practice working case study of an actual dealership-sales techniques and strategy- corporate sales deal-group presentations and action planning.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Rephrase the basic concepts of dealership and their methods.
CO2: Demonstrate the contemporary showroom management
CO3: Apply a strategic perspective of the retailing industry
CO4: Apply the concept of management in parts ordering and servicing
CO5: Analyze the case study of vehicle dealership, service and showroom management

Text Books

T1 Gibson G.Vedamani (2003), Retail Management, Jaico Publishing House, New Delhi

References

R1 A.Sivakumar (1997), Retail Management, Excel Books, New Delhi.
R2 Kapil Sharma (2009), Marketing Management, Global India Publication Pvt.Ltd. New Delhi.
R3 KVS Madaan (2009), Fundamentals of Retailing, Tata McGraw Hill, New Delhi

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7306	OPERATION RESEARCH (COMMON TO AUTO & MECH)	L	T	P	C
		3	0	0	3

Course Objectives

1. To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.
2. Learn the theoretical workings of the simplex method for linear programming and perform iterations of it by hand
3. To introduce the students to the advanced methods for large-scale transportation and assignment problems
4. To solve the problems of project management by PERT, critical path method
5. To Model a dynamic system as a queuing model and compute important performance measures

UNIT I LINEAR MODELS (9)

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method) – duality in simplex

UNIT II TRANSPORTATION AND ASSIGNMENT PROBLEM (9)

Transportation model – Initial solution by North West corner method – least Cost method – VAM. Optimality test – MODI method and stepping stone method–Assignment model – formulation – balanced and unbalanced assignment problems

UNIT III PROJECT MANAGEMENT BY PERT & CPM (9)

Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM –Resource smoothening–Resource leveling–PERT Cost

UNIT IV REPLACEMENT AND SEQUENCING MODELS (9)

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies) –Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem

UNIT V INVENTORY AND QUEUING THEORY (9)

Variables in inventory problems–EOQ, deterministic inventory models–order quantity with price Break–techniques in inventory management–Queuing system and its structure – Kendall‘s notation – Common queuing models

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: The students can able to use the optimization techniques for use engineering and Business problems
- CO2: Apply linear programming model and assignment model to domain specific situations
- CO3: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results
- CO4: Apply the concepts of PERT and CPM for decision making and optimally managing Projects
- CO5: Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions

Text Books

- T1 Taha H.A., ―Operation Research, Pearson Education
- T2 Hira and Gupta ―Introduction to Operations Research, S.Chand and Co.2002
- T3 Hira and Gupta ―Problems in Operations Research, S.Chand and Co.2008
- T4 Wagner, ―Operations Research, Prentice Hall of India, 2000

References

- R1 S.Bhaskar, ―Operations Research, Anuradha Agencies, Second Edition, 2004

Web Sources

- W1 http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf
- W2 http://nptel.ac.in/reviewed_pdfs/112106131/lec1.pdf

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7307	AUTOMOTIVE SENSOR AND EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

1 To get basic knowledge in transducer principles, sensors and measurement systems.
2 To know the theoretical and practical concepts of actuators.
3 To comprehend about embedded systems.
4 To make use of interrupts and timers in automotive field.
5 To develop the interfacing of sensors with pc.

UNIT I SENSORS (10)

Introduction to automotive sensors – resistive, inductive, capacitive transducers - Piezo electric transducers - Hall effect, Ultrasonic sensors - Ranging radar (ACC) - **Power Train:-** Fuel level sensors - Speed and RPM sensors - Lambda Oxygen sensor - NO_X sensors - Hotwire air mass meter - **Chassis:-** Steering wheel angle sensor - Vibration and acceleration sensors - Pressure sensors - Speed and RPM sensors - torque sensors.

UNIT II ACTUATORS (9)

Introduction to automotive Actuators – Solenoids - brushless DC motors - Operation and applications - Servo and stepper motors - switched reluctance motors - Suspension semi active actuators - Mangetostrictive anti vibration actuators - Piezo Actuators.

UNIT III INTRODUCTION TO EMBEDDED SYSTEM (9)

Introduction to embedded system – applications - Microcontroller v/s microprocessor - introduction to MPLAB - making and running projects - basic programs - introduction to PIC Microcontroller - Types - products of PIC - architecture – memory devices- addressing modes - memory mapping - System Peripherals and User peripherals - ADC - Interfacing temperature sensor with PIC micro via ADC.

UNIT IV INTERRUPTS AND TIMERS (9)

Programming interrupts - counters and timers and serial communication (MSSP) - External Memory.

UNIT V INTERFACING WITH PC (8)

Interfacing with LCD - sensors and motor control applications.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Gain knowledge in transducer principles, sensors and measurement systems.
CO2: Know the theoretical and practical concepts of actuators.
CO3: Comprehend about embedded systems.
CO4: Utilize interrupts and timers in automotive field.
CO5: Perform the interfacing between sensors and pc.

Text Books

T1 Automotive Sensors, BOSCH. 2002
T2 Ronald K. Jurgen, ―Sensors and Transducers, 2nd Edition, SAE, 2003.

References

R1 Muhammad Ali Mazidi, RolinMcKinlay, Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18" Pearson Education, 2007.

Web Resources:

W1 https://www.engineersgarage.com/articles/sensors - Unit I
W2 http://www.sensorsmag.com/ - Unit I and V
W3 http://www.murata.com/products/sensor - Unit I and II

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7308	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

Course Objectives

1. To learn the hydraulic and pneumatic principles.
2. To know about the fluid power fundamentals with various drive systems.
3. To Learn the working principles of hydraulic and pneumatic components.
4. To access the various techniques of circuit building in fluidics.
5. To get an exposure to advancements, diagnosis and troubleshooting of hydro pneumatic, electro pneumatic circuits.

UNIT I INTRODUCTION TO FLUID POWER AND PRINCIPLES (9)

Introduction to fluid power - Hydraulics and Pneumatics - Selection criteria - application of fluid power - application of Pascal's law – equation - transmission and multiplication of force - pressure losses – fluids - selection and properties - ISO symbols.

UNIT II FLUID POWER DRIVES (9)

Fluid power drives – pumps - construction details of gear, vane and piston pumps - working principle - hydraulic motor - Hydrostatic transmission drives and characteristics- Hydraulic supply components - Pneumatic power supply – Compressor - air distribution - air motors.

UNIT III FLUID POWER ELEMENTS (9)

Control valves - pressure, flow and direction - working principles and construction - Special type valves – cartridge – modular - proportional and servo - Selection and actuation methods. Actuators - Selection and specification – cylinders – mounting – cushioning - pipe fittings - fluid conditioning elements – accumulators - case study.

UNIT IV HYDRAULICS AND PNEUMATICS CIRCUITS DESIGN (9)

Design of Hydraulic and Pneumatic circuits for automation - Selection and specification of circuit components - sequencing circuits - cascade and KV mapping method – Regenerative speed control - Synchronizing circuits - case study.

UNIT V ADVANCEMENTS IN HYDRAULICS AND PNEUMATICS AND APPLICATIONS (9)

Electro pneumatics - ladder diagram - Servo and Proportional valves – types – operation – application – Hydro Mechanical servo systems – PLC construction – types – operation – programming – Applications: Hydraulic tipping mechanism - power steering - fort lift hydraulic gear - hydro-pneumatic suspension - air brake**.**

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Learn the basic principles of hydraulics and pneumatics systems.
- CO2: Design the various operational circuits with the knowledge of construction and operation of fluid power drives.
- CO3: Identify, Learn and draw fluid power symbols.
- CO4: Design the application circuits of hydraulic and pneumatic systems.
- CO5: Demonstrate the knowledge of fluid power systems with applications and advancements.

Text Books

- T1 Anthony Esposito, ―Fluid power with applications, 7th Edition, Pearson Education 2009.
- T2 Majumdar, ―Pneumatic system: Prinicples and maintenance, Tata McGraw Hill,2004

References

- R1 Srinivasan R, "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints Private Ltd, 2005
- R2 Shanmugasundaram.K, ―Hydraulic and Pneumatic controls, Chand & Co, 2006.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7309	TOTAL QUALITY MANAGEMENT (COMMON TO AUTO & MECH)	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn the significance of quality gurus works to the management of modern organizations.
2 To facilitate the Learning of Quality Management principles and process.
3 To Learn the purpose of the statistical process tools
4 To distinguish and use of the several techniques of quality management tools
5 To gain the knowledge on various ISO standards and quality systems

UNIT I INTRODUCTION (9)

Definition of Quality–Dimensions of Quality–Quality Costs–Top Management Commitment–Quality Council–Quality Statements–Barriers to TQM Implementation–Contributions of DemingJuran and Crosby–Team Balancing.

UNIT II TQM PRINCIPLES (9)

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality,Customer Retention, Continuous Process Improvement,5S, Kaizen, Just-In-Time and TPS

UNIT III STATISTICAL PROCESS CONTROL (9)

The seven tools of quality, New seven Management tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts forvariables and attributes, Concept of six sigma

UNIT IV TQM TOOLS (9)

Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA s

UNIT V QUALITY SYSTEMS (9)

Need for ISO 9000 and Other Quality Systems, ISO 9001:2008 Quality System – Elements,Implementation of Quality System, Documentation, Quality Auditing, ISO 14001:2004

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Explain the different meanings of the quality concept and its influence.
CO2: Apply TQM principles and concepts of continuous improvement
CO3: Predict the errors in the measuring process, distinguishing its nature and the root causes.
CO4: Write reports to management describing processes and recommending ways to improve them
CO5: Explain the regulation and the phases of a quality system certification process.

Text Books

T1 Dale H.Besterfiled, ―Total Quality Management, Pearson Education
T2 Feigenbaum.A.V. ―Total Quality Management, McGraw Hill

References

R1 Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall, 2006.
R2 Narayana V. and Sreenivasan, N.S. ―Quality Management – Concepts and Tasks, New Age, 2007
R3 Zeiri. ―Total Quality Management for Engineers, Wood Head Publishers.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7310	NON DESTRUCTIVE TESTING OF MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives

1. To study and Learn the various Non-Destructive Evaluation and Testing methods, theoryand their industrial applications.
2. To provide a basic Learning on different surface NDE techniques and apply them for inspecting materials in accordance with industry specifications and standards
3. To Learn principles and techniques of thermography and eddy current testing
4. To provide a sound theoretical knowledge and practical skill for Ultrasonic testing
5. To get familiarized with codes, standards and specifications for RT with respect to safety norms

UNIT I INTRODUCTION TO NDT (7)

NDT Versus Mechanical testing–Overview of NDT Methods for the detection of manufacturing defects as well as material characterisation–merits and limitations–Various physical characteristics of materials and their applications in NDT–Visual inspection – Unaided and aided

UNIT II SURFACE NDE METHODS (8)

Liquid Penetrant Test-Principles–Types and properties of liquid penetrants–developers, advantages and limitations of various methods–Testing Procedure–Interpretation of results Magnetic Particle Testing- Theory of magnetism–Inspection materials–Magnetisation methods–Interpretation and evaluation of test indications–Principles and methods of demagnetization, Residual magnetism.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET) (10)

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying
liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications–Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements–Probes–Instrumentation–Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) (10)

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A-Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique–Principle, AE parameters, Applications

UNIT V RADIOGRAPHY (RT) (10)

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess,density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographicequivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: To have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures
- CO2: Differentiate various defect types and select the appropriate NDT methods for better evaluation.
- CO3: Identify equipment required for the testing process
- CO4: Ability to communicate their conclusions clearly to specialist and non-specialist audiences.
- CO5: Documentation of the testing and evaluation of the results for further analysis.

Text Books

- T1 Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, NarosaPublishing, 2009.
- T2 Ravi Prakash, “Non-Destructive Testing Techniques”, 1st revised edition, New AgePublishers, 2010

References

- R1 Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, NewJersey, 2005
- R2 Charles, J. Hellier,“ Handbook of Nondestructive evaluation”, McGraw Hill, New York 2001

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7311	MICROPROCESSOR APPLICATION IN AUTOMOBILES	L	T	P	C
		3	0	0	3

Course Objectives

1 To know about the increasing use of electronic circuitry in motor vehicle control systems.
2 To get an exposure of microprocessor programming and interfacing.
3 To have knowledge about interfacing devices.
4 To comprehend the microcontroller architecture, ports and programming.
5 To explore the microprocessor hardware which contributes to vehicular safety, comfort and economy.

UNIT I INTRODUCTION TO MICROPROCESSORS (9)

Need for microprocessor based system design – Design cycle - Microcomputer System – 8085 Architecture – 8085 Pin Diagram – Buses and Memory Operations - Addressing Modes - basic concepts of microprocessor programming – Mnemonics – Hex code – fundamentals of assembly language.

UNIT II MICROPROCESSOR PROGRAMMING AND INTERFACING (9)

Microprocessor programming - format - instruction set 8085 - simple programs – addition, subtraction, multiplication, division - block movement of data - finding smallest number array and sorting.

UNIT III INTERFACING DEVICES (9)

Interfacing devices - types: Input / Output port – 8255, 8251, 8279, 8253 and 8259 (Programmable Interrupt Controller)

UNIT IV 8051 MICROCONTROLLER (9)

8051 Architecture - microcontroller hardware – I/O Pins - Ports - Internal and External memory – Counters and Timers – Serial data I/O – Interrupts – 8051 Assembly Language Programming: Addressing modes - Instruction set of 8051 - Data transfer instructions - Arithmetic and Logical Instructions - Jump and Call Instructions interrupts - return interrupts and handling.

UNIT V APPLICATIONS (9)

8051 Interfacing with: LCD, Sensors, Stepper Motors, Keyboard, Pulse measurement, ADC and DAC – Applications: Data acquisitions - temperature control - stepper motor control -automotive applications - engine control - Suspension system control - Driver information systems - Development of a high speed - high precision learning control system for the engine control.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Get an exposure to the increasing use of electronic circuitry in motor vehicle control systems.
CO2: Learn the microprocessor programming and interfacing.
CO3: Design application circuits with various interfacing devices in automotive sector.
CO4: Learn the microcontroller architecture, ports and programming.
CO5: Develop the microprocessor application which contributes to advances in vehicular safety, comfort and economy.

Text Books

T1 Ramesh S Gaonkar, Microprocessor Architecture, Programing and application with 8085, 4th Edition, Penram International Publishing, New Delhi, 2000.
T2 Douglas V., Hall, Microprocessors and Interfacing, Tata McGraw Hill Publishers, 3rd edition, 2012.

References

R1 Mohammed Ali Mazidi and Janice GillispieMazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, New Delhi, 2nd edition, 2007.
R2 Rafiquazzaman M, Microprocessors Theory and Applications: Intel and Motorola prentice Hall of India, Pvt. Ltd., New Delhi, 2016.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	1	1	-	2	-	-	2	-	2	-	3	1	1
CO2	1	2	2	2	2	-	-	-	-	2	-	2	2	1
CO3	2	2	3	2	2	-	-	-	-	2	-	2	1	1
CO4	3	1	1	2	2	-	-	2	-	2	-	2	1	1
CO5	2	2	3	2	1	-	-	-	-	2	-	2	2	1
AVG	2	1.6	2	2	1.8	-	-	2	-	2	-	2.2	1.4	1

16AU7312 **VEHICLE BODY ENGINEERING**

L	T	P	C
3	0	0	3

Course Objectives

1. The main intention of this course is to impart knowledge in the construction of vehicle body, aerodynamic, concept, paneling of body trim and the different body construction.
2. To get well versed in the design and construction of external body of the vehicles.
3. To acquire knowledge in vehicle body regulations
4. To Learn the various vehicle body construction
5. To learn about visibility, ergonomic design and materials

UNIT I CAR BODY DETAILS (9)

Car body-Saloon-convertibles-Limousine-Estate Van-Racing and Sports car-Visibility regulations-driver's visibility-improvement in visibility-tests for visibility-Driver seat design-Car body construction-Various panels in car bodies-Safety aspect of car body.

UNIT II BUS BODY DETAILS (9)

Types of bus body-based on capacity-distance traveled-based on construction-Bus body lay out for various types-Types of metal sections-Regulations-Constructional details-Conventional and integral-driver seat design-Safety aspect of bus body.

UNIT III COMMERCIAL VEHICLE DETAILS (9)

Types of commercial vehicle bodies-Light commercial vehicle body-Construction details ofcommercial vehicle body-Flat platform body-Trailer-Tipper body-Tanker body-Dimensions of driver's seat in relation to controls-Drivers cab design-Regulations.

UNIT IV VEHICLE AERODYNAMICS (9)

Objectives-Vehicle drag-types-forces and moments-Effects of forces and moments-Side wind effects-body optimization techniques for minimum drag-Wind tunnels-Principle of operation-Types-Wind tunnel testing-Flow visualization techniques-Airflow management test-measurement of various forces and moments by using wind tunnel.

UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR (9)

body construction-Types-materials used-Steel sheet-timber-plastics-GRP-properties-Body trim items-body mechanisms-Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion-Anticorrosion methods-Modern painting process procedure-paint problems

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Be familiar with different aspects of car body, bus body, types and commercial vehicle.
CO2: Able to know the role of various aerodynamic forces and moments and its measuring instruments
CO3: Learn the vehicle body regulation to build the body
CO4: Discover some new vehicle body and ergonomics designs
CO5: Know about the material used in body building, tools used, body repairs.

Text Books

T1 Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.
T2 James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 2009.

References

R1 Giles, G.J., "Body construction and design", Illiffe Books Butterworth & Co., 1991.
R2 John Fenton, "Vehicle Body layout and analysis", Mechanical Engg. Publication Ltd., London, 1992.
R3 Braithwaite, J.B., "Vehicle Body building and drawing", Heinemann Educational Books Ltd., London, 1997.
R4 Dieler Anselm., The passenger car body, SAE International, 2000

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	2	3	3	2	-	-	-	3	-	3	3	2
CO2	3	2	2	3	2	2	-	-	-	3	-	3	3	2
CO3	2	2	2	2	3	-	-	-	-	2	-	2	2	2
CO4	2	2	2	2	2	-	-	-	-	2	-	2	2	2
CO5	3	2	1	2	2	2	-	-	-	2	-	2	3	2
AVG	2.4	2	1.8	2.4	2.4	2	-	-	-	2.4	-	2.4	2.6	2

16AU8301	DESIGN FOR MANUFACTURE AND ASSEMBLY	L	T	P	C
		3	0	0	3

Course Objectives

1 To introduce the concept and application of design for manufacturing and assembly
2 To discuss various fundamentals of assembly and design recommendations for product development
3 To gain knowledge on geometric tolerances used to define machine component
4 To apply a systematic Learning of knowledge in the field of metal casting and welding
5 To interpret the differences and similarities between Design for Manufacturing and Assembly

UNIT I DFM APPROACH, SELECTION AND SUBSTITUTION OFMATERIALS (9)

DFM – Approach, guidelines, standardisation, group technology, value engineering, comparison of materials on Cost basis.

UNIT II GEOMETRIC DIMENSIONING & TOLERANCE INTRODUCTION (9)

Process capability- metrics, Cp, Cpk , Cost aspects–Feature tolerances–Geometric tolerances–Surface finish–Relationship between attainable tolerance grades,different machining process– cumulative effect of tolerances–sure fit law,normal law and truncated normal law–6σ concept.

UNIT III TOLERANCE CHARTING TECHNIQUE (9)

Operation sequence for typical shaft type of components–preparation of process drawings fordifferent operations–tolerance worksheets and centrality analysis.

UNIT IV DESIGN FOR MANUFACTURE (9)

Design features to facilitate machining–datum features– Functional and manufacturing,component design–machining considerations– redesign for manufacture–Redesign ofcastings based on parting line considerations, minimising core requirements–redesigning castmembers using weldments, use of welding symbols – Case studies.

UNIT V SELECTIVE ASSEMBLY (9)

Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal–Model-II: total and group tolerances of shaft–control of axial play introducing secondary machining operations–laminated shims, examples

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Learn the basic background of DFM and related concepts
CO2: Apply the fundamentals of GD &T in machining the components
CO3: Apply the concept of manufacturing and assembly to solve the industrial problem
CO4: To identify, quantify and eliminate waste or inefficiency in a product design
CO5: Explain the impact and importance of adopting integrated manufacturing systems in modern manufacturing.

Text Books

T1 Harry Peck, "Designing for Manufacture", Pitman Publications, London, 1983.
T2 Krulikowski A, ―Fundamentals of Geometric Dimensioning and Tolerancing, DelmarPublishers, New York, 1991
T3 Spotts M. F, "Dimensioning and Tolerance for Quantity Production", Prentice Hall Inc.,New Jersey, 1983.

References

R1 Oliver R Wade, "Tolerance Control in Design and Manufacturing", Industrial Press Inc.,New York, 1967.
R2 Creveling C. M, "Tolerance Design - A Hand Book for Developing Optimal Specifications", Addison Wesley Longman Inc.,USA, 1997.
R3 Pahl.G and Beitz .W, "Engineering Design-Systematic Approach", Springer VerlagPublications, 1996.

Web Sources

W1 http://nptel.ac.in/courses/107103012/module1/lec1.pdf
W2 http://me.gatech.edu/files/capstone/L071ME4182DFA

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	2	3	3	2	-	-	-	3	-	3	3	2
CO2	3	2	2	3	2	2	-	-	-	3	-	3	3	2
CO3	2	2	2	2	3	-	-	-	-	2	-	2	2	2
CO4	2	2	2	2	2	-	-	-	-	2	-	2	2	2
CO5	3	2	1	2	2	2	-	-	-	2	-	2	3	2
AVG	2.4	2	1.8	2.4	2.4	2	-	-	-	2.4	-	2.4	2.6	2

16AU8302 VEHICLE CONCEPT DESIGN AND STYLING

L	T	P	C
3	0	0	3

Course Objectives

1. To Learn the design trends of concept cars
2. To Learn the concept of ergonomics in design of cars
3. To get exposures in the field of computer aided styling
4. To able to convert their creativity into concept styling and design
5. To make familiar in technical illustration of styling and design

UNIT I INTRODUCTION (9)

Drawing in product design-drawing by hand-by computer-mass production-geometric versus naturalistic drawing-modernist design-Basic drawing skills-Perspectives- projections-metric- spherical-orthographic-sections and scrap views-Tools and materials-Pencils-pens-erasers-markers-paints-ink-airbrush-drawing instruments-paper and aboard.

UNIT II COMPUTER SYSTEMS (9)

The computer processor-system software-central processing unit-memory-frame buffers-display- input devices-hardcopy output-3D output devices-networking-healthy and safety-Concept design-Satisfying the client-sketch-schematic-evaluating the design-3D modeling concepts-hybrid approach-commercial computer solutions-drawing in space-creating organic forms.

UNIT III PRESENTATION DRAWING AND VISUALS (9)

From watercolor washes to markers-painting by numbers-art of design-visual tricks-making marker drawing-2D computer programs-paint and vector-3D computer aided styling (CAS)-creating virtual reality-shading a computer model-ray tracing and radiosity-adding texture- fractals and commercial modelers.

UNIT IV FROM GENERAL ARRANGEMENTS DRAWING TO PRODUCTION (9)

Technical production documentation-general arrangement drawing-drafting standards-computer aided drafting-geometric constructions-controlling curves-parametric design-CAD data-Exchange standards and all change in the CAD market.

UNIT V TECHNICAL ILLUSTRATION (9)

Art of technical illustration-techniques of technical illustration-thick and thin lines-sections- cutaways-ghosting-photo-tracing-annotation and labeling-computer aided illustration-interactive technical illustration and commercial solutions.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Completion of this course the students will familiar in the design trends of concept cars with computer aided styling and new vehicle concept design and its technical illustration

CO2: Capable of design of concept cars based on aesthetic and ergonomics factors

CO3: Learners will be familiar in the field of computer aided styling

CO4: Improve learners creativity and convert into concept design and styling

CO5: Learners able to design a vehicle with their own idea

Text Books

T1 Alan Pipes, “Drawing for Designers”, Laurence King Publishing, 2007

T2 Erik Olofsson, KlaraSjölén, “Design Sketching”, Keeos Design Books AB, 2005

References

R1 Tony Lewin, Ryan Borroff, “How to Design Cars Like a Pro”, MotorBooks International, 2010.

R2 Stuart Macey, Geoff Wardle, Ralph Gilles, Freeman Thomas, Gordon Murray , “H-Point: The Fundamentals of Car Design & Packaging”, Design Studio Press, 2009

R3 Thom Taylor, “How to Draw Cars Like a Pro”, MotorBooks International, 2006

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	2	3	3	2	-	-	-	3	-	3	3	2
CO2	3	2	2	3	2	2	-	-	-	3	-	3	3	2
CO3	2	2	2	2	3	-	-	-	-	2	-	2	2	2
CO4	2	2	2	2	2	-	-	-	-	2	-	2	2	2
CO5	3	2	1	2	2	2	-	-	-	2	-	2	3	2
AVG	2.4	2	1.8	2.4	2.4	2	-	-	-	2.4	-	2.4	2.6	2

16AU8303	OFF ROAD VEHICLES	L	T	P	C
		3	0	0	3

Course Objectives

1. Students will be able to Learn the various off road vehicle, earth moving machine, construction machine and equipments
2. To impart knowledge in off road vehicle special equipments
3. Able to Learn the design concepts of off road vehicle special equipments
4. To impart the knowledge of handling off road vehicles and equipments
5. To learn about off road vehicle systems and features

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES (9)

Off road vehicles-Construction layout-capacity-applications-Power Plants-Chassis and Transmission-Multi axle vehicles.

UNIT II EARTH MOVING MACHINES (9)

Earthmovers-dumpers-loaders-single bucket-Multi bucket-rotary types-bulldozers-excavators-backhoe loaders-scrappers-drag and self powered types-Bush cutters-stumpers-tree dozer-rippers etc-crawler tracks mounted / wheeled-bull dozers-tilt dozers and angle dozers-front end loaders- factors affecting efficiency output of tractors-and demerits.

UNIT III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS (9)

Scrappers-elevating graders-motor graders-self powered scrappers and graders-Power shovel-revolving and stripper shovels-drag lines-ditchers-capacity of shovels.

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES (9)

Earth moving machines-Power and capacity-General description-specification-functions-light- medium and heavy wheeled tractors-Power take off-special implements-Special features and constructional details of tankers-gun-carriers and transport vehicles.

UNIT V VEHICLE SYSTEMS ,FEATURES (9)

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-dumper-Safety features-safe warning system-Design aspects-loader bucket-dumper and water tank of sprinkler.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: At the end of the course, the students will Learn the off road vehicles based on the need and purpose.
CO2: Learnt about off road vehicle special equipments
CO3: To develop the design concepts of off road vehicle special equipments
CO4: Learners able to handle the off road vehicle and its special equipments
CO5: Learners will be familiar in off road vehicle system and features

Text Books

T1 Robert L Peurifoy, “Construction, planning, equipment and methods” Tata McGraw Hill, 2009.
T2 Nakra C.P., “Farm machines and equipments” Dhanparai Publishing company Pvt. Ltd.
T3 Abrosimov.K. Bran berg.A and Katayer.K., "Road making machinery", MIR Publishers,Moscow, 1971.
T4 SAE Handbook Vol. III., Society of Automotive Engineers, 1997
T5 Wong.J.T., "Theory of Ground Vehicles”, John Wiley & Sons, New York, 1987.

References

R1 Ia. S. Ageikin, “Off the Road Wheeled and Combined Traction Devices: Theory andCalculation”, Ashgate Publishing Co. Ltd. 1988.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	2	3	3	2	-	-	-	3	-	3	3	2
CO2	3	2	2	3	2	2	-	-	-	3	-	3	3	2
CO3	2	2	2	2	3	-	-	-	-	2	-	2	2	2
CO4	2	2	2	2	2	-	-	-	-	2	-	2	2	2
CO5	3	2	1	2	2	2	-	-	-	2	-	2	3	2
AVG	2.4	2	1.8	2.4	2.4	2	-	-	-	2.4	-	2.4	2.6	2

16AU8304	ENGINE AUXILLARY SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

1 To make the students Learn the Carburetion systems used in automobiles and their functions.
2 To make the students Learn the gasoline injection systems used in automobiles and their functions.
3 To make the students Learn the diesel injection systems used in automobiles and their functions.
4 To make the students Learn the manifolds and mixture distribution in automobiles and their functions.
5 To Demonstrate the lubrication and cooling systems used in automobiles and their functions.

UNIT I CARBURETION (9)

Introduction- principle of working-factors affecting carburetion-Air fuel mixtures-mixture requirements at different loads and speeds- Carburetor-Essential Parts-different circuits-compensating devices-working -types- Chokes-Effects of altitude on carburetion.

UNIT II ELECTRONICS INJECTION SYSTEMS (9)

Introduction-Need of Gasoline injection-types-components-EFI-merits-Demerits-MPFI system- port injection- throttle body injection-Function of MPFI-Electronic control system - group gasoline injection system- electronic diesel injection system - EDI control-CRFI system.

UNIT III DIESEL FUEL INJECTION (9)

Factors influencing fuel spray atomization- penetration and dispersion of diesel and heavy oils and their properties-rate and duration of injection- fuel line hydraulics- fuel pump- injectors- CRDI systems and its merits and demerits.

UNIT IV INTAKE ANS EXHAUST MANIFOLDS (9)

Intake system components- Discharge coefficient- Pressure drop-Air filter-Intake manifold-Connecting pipe-Exhaust system components-Exhaust manifold and exhaust pipe- Spark arresters- Waste heat recovery-Exhaust mufflers-Type of mufflers- exhaust manifold expansion.

UNIT V LUBRICATION AND COOOLING SYSTEMS (9)

Lubricants-lubricating systems- Lubrication of piston rings- bearings-oil consumption-Oil cooling. Heat transfer coefficients-liquid and air cooled engines-coolants-additives and lubricity improvers- concept of adiabatic engines.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: At the end of the course, the student will be familiar with the functionality, construction, working principle of carburetion.
CO2: Illustrate the electronics injection systems in automotive engines
CO3: Illustrate the diesel fuel injection systems in automotive engines
CO4: Students can Improve the Manifolds and Mixture Distribution in IC engine
CO5: Summarize the lubrication and cooling system in automotive engines.

Text Books

T1 Ramalingam, K.K, "Internal Combustion Engine", Scitech Publication (India).
T2 Ganesan, V.,"Internal Combustion Engines", Tata McGraw-Hill Book Co., 1995.

References

R1 Domkundwar, V.M, "A Course in Internal Combustion Engines", DhanpatRai and Co., 1999.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	2	3	3	2	-	-	-	3	-	3	3	2
CO2	3	2	2	3	2	2	-	-	-	3	-	3	3	2
CO3	2	2	2	2	3	-	-	-	-	2	-	2	2	2
CO4	2	2	2	2	2	-	-	-	-	2	-	2	2	2
CO5	3	2	1	2	2	2	-	-	-	2	-	2	3	2
AVG	2.4	2	1.8	2.4	2.4	2	-	-	-	2.4	-	2.4	2.6	2

16AU8305 VEHICLE TROUBLESHOOTING AND MAINTENANCE

L	T	P	C
3	0	0	3

Course Objectives

1 To impart knowledge of maintaining the records and maintenance schedules.
2 To acquire the complete knowledge of the vehicle engine maintenance procedures in breakdown situations.
3 To improve the knowledge and skills of chassis servicing and maintenance.
4 To comprehend various types of maintenance activities performed in electrical system.
5 To have an exposure to various new vehicle testing methods for fuel, lubrication and cooling systems.

UNIT I MAINTENANCE OF RECORDS AND SCHEDULES (9)

Importance of maintenance - preventive (scheduled) and breakdown (unscheduled) maintenance - requirements - preparation of check lists - Inspection schedule - maintenance of records - log sheets and other forms - safety precautions - service schedule - service history maintenance.

UNIT II ENGINE MAINTENANCE (9)

Dismantling of engine components - cleaning methods - visual and dimensional inspections - minor and major reconditioning of various components – methods - engine assembly - special tools used for maintenance - engine tuning - need for overhauling- preparation of cost sheets (estimation) - Engine performance analysis - Troubleshoot and Remedies.

UNIT III CHASSIS MAINTENANCE (9)

Automobile clutch and gear box - servicing and maintenance – propeller shaft - differential -maintenance and servicing - suspension - maintenance and servicing – brakes - maintenance and servicing - steering systems - overhauling and maintenance - wheel alignment - computerized alignment - wheel balancing.

UNIT IV ELECTRICAL SYSTEM MAINTENANCE (9)

Electrical components – testing and maintenance – battery - starter motor - charging system - DC generator and alternator - ignition system - lighting system - fault diagnosis and maintenance - modern electronic control - dash board instruments - checking and servicing.

UNIT V AUXILLIARY SYSTEMS MAINTENANCE (9)

Fuel system - servicing and maintenance - cooling systems - anti corrosion and antifreeze additives - lubrication system - maintenance - vehicle body maintenance and repairs - door locks - window glass actuating system - maintenance - Kaizen method on schedule services - Case studies - latest technologies in servicing.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Maintain the records and maintenance schedule.
CO2: Perform the engine maintenance procedures in vehicle breakdown situations.
CO3: Solve the problems normally arising in vehicular chassis components.
CO4: Evaluate the performance of the electrical systems of a vehicle.
CO5: Get an exposure to various new vehicle testing methods and standards for fuel, lubrication and cooling systems.

Text Books

T1 John Duke, "Fleet management ", McGraw Hill Co, 1984.
T2 James D Halderman - Advanced Engine Performance Diagnosis Pearson, 6th Edition - 2015.
T3 Judge A W, Motor vehicle engine servicing, 3rd, Edition ", Pitman Paper pack, London, 1970.

References

R1 Service Manuals from Different Vehicle Manufacturers.

Web Resources:

W1 www.carcare.org/car-care-service-schedules/general-service-schedule/ - Unit I and V
W2 https://mobiloil.com/en/article/car-maintenance/basic-car-maintenance-tips - Unit I and V
W3 http://lifehacker.com/the-preventative-maintenance-you-need-to-do-on-your-car-1394196018 - Unit V

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	2	2	2	3	3	2	-	-	-	3	-	3	3	2
CO2	3	2	2	3	2	2	-	-	-	3	-	3	3	2
CO3	2	2	2	2	3	-	-	-	-	2	-	2	2	2
CO4	2	2	2	2	2	-	-	-	-	2	-	2	2	2
CO5	3	2	1	2	2	2	-	-	-	2	-	2	3	2
AVG	2.4	2	1.8	2.4	2.4	2	-	-	-	2.4	-	2.4	2.6	2

16AU8306	UNCONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

Course Objectives

1 To learn about various unconventional machining processes
2 To learn machining processes that use different energies
3 To Learn the principle, mechanism of metal removal of various unconventional machining processes.
4 To study the various process parameters and their effect on the component machined on various unconventional machining processes.
5 To Learn the applications of different processes

UNIT I INTRODUCTION (5)

Unconventional machining Process – Need – classification – Brief overview.

UNIT II MECHANICAL ENERGY BASED PROCESSES (10)

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining – UltrasonicMachining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Processparameters – MRR–Variation in techniques used – Applications

UNIT III ELECTRICAL ENERGY BASED PROCESSES (10)

Electric Discharge Machining (EDM)–working Principle–Equipment's–Process Parameters–Surface Finish and MRR–Electrode / Tool – Power and control Circuits–Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES (10)

Chemical machining and Electro–Chemical machining–Etchants–maskant techniques of applying maskants–Process Parameters–Surface finish and MRR–Applications–Principles of ECM–equipments–Surface Roughness and MRR–Electrical circuit–Process Parameters–ECG and ECH –Applications.

UNIT V THERMAL ENERGY BASED PROCESSES (10)

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron BeamMachining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Able to differentiate the machining processes that use different energies
CO2: Able to identify the process parameters, their effect and applications of different processes.
CO3: Select the best machining process for different materials to be processed
CO4: Apply and analyze the manufacturing processes to reduce the cost of the product
CO5: Solve problems related to tools, equipment and processes used in the industry

Text Books

T1 Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
T2 Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi,2007

References

R1 Benedict. G.F. "Nontraditional Manufacturing Processes", Marcel Dekker Inc., New York,1987.
R2 McGeough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	1	2	2	2			2		2	3	2
CO2	3	2	2	1	3	2	2			2		3	3	2
CO3	3	3	3	1	3	2	2			2		3	3	2
CO4	3	3	2	1	3	2	2			2		3	3	2
CO5	3	3	3	1	3	2	2			2		3	3	2
AVG	3	2.6	2.4	1	2.8	2	2	-	-	2	-	2.8	3	2

16AU8307 SUPERCHARGING AND SCAVENGING

L	T	P	C
3	0	0	3

Course Objectives

1. To impart basic knowledge in the field of supercharging and turbo charging processes
2. To impart basic knowledge in the field of Superchargers and their types.
3. To Learn the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines.
4. To Learn the design of ports and muffler.
5. To Learn the experimental methods available in the scavenging.

UNIT I SUPERCHARGING (9)

Effects on engine performance – engine modification required Thermodynamics of Mechanical Supercharging and Turbo charging – Turbo charging methods – Engine exhaust manifolds arrangements.

UNIT II SUPERCHARGERS (9)

Types of compressors – Positive displacement blowers – Centrifugal compressors – Performance characteristic curves – Suitability for engine application – Surging – Matching of supercharger compressor and Engine – Matching of compressor-Turbine-Engine.

UNIT III SCAVENGING OF TWO STROKE ENGINES (9)

Peculiarities of two stroke cycle engines – Classification of scavenging systems – Mixture control through Reed valve induction – Charging Processes in two stroke cycle engine – Terminologies – Shankey diagram – Relation between scavenging terms – scavenging modeling – Perfect displacement, Perfect mixing – Complex scavenging models.

UNIT IV PORTS AND MUFFLER DESIGN (9)

Porting – Design considerations – Design of Intake and Exhaust Systems – Tuning.

UNIT V EXPERIMENTAL METHODS (9)

Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

- CO1: Demonstrate the fundamental philosophy of internal combustion engines.
- CO2: Summarize the working principle of super chargers and their types
- CO3: Summarize the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines
- CO4: Interpret the design of ports and mufflers
- CO5: Analyze the Experimental methods for evaluating scavenging tests.

Text Books

- T1 Watson, N. and Janota, M.S., “Turbocharging the I.C.Engine”, MacMillan Co., 1982.
- T2 John B.Heywood, “Two Stroke Cycle Engine”, SAE Publications, 1997

References

- R1 Obert, E.F., “Internal Combustion Engines and Air Pollution”, Intext Educational Publishers,1980.
- R2 Richard Stone,”Internal Combustion Engines”, SAE, 1992.
- R3 Vincent,E.T., “Supercharging the I.C.Engines”, McGraw-Hill. 1943
- R4 Schweitzer, P.H., “Scavenging of Two Stroke Cycle Diesel Engine”, MacMillan Co., 1956

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	1	2	2	2			2		2	3	2
CO2	3	2	2	1	3	2	2			2		3	3	2
CO3	3	3	3	1	3	2	2			2		3	3	2
CO4	3	3	2	1	3	2	2			2		3	3	2
CO5	3	3	3	1	3	2	2			2		3	3	2
AVG	3	2.6	2.4	1	2.8	2	2	-	-	2	-	2.8	3	2

16AU8308 RELIABILITY CONCEPTS IN ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives

1. The objective of this course is to make the student Learn the importance of the reliability concept
2. To acquire the knowledge on life data analyze
3. To create confidence to estimate the reliability
4. To make familiar with reliability management concepts
5. To forecast the reliability improvement

UNIT I RELIABILITY CONCEPT (9)

Reliability definition –Reliability parameters- f(t), F(t) and R(t) functions- Measures of central tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality - Useful life.

UNIT II LIFE DATA ANALYSIS (9)

Data classification – Non parametric methods: Ungrouped, Grouped, Complete, Censored data – Time to failure distributions – Probability plotting: Exponential, Weibull - Goodness of fit tests – Survival graphs.

UNIT III RELIABILITY ESTIMATION (9)

Series parallel configurations – Parallel redundancy – m/n system – Complex systems: RBD approach – Baye's method – Minimal path and cut sets - Fault Tree analysis – Standby system.

UNIT IV RELIABILITY MANAGEMENT (9)

Reliability testing: Failure terminated test – Time terminated test – Upper and lower MTBFs – Sequential Testing – Reliability growth monitoring – Reliability allocation.

UNIT V RELIABILITY IMPROVEMENT (9)

Analysis of downtime – Repair time distribution – Maintainability prediction – Measures of maintainability – Availability definitions – System Availability – Replacement decisions – Economic life.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: The student will be familiar with the basics of reliability and importance.
CO2: Apply the various methods to analysis the life of the product or component
CO3: Ability to calculate the estimated reliability period of the automotive element
CO4: Learners will be familiar with reliability management
CO5: Able to predict and maintain the economic life of the component

Text Books

T1 An Introduction to Reliability and Maintainability Engineering, Charles E.Ebeling, TMH, 2000.

References

R1 Roy Billington and Ronald N. Allan, Reliability Evaluation of Engineering Systems, Springer, 2007.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	1	2	2	2			2		2	3	2
CO2	3	2	2	1	3	2	2			2		3	3	2
CO3	3	3	3	1	3	2	2			2		3	3	2
CO4	3	3	2	1	3	2	2			2		3	3	2
CO5	3	3	3	1	3	2	2			2		3	3	2
AVG	3	2.6	2.4	1	2.8	2	2	-	-	2	-	2.8	3	2

16AU8309 **PRINCIPLES OF MANAGEMENT**

L	T	P	C
3	0	0	3

Course Objectives

1 To enable the students to study the evolution, functions and organization of Management.
2 To have a clear Learning of the managerial functions of planning.
3 To learn the Principles of management and the application of the principles in an organization.
4 To have clear explanation of staffing, leading and controlling.
5 To have basic knowledge on international aspect of management

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS (9)

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers -managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING (9)

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING (9)

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING (9)

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V CONTROLLING (9)

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Interpret the concepts of management, administration and the evolution of management thoughts.
CO2: Choose and apply the planning concepts.
CO3: Analyze the different organizational structures and Learn the staffing process
CO4: Analyze the various motivational and leadership theories and Learn the communication and controlling processes.
CO5: Identify the various international approaches to management

Text Books

T1 Harold Koontz & Heinz Weihrich “Essentials of management” Tata McGraw Hill, 1998.
T2 Stephen P. Robbins & Mary Coulter, “Management”, 10th Edition, Prentice Hall (India) Pvt. Ltd.,2009.
T3 JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson Education, 2004.

References

R1 Stephen A. Robbins & David A. Decenzo& Mary Coulter, “Fundamentals of Management”,7th Edition, Pearson Education, 2011.
R2 Robert Kreitner&MamataMohapatra, “Management”, Biztantra, 2008
R3 Tripathy PC & Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
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CO3	3	3	3	1	3	2	2			2		3	3	2
CO4	3	3	2	1	3	2	2			2		3	3	2
CO5	3	3	3	1	3	2	2			2		3	3	2
AVG	3	2.6	2.4	1	2.8	2	2	-	-	2	-	2.8	3	2

16AU8310	NEW GENERATION AND HYBRID VEHICLES	L	T	P	C
		3	0	0	3

Course Objectives

1. To illustrate the new generation vehicles and their operation and controls
2. Learning various aspects of hybrid and electric drive trains.
3. To get exposure in the research and development field of automated vehicles.
4. To Learn advanced combustion processes and modern engine technologies
5. To impart knowledge advancements of safety systems

UNIT I INTRODUCTION (9)

Electric and hybrid vehicles-flexible fuel vehicles (FFV)-solar powered vehicles-magnetic track Vehicles-fuel cells vehicles-Modern Engine Technology-DTS-Fi-DTS-Si-VVT-Camless Engine- GDi-CRDI.

UNIT II POWER SYSTRM AND NEW GENERATION VEHICLES (9)

Hybrid Vehicle-Stratified charge engines-learn burn engines-low heat rejection engines- hydrogen engines-HCCI engine-VCR engine-surface ignition engines-flexible fuel systems.

UNIT III VEHICLE OPERATION AND CONTROL (9)

Computer Control for pollution, noise control and for fuel economy-Transducers-actuators-Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT IV VEHICLE AUTOMATED TRACKS (9)

road network-Preparation-maintenance-National highway network with automated roads and vehicles-Automated highway systems-Lane warning system-Driver Information System-driver assistance systems-Driver conditioning warning-Route Guidance-Navigation Systems-Satellite control of vehicle operation-GPS.

UNIT V SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY (9)

Air suspension-Closed loop suspension-compensated suspension-anti skid braking system-retarders-regenerative braking-safety gauge air backs-crash resistance-Aerodynamics for modern vehicles-safety systems-materials and standards.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Upon completion of this course the student will familiar in the recent development pertain to energy system.

CO2: Learnt about hybrid and electric drive trains

CO3: Learn the principles of automated vehicles

CO4: Able to familiar in advanced engine technologies.

CO5: Gain the knowledge in the field of advancement of safety systems

Text Books

T1 Heinz, "Modern Vehicle Technology" Second Edition, Bu

T2 Bosch Hand Book, SAE Publication, 2000

T3 Robert N.Brandy, “Automotive Electronics and Computer Systems”, Prentice Hall ,2001

References

R1 Advance hybrid vehicle power transmission, SAE

R2 Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1993

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	1	2	2	2			2		2	3	2
CO2	3	2	2	1	3	2	2			2		3	3	2
CO3	3	3	3	1	3	2	2			2		3	3	2
CO4	3	3	2	1	3	2	2			2		3	3	2
CO5	3	3	3	1	3	2	2			2		3	3	2
AVG	3	2.6	2.4	1	2.8	2	2	-	-	2	-	2.8	3	2

16AU8311	PRODUCT DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

1 To discuss the main stages of designing and manufacturing a product.
2 To discuss the main activities involved in testing, refining a new product, launching and selling.
3 To Learning the steps for defining the product specifications
4 To discuss about principles and planning of industrial design process and its management
5 Learning the technologies of prototyping and economic analysis

UNIT I INTRODUCTION TO PRODUCT DESIGN (9)

Introduction–principles of new product development, success and failure in new products–risk management, funnel and its stages–Quality control of product development and meeting targets– Principles of product styling-virtual perception of product style, attractiveness and product styling process

UNIT II IDENTIFYING CUSTOMER NEEDS (9)

Gathering raw data from customers–Interpreting raw data in terms of customer needs–Organizingthe needs into a hierarchy–Establishing the relative importance of the needs and reflecting on theresults and the process.

UNIT III PRODUCT SPECIFICATIONS AND CONCEPT GENERATION (9)

Product specification–steps to establish the target specifications–Concept generation–Five step concept generation method–concept selection, concept screening, concept testing, product architecture

UNIT IV PRODUCT ARCHITECTURE–INDUSTRIAL DESIGN–DESIGN FOR MANUFACTURING (9)

Meaning of product architecture–Implications of the architecture, establishing the architecture,Variety and supply chain considerations, platform planning, related system level design issues. –principle and planning industrial design process and its management, legal issues in product design, design resources, economics and management of product development projects. Estimating manufacturing cost, reducing component, assembly and support costs, design for assembly, design for disassembly, design for environment, design for graphics and packaging, effective prototyping

UNIT V PROTOTYPING–PRODUCT DEVELOPMENT ECONOMICS –MANAGING PROJECTS (9)

Prototyping–Basics, Principles, Technologies, Planning– Elements of economic analysis, base case financial mode–Sensitive analysis–Project trade-offs–Influence of qualitative factors on project success–Qualitative analysis–Learning and representing task–Baseline project planning, accelerating projects, project execution and postmortem project evaluation.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Apply the process to plan and develop products
CO2: Analyze the process by collecting information and developing product specifications
CO3: Analyze the environmental issues that are involved in making a product and in retiring it.
CO4: Apply the concepts of product architecture, industrial design and design for manufacture
CO5: Apply the basics of prototyping, economic analysis and project planning and executionProcesses for product development

Text Books

T1 Product Design and Development: Karl. T. Ulrich, Steven D Eppinger, IrwinMcGrawHill.
T2 Product Design and Manufacturing: A C Chitale and R C Gupta, PHI
T3 New Product Development: Timjones. Butterworth Heinemann, Oxford.

References

R1 Product Design for Manufacture and Assembly: GeofferyBoothroyd, Peter Dewhurst andWinston Knight.
R2 George Dietor, A Material and Processing approach, McGraw Hill

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2	1	2	2	2			2		2	3	2
CO2	3	2	2	1	3	2	2			2		3	3	2
CO3	3	3	3	1	3	2	2			2		3	3	2
CO4	3	3	2	1	3	2	2			2		3	3	2
CO5	3	3	3	1	3	2	2			2		3	3	2
AVG	3	2.6	2.4	1	2.8	2	2	-	-	2	-	2.8	3	2

16AU8312	VEHICLE TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

1 To Learn managerial activities related to transport system.
2 To know about features of scheduling, fixing the fares for passenger transport operations.
3 To discuss about the various aspects of goods transport operations.
4 To learn the various scheduled and unscheduled maintenance procedures.
5 To get an exposure about the motor vehicle act and maintenance aspects of transport.

UNIT I INTRODUCTION (9)

Personnel management - objectives – functions – psychology - sociology with relevance to organization - personality problems - Selection process - job description - employment tests - interviewing – training – objectives – advantages - methods – procedure - psychological tests.

UNIT II PASSENGER TRANSPORT OPERATION (9)

Passenger transport organizations - depot layouts - requirements and problems on fleet management - fleet maintenance - planning - scheduling operation and control - personnel training - training for drivers and conductors - public relations – propaganda - publicity and passenger amenities - parcel traffic - theory of fares - fare charging - economics and records.

UNIT III GOODS TRANSPORT OPERATION (9)

Structure of goods transport organizations - scheduling of goods transport - management Information System (MIS) in passenger and goods transport operation - storage and transportation of petroleum products – advanced techniques in Traffic Management - Traffic navigation - Global positioning system (GPS).

UNIT IV MAINTENANCE (9)

Scheduled and unscheduled maintenance - preventive maintenance system - tyre maintenance - causes for uneven tyre wear – remedies - maintenance procedure for better fuel economy -breakdown analysis - control of repair backlogs.

UNIT V MOTOR VEHICLE ACT (9)

Schedules and sections – registration of motor vehicles – EURO Norms - licensing of drivers – control of permits – limits of speed – traffic signs – constructional regulations – description of goods carrier - delivery van – tanker – tipper – municipal - firefighting and break down service vehicle – Bharat stage – evaluation – BS I, II, III and IV norms.

TOTAL:45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Manage a transport fleet and their related activities with improved managerial skills.
CO2: Maintain the services with good relationship, good behavior and trustworthiness.
CO3: Improve the efficiency of goods transport with minimal operational cost.
CO4: Perform maintenance activities in time to avoid unnecessary downtime.
CO5: Know about the various transport laws and motor vehicle acts.

Text Books

T1 John Duke - Fleet Management – McGraw-Hill Co, USA -1984.
T2 Government Motor Vehicle Act – Eastern Book Company, Lucknow – 1989.
T3 Kitchin.L.D., - Bus Operation - Illiffee and Sons Co., London, III edition – 1992

References

R1 The motor vehicle Act 1939 – EjazAhemad, Ashok law house, India - 1989

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO-1**	**PSO-2**
CO1	3	2	1	1	-	-	-	-	-	2	-	1	3	2
CO2	2	2	1	1	1	1	-	-	-	2	-	1	3	2
CO3	3	2	1	1	2	2	1	-	-	1	-	3	3	2
CO4	2	2	-	1	-	1	1	-	-	2	-	2	2	2
CO5	2	2	1	1	-	1	1	-	-	1	-	2	2	2
AVG	2.4	2	1	1	1.5	1.25	1	-	-	1.6	-	1.8	2.6	2

16AU6401	BASIS OF AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

1. To Learn the basic fundamentals of automobile engineering
2. To acquire knowledge of automotive engines
3. To impart knowledge of various power transmission unit
4. To Learn the principles of steering and brake systems
5. To know about automotive electrical systems and its functions

UNIT I INTRODUCTION (8)

Automobile - Components of an automobile - Classification of automobiles - Layout of chassis - Types of drives front wheel - rear wheel - four wheel.

UNIT II IC ENGINES (9)

I.C. Engines - 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 - Carburetor - types.

UNIT III TRANSMISSION SYSTEM (10)

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 (9)

Steering system - function and principle - Ackerman and Davis steering principles - steering and wheel geometry – steering gear boxes. Brakes - Mechanical - hydraulic and vaccum brake - master cylinder - wheel cylinder - Bleeding of brakes.

UNIT V ELECTRICAL SYSTEMS (9)

Battery – types - Dynamo and Alternator – Cutout relay - Diagram of Wiring system - Lighting System and Accessories - Lighting system – Headlight - Lighting switches - Windscreen Wipers – Horn – Speedometer – Heater and Air conditioning

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Provides basic platform knowledge of automobile engineering
CO2: Learn the working principal of petrol and diesel engines
CO3: Interpret the method of power transmission unit
CO4: Built knowledge of steering and brake
CO5: Acquired the knowledge of automotive electrical systems and functioning

Text Books

T1 Kirpal Singh, Automotive Engineering, Vol. I & II, Standard Publishers, New Delhi,2010.
T2 Gupta,S K“A Textbook of Automobile Engineering”, Chand Publishing,2013.

References

R1 Rajput, R K, “A Textbook of Automobile Engineering”, Firewall Media, 2007.
R2 Butterworth-Heinemann, “ Automobile and Mechanical Electrical Systems”, Tom Denton Publisher,2011.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	3	3	-	-	2	-	3
CO2	3	3	2	2	2	2	2	-	-	2	-	2
CO3	2	2	-	3	3	3	3	-	-	2	-	3
CO4	2	2	2	2	2	2	2	-	-	2	-	2
CO5	3	3	2	2	3	2	2	-	-	2	-	2
AVG	2.6	2.4	2	2.4	2.6	2.4	2.4	-	-	2	-	2.4

16AU7401	AUTOMOTIVE SAFETY	L	T	P	C
		3	0	0	3

Course Objective

1 To get good exposure an automotive safety
2 To Learn the active and passive safety concepts
3 To acquire knowledge in safety equipments
4 To familiarize the warning systems
5 To recognize the various adjustment systems for comfort and convenience drive

UNIT I INTRODUCTION (9)

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

UNIT II SAFETY CONCEPTS (9)

Active safety: driving safety - conditional safety - perceptibility safety - operating safety - passive safety: exterior safety - interior safety - deformation behavior of vehicle body - speed and acceleration characteristics of passenger compartment on impact.

UNIT III SAFETY EQUIPMENTS (9)

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 IV COLLISION WARNING AND AVOIDANCE (9)

Collision warning system - causes of rear end collision - frontal object detection - rear vehicle object detection system - object detection system with braking system interactions.

UNIT V COMFORT AND CONVENIENCE SYSTEM (9)

Steering and mirror adjustment - central locking system - Garage door opening system - tyre pressure control system - rain sensor system - environment information system.

TOTAL: 45 PERIODS

Course Outcomes

At the end of this course students will be able to:

CO1: Acquire knowledge in automotive safety and importance
CO2: Able to analyze the safety concepts
CO3: Learn the various safety equipments functions and importance
CO4: Able to know the function of warning and avoidance systems
CO5: Acquire knowledge on various adjustment and measurement importance for comfort and convenience riding

Text Books

T1 Powloski. J., “Vehicle Body Engineering”, Business books limited, London, 1969.
T2 Bosch, “Automotive Handbook”, 8th Edition, SAE publication, 2011.

References

R1 Ronald.K.Jurgen, “Automotive Electronics Handbook”, Second Edition, McGraw-Hill Inc.,1999.
R2 George A. Peters, Barbara J. Peters, ―Automotive Vehicle Safety – 2002.

CO PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	3	3	-	-	2	-	3
CO2	3	3	2	2	2	2	2	-	-	2	-	2
CO3	2	2	-	3	3	3	3	-	-	2	-	3
CO4	2	2	2	2	2	2	2	-	-	2	-	2
CO5	3	3	2	2	3	2	2	-	-	2	-	2
AVG	2.6	2.4	2	2.4	2.6	2.4	2.4	-	-	2	-	2.4