ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

B.E. AUTOMOBILE ENGINEERING

The vision of the Department of Automobile Engineering is :

"To be a premier department in Automobile engineering and reach the highest academic level in the field of Automobile Engineering by imparting knowledge, continuously enhancing Research & Development activities, supporting industries through consultancy programme and providing the nation with high quality engineers"

The mission of the Department of Automobile engineering is :

1. To prepare students excel in their chosen professions by offering high quality education in automobile engineering with fundamental knowledge, interdisciplinary problem-solving skills and confidence required.
2. To provide supportive and diverse environment that encourage students to achieve the best of their abilities to be innovators or job providers.
3. To maintain constant and active partnership with industries for technology development and transfer through consultancy projects.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Students will

i. Excel in their professional career in automobile industry.
ii. Exhibit research with highest professional and ethical standards.
iii. Acquire knowledge in basics of automobile engineering to apply in growth of the industry.
iv. Showcase professionalism, team work in their chosen profession and
v. Update themselves to recent trends, technologies and industrial scenarios by pursuing lifelong learning.

PROGRAMME OUTCOMES (POs)

After completion of their Under Graduate Program in Automobile Engineering, the graduates will demonstrate ability to:

PO	Graduate Attribute	Programme Outcome
1	Engineering knowledge	express strong basics skills in Mathematics, Science and Engineering.
2	Problem analysis	design and conduct Experiments, as well as to analyze and interpret data.
3	Design/development of solutions	design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and Safety, manufacturability and sustainability.
4	Conduct investigations of complex problems	acquire the capability to identify, formulate and solve complex engineering problems related to Automobile Engineering
5	Modern tool usage	become familiar with modern engineering tools and analyze the problems within the domains of Automobile Engineering as the members of multidisciplinary teams.
6	The engineer and society	understand and work for the impact of development of Automobile engineering on global, economic environment and societal context.
7	Environment and sustainability	design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
8	Ethics	understand the professional and ethical responsibility with reference to their career in the field of Automobile Engineering
9	Individual and team work	work as team player or individual in solving their assigned task.
10	Communication	communicate effectively both in verbal non-verbal forms.
11	Project management and finance	understand engineering and management principles to apply for (his/her) own work and team. Manage projects in multidisciplinary environments with financial concise.
12	Life-long learning	pursue higher studies and do research in inter and multidisciplinary fields for continuous learning lifestyle.

MAPPING OF PEOS WITH POS

Programme Educational Objectives	Programme Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
i.	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
ii.	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
iii.	✓	✓	✓	✓	✓	✓	✓					✓
iv.			✓			✓		✓	✓	✓	✓	
v.	✓	✓	✓	✓	✓	✓	✓					✓

Mapping of Course Outcome and Programme Outcome

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12
YEAR 1	Semester1	Technical English												
		Engineering Mathematics - I												
		Engineering Physics												
		Engineering Chemistry												
		Engineering Graphics	✓		✓		✓					✓		✓
		Basic Sciences Laboratory												
		Workshop Practices Laboratory	✓	✓	✓	✓								
		Professional Communication												
		Engineering Mathematics - II												
		Problem Solving and Python Programming	✓	✓	✓	✓	✓			✓	✓			✓
		Basics of Electrical and Electronics Engineering	✓	✓	✓	✓	✓							
		Engineering Mechanics	✓		✓									
		Materials Science	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Problem Solving and Python Programming Laboratory	✓	✓	✓	✓	✓			✓	✓			✓
		Electrical and Electronics Engineering Laboratory	✓	✓	✓	✓					✓		✓	

		Subject	Programme Outcome											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
2	SEM III	Transform Techniques and Partial Differential Equations												
		Education, Technology and Society	✓	✓				✓	✓	✓	✓	✓		✓
		Manufacturing Processes	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
		Thermodynamics and Thermal Engineering	✓	✓	✓	✓		✓	✓					✓
		Mechanics of Solids	✓		✓	✓				✓	✓			✓
		Automotive Engines	✓	✓	✓		✓	✓		✓				✓
		Mechanical Sciences Laboratory	✓	✓			✓				✓			✓
		Manufacturing Technology Laboratory	✓	✓	✓	✓	✓				✓	✓		✓
	SEM IV	Human Relations at Work	✓	✓				✓	✓	✓	✓	✓		✓
		Environmental Sciences	✓	✓	✓									
		Automotive Chassis	✓	✓	✓		✓	✓		✓	✓	✓		✓
		Vehicle Body Engineering	✓	✓	✓	✓	✓	✓	✓	✓				✓
		Fluid Mechanics for Automotive applications	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Kinematics and Dynamics of Machines	✓	✓	✓	✓	✓				✓	✓		✓
		Vehicle Components Laboratory		✓	✓		✓	✓		✓		✓		✓
		Fuels and Lubricants Laboratory	✓	✓			✓	✓	✓		✓			✓

		Subject	Programme Outcome											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	SEM V	Values and Ethics	✓	✓				✓	✓	✓	✓	✓		✓
YEAR 3		Engineering Design	✓	✓	✓	✓	✓	✓	✓					✓
		Automotive Electrical and Electronics Systems	✓	✓	✓	✓	✓			✓	✓			✓
		Automotive Transmission	✓		✓		✓	✓		✓	✓			✓
		Automotive Electrical and Electronics Laboratory	✓	✓	✓	✓	✓			✓	✓			✓
		Vehicle Testing Laboratory	✓	✓			✓	✓	✓		✓			✓
	SEM VI	Automotive Pollution and Control		✓		✓	✓	✓	✓	✓				✓
		Dynamics of Ground Vehicles	✓	✓	✓	✓	✓	✓		✓				✓
		Electric and Hybrid Vehicles	✓	✓	✓	✓	✓	✓		✓				✓
		Engine Testing and Emission Measurement Laboratory	✓	✓	✓	✓		✓	✓					✓

		Subject	Programme Outcome											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
YEAR 4	SEM VII	Design of Vehicle Components	✓	✓	✓	✓	✓	✓	✓					✓
		IC Engine Process Modelling	✓	✓	✓	✓	✓				✓			✓
		Computer Aided Vehicle Components Design Laboratory	✓	✓	✓	✓	✓	✓	✓					✓
		Project I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SEM VIII	Project II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PROFESSIONAL ELECTIVES COURSES

	Subject		Program Outcome											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PROFESSIONAL ELECTIVE I	1	Engine Management Systems	✓	✓	✓	✓	✓			✓				✓
	2	Measurement System	✓		✓		✓	✓	✓				✓	✓
	3	Theory of Fuels and Lubricants	✓	✓			✓		✓	✓				✓
	4	Transport Management	✓	✓	✓	✓	✓	✓		✓	✓		✓	
PROFESSIONAL ELECTIVE II	1	Automotive Safety	✓	✓	✓	✓	✓		✓	✓	✓			✓
	2	Entrepreneurship Development		✓				✓	✓	✓	✓	✓	✓	✓
	3	Finite Element Techniques	✓	✓	✓	✓	✓			✓	✓			✓
	4	Principles of Control Systems	✓	✓	✓	✓		✓		✓				✓
PROFESSIONAL ELECTIVE III	1	Combustion Thermodynamics and Heat Transfer	✓	✓		✓	✓	✓		✓				✓
	2	Hydraulic and Pneumatic Systems	✓	✓	✓	✓	✓	✓		✓	✓			✓
	3	Special Purpose Vehicles		✓	✓		✓	✓	✓				✓	✓
	4	Vehicle Control Systems	✓	✓	✓	✓	✓	✓		✓				✓
PROFESSIONAL ELECTIVE IV	1	Noise, Vibration and Harshness	✓	✓	✓	✓	✓	✓		✓				✓
	2	Manufacturing of Automotive Components	✓	✓		✓	✓	✓	✓	✓			✓	✓
	3	Non Traditional Machining Techniques	✓	✓	✓	✓	✓		✓				✓	
	4	Road Vehicle Aerodynamics	✓	✓	✓	✓		✓	✓	✓	✓			✓
PROFESSIONAL ELECTIVE V	1	Alternative and Advanced Fuels for IC	✓			✓	✓	✓	✓	✓				✓
	2	Computational Techniques for Fluid Dynamics	✓	✓	✓	✓	✓	✓	✓				✓	
	3	Total Quality Management	✓	✓	✓		✓			✓	✓	✓	✓	✓
	4	New Product Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PROFESSIONAL ELECTIVE VI	1	Advanced Theory of IC Engines	✓	✓	✓		✓	✓	✓	✓				✓
	2	Automotive Materials	✓	✓		✓		✓		✓	✓			✓
	3	Two and Three Wheeler Technology	✓	✓	✓			✓		✓				✓

	4	Vehicle Maintenance	✓	✓	✓		✓	✓	✓	✓				✓
PROFESSIONAL ELECTIVE VII	1	Automotive Instrumentation and Testing	✓		✓		✓	✓	✓				✓	✓
	2	Introduction to Operations research	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
	3	Renewable Sources of Energy	✓	✓	✓			✓	✓	✓			✓	✓
	4	Vehicle Air-Conditioning	✓	✓	✓	✓	✓	✓	✓	✓				✓

ANNA UNIVERSITY, CHENNAI

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B.E. AUTOMOBILE ENGINEERING

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI FOR I - VIII SEMESTERS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5151	Technical English	HSMC	4	0	0	4	4
2.	MA5158	Engineering Mathematics - I	BSC	3	1	0	4	4
3.	PH5151	Engineering Physics	BSC	3	0	0	3	3
4.	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
5.	GE5151	Engineering Graphics	ESC	1	0	4	5	3
PRACTICALS								
6.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
7.	GE5162	Workshop Practices Laboratory	ESC	0	0	4	4	2
			TOTAL	**14**	**1**	**12**	**27**	**21**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5251	Professional Communication	HSMC	4	0	0	4	4
2.	MA5252	Engineering Mathematics -II	BSC	3	1	0	4	4
3.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
4.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	GE5152	Engineering Mechanics	ESC	3	1	0	4	4
6.	PH5251	Materials Science	BSC	3	0	0	3	3
PRACTICALS								
7.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
			TOTAL	**19**	**2**	**8**	**29**	**25**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective – Humanities I	HSMC	3	0	0	3	3
2.	MA5355	Transform Techniques and Partial Differential Equations	BSC	3	1	0	4	4
3.	ME5251	Manufacturing Processes	PCC	3	0	0	3	3
4.	AU5351	Thermodynamics and Thermal Engineering	PCC	3	1	0	4	4
5.	AU5352	Mechanics of Solids	PCC	3	0	0	3	3
6.	AU5301	Automotive Engines	PCC	3	0	0	3	3
PRACTICALS								
7.	AU5361	Mechanical Sciences Laboratory	PCC	0	0	4	4	2
8.	ME5461	Manufacturing Technology Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**2**	**8**	**28**	**24**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective – Humanities II	HSMC	3	0	0	3	3
2.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
3.	AU5401	Automotive Chassis	PCC	4	0	0	4	4
4.	AU5402	Vehicle Body Engineering	PCC	3	0	0	3	3
5.	AU5403	Fluid Mechanics for Automotive applications	PCC	3	0	0	3	3
6.	PR5451	Kinematics and Dynamics of Machines	PCC	3	1	0	4	4
7.		Audit Course – I*	AC	3	0	0	3	0
PRACTICALS								
8.	AU5411	Vehicle Components Laboratory	PCC	0	0	4	4	2
9.	AU5412	Fuels and Lubricants Laboratory	PCC	0	0	4	4	2
			TOTAL	**22**	**1**	**8**	**31**	**24**

*****Audit Course is optional.

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE5552	Engineering Management	HSMC	3	0	0	3	3
2.	AU5501	Engineering Design	PCC	3	0	0	3	3
3.	AU5551	Automotive Electrical and Electronics Systems	PCC	3	0	0	3	3
4.	AU5502	Automotive Transmission	PCC	3	0	0	3	3
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Audit Course – II*	AC	3	0	0	3	0
PRACTICALS								
7.	AU5511	Automotive Electrical and Electronics Laboratory	PCC	0	0	4	4	2
8.	AU5512	Vehicle Testing Laboratory	PCC	0	0	2	2	1
9.	AU5513	Industrial Training/Internship**	EEC	0	0	4	4	2
			TOTAL	**18**	**0**	**10**	**28**	**20**

*****Audit Course is optional.

** The students will undergo industrial training / Internship during previous vacation

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AU5601	Automotive Pollution and Control	PCC	3	0	0	3	3
2.	AU5602	Dynamics of Ground Vehicles	PCC	3	0	0	3	3
3.	AU5651	Electric and Hybrid Vehicles	PCC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Open Elective I	OEC	3	0	0	3	3
PRACTICALS								
7.	AU5611	Engine Testing and Emission Measurement Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**0**	**4**	**22**	**20**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AU5701	Design of Vehicle Components	PCC	3	0	0	3	3
2.	AU5702	IC engine Process Modelling	PCC	3	0	0	3	3
3.		Professional Elective IV	PEC	3	0	0	3	3
4.		Professional Elective V	PEC	3	0	0	3	3
5.		Open Elective II	OEC	3	0	0	3	3
PRACTICALS								
6.	AU5711	Computer Aided Vehicle Components Design Laboratory	PCC	0	0	4	4	2
7.	AU5712	Project I	EEC	0	0	6	6	3
			TOTAL	**15**	**0**	**10**	**25**	**20**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective VI	PEC	3	0	0	3	3
2.		Professional Elective VII	PEC	3	0	0	3	3
PRACTICALS								
3.	AU5811	Project II	EEC	0	0	16	16	8
			TOTAL	**6**	**0**	**16**	**22**	**14**

TOTAL NO. OF CREDITS: 168

HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	HS5151	Technical English	HSMC	4	4	0	0	4
2	HS5251	Professional Communication	HSMC	4	4	0	0	4
3	GE5552	Engineering Management	HSMC	3	3	0	0	3

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5171	Language and Communication	3	0	0	3
2.	HU5172	Values and Ethics	3	0	0	3
3.	HU5173	Human Relations at Work	3	0	0	3
4.	HU5174	Psychological Processes	3	0	0	3
5.	HU5175	Education, Technology and Society	3	0	0	3
6.	HU5176	Philosophy	3	0	0	3
7.	HU5177	Applications of Psychology in Everyday Life	3	0	0	3

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5271	Gender Culture and Development	3	0	0	3
2.	HU5272	Ethics and Holistic Life	3	0	0	3
3.	HU5273	Law and Engineering	3	0	0	3
4.	HU5274	Film Appreciation	3	0	0	3
5.	HU5275	Fundamentals of Language and Linguistics	3	0	0	3
6.	HU5276	Understanding Society and Culture through Literature	3	0	0	3

BASIC SCIENCE COURSES

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	MA5158	Engineering Mathematics – I	BSC	4	3	1	0	4
2	PH5151	Engineering Physics	BSC	3	3	0	0	3
3	CY5151	Engineering Chemistry	BSC	3	3	0	0	3
4	BS5161	Basic Sciences Laboratory	BSC	4	4	0	0	4
5	MA5252	Engineering Mathematics - II	BSC	4	3	1	0	4
6	PH5251	Materials Science	BSC	3				
7	MA5355	Transform Techniques and Partial Differential Equations	BSC	4	3	1	0	4
8	GE5251	Environmental Sciences	BSC	3	3	0	0	3

ENGINEERING SCIENCE COURSES

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	GE5151	Engineering Graphics	ESC	5	1	0	4	3
2	GE5162	Workshop Practices Laboratory	ESC	4	0	0	4	2
3	GE5153	Problem Solving and Python Programming	ESC	3	0	0	4	2
4	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	3	0	0	3
5	GE5152	Engineering Mechanics	ESC	4	3	1	0	4
6	GE5161	Problem Solving and Python Programming Laboratory	ESC	4	0	0	4	2
7	EE5261	Electrical and Electronics Engineering Laboratory	ESC	4	0	0	4	2

PROFESSIONAL CORE COURSES

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	ME5251	Manufacturing Processes	PCC	3	3	0	0	3
2.	AU5351	Thermodynamics and Thermal Engineering	PCC	3	3	1	0	4
3.	AU5352	Mechanics of Solids	PCC	3	3	0	0	3
4.	AU5301	Automotive Engines	PCC					
5.	AU5361	Mechanical Sciences Laboratory	PCC	4	4	0	0	4
6.	ME5461	Manufacturing Technology Laboratory	PCC	4	0	0	4	2
7.	AU5401	Automotive Chassis	PCC	4	4	0	0	4
8.	AU5402	Vehicle Body Engineering	PCC	3	3	0	0	3
9.	AU5403	Fluid Mechanics for Automotive Applications	PCC	3	3	0	0	3
10.	PR5451	Kinematics and Dynamics of Machines	PCC	4	3	1	0	4
11.	AU5411	Vehicle Components Laboratory	PCC	4	0	0	4	2
12.	AU5412	Fuels and Lubricants Laboratory	PCC	4	0	0	4	2
13.	AU5501	Engineering Design	PCC	3	3	0	0	3
14.	AU5551	Automotive Electrical and Electronics Systems	PCC	3	3	0	0	3
15.	AU5502	Automotive Transmission	PCC	3	3	0	0	3
16.	AU5511	Automotive Electrical and Electronics Laboratory	PCC	4	0	0	4	2
17.	AU5512	Vehicle Testing Laboratory	PCC	4	0	0	4	2
18.	AU5601	Automotive Pollution and Control	PCC	3	3	0	0	3
19.	AU5602	Dynamics of Ground Vehicles	PCC	3	3	0	0	3
20.	AU5651	Electric and Hybrid Vehicles	PCC	3	3	0	0	3
21.	AU5611	Engine Testing and Emission Measurement Laboratory	PCC	4	0	0	0	2
22.	AU5701	Design of Vehicle Components	PCC	3	3	0	0	3
23.	AU5702	IC Engine Process Modelling	PCC	3	3	0	0	3
24.	AU5711	Computer Aided Vehicle Components Design Laboratory	PCC	4	0	0	4	2

PROFESSIONAL ELECTIVES COURSES
SEMESTER V, ELECTIVE – I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AU5001	Engine Management Systems	PEC	3	0	0	3	3
2.	AU5002	Measurement System	PEC	3	0	0	3	3
3.	AU5003	Theory of Fuels and Lubricants	PEC	3	0	0	3	3
4.	AU5004	Transport Management	PEC	3	0	0	3	3

SEMESTER VI, ELECTIVE – II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AU5005	Automotive Safety	PEC	3	0	0	3	3
2.	ME5075	Entrepreneurship Development	PEC	3	0	0	3	3
3.	AU5006	Finite Element Techniques	PEC	3	0	0	3	3
4.	AU5007	Principles of Control Systems	PEC	3	0	0	3	3

SEMESTER VI, ELECTIVE – III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AU5008	Combustion Thermodynamics and Heat Transfer	PEC	3	0	0	3	3
2.	AU5009	Hydraulic and Pneumatic Systems	PEC	3	0	0	3	3
3.	AU5010	Special Purpose Vehicles	PEC	3	0	0	3	3
4.	AU5072	Vehicle Control Systems	PEC	3	0	0	3	3

SEMESTER VII, ELECTIVE – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AU5011	Noise, Vibration and Harshness	PEC	3	0	0	3	3
2.	AU5012	Manufacturing of Automotive Components	PEC	3	0	0	3	3
3.	AU5013	Non Traditional Machining Techniques	PEC	3	0	0	3	3
4.	AU5014	Road Vehicle Aerodynamics	PEC	3	0	0	3	3

SEMESTER VII, ELECTIVE – V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AU5015	Alternative and Advanced Fuels for IC engines.	PEC	3	0	0	3	3
2.	ME5072	Computational Techniques for Fluid Dynamics	PEC	3	0	0	3	3
3.	GE5451	Total Quality Management	PEC	3	0	0	3	3
4.	AU5016	New Product Development	PEC	3	0	0	3	3

SEMESTER VIII, ELECTIVE – VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AU5017	Advanced Theory of IC Engines	PEC	3	0	0	3	3
2.	AU5018	Automotive Materials	PEC	3	0	0	3	3
3.	AU5019	Two and Three Wheeler Technology	PEC	3	0	0	3	3
4.	AU5020	Vehicle Maintenance	PEC	3	0	0	3	3

SEMESTER VIII, ELECTIVE – VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AU5071	Automotive Instrumentation and Testing	PEC	3	0	0	3	3
2.	AU5021	Introduction to Operations Research	PEC	3	0	0	3	3
3.	AU5022	Renewable Sources of Energy	PEC	3	0	0	3	3
4.	AU5023	Vehicle Air-Conditioning	PEC	3	0	0	3	3

EMPLOYABILITY ENHANCEMENT COURSES

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	Periods Per week			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	AU5513	Industrial Training/Internship*	EEC	0	0	4	4	2
2	AU5712	Project I	EEC	0	0	6	6	3
3	AU5811	Project II	EEC	0	0	16	16	8

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

Sl. No	Course	Course Title	Periods per week			Total Contact Periods	Credits
			L	T	P		
1.	AD5091	Constitution of India	3	0	0	3	0
2.	AD5092	Value Education	3	0	0	3	0
3.	AD5093	Pedagogy Studies	3	0	0	3	0
4.	AD5094	Stress Management by Yoga	3	0	0	3	0
5.	AD5095	Personality Development Through Life Enlightenment Skills	3	0	0	3	0
6.	AD5096	Unnat Bharat Abhiyan	3	0	0	3	0
7.	AD5097	Essence of Indian Knowledge Tradition	3	0	0	3	0
8.	AD5098	Sanga Tamil Literature Appreciation	3	0	0	3	0

SUMMARY

SL. NO.	SUBJECT AREA	CREDIT AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	4	4	3	3	3	0	0	0	17
2	BSC	12	7	4	3	0	0	0	0	26
3	ESC	5	14	0	0	0	0	0	0	19
4	PCC	0	0	17	18	12	11	8	0	66
5	PEC	0	0	0	0	3	6	6	6	21
6	OEC	0	0	0	0	0	3	3	0	6
7	EEC	0	0	0	0	2	0	3	8	13
8	AC	0	0	0	0	0	0	0	0	0
	TOTAL	**21**	**25**	**24**	**24**	**20**	**20**	**20**	**14**	**168**

HS5151 TECHNICAL ENGLISH L T P C
4 0 0 4

COURSE OBJECTIVES:

The first semester English course entitled 'Technical English' aims to,

- Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I INTRODUCING ONESELF 12

Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – **Speaking**: Introducing oneself – introducing friend/ family - **Reading:** Descriptive passages (from newspapers / magazines)- **Writing**: Writing a paragraph (native place, school life)- **Grammar:** Simple present, present continuous – **Vocabulary Development**: One word substitution

UNIT II DIALOGUE WRITING 12

Listening: Listening to conversations (asking for and giving directions) –**Speaking:** making conversation using (asking for directions, making an enquiry), Role plays-dialogues- **Reading:** Reading a print interview and answering comprehension questions-**Writing**: Writing a checklist, Dialogue writing- **Grammar**: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions)- **Vocabulary Development**: Stress shift, lexical items related to the theme of the given unit.

UNIT III FORMAL LETTER WRITING 12

Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions)-**Speaking:** Giving short talks on a given topic-**Reading:** Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions)- **Writing:** Writing formal letters/ emails (Complaint letters)-**Grammar**: Future Tense forms of verbs, subject and verb agreement-**Vocabulary Development**: Collocations – Fixed expressions

UNIT IV WRITING COMPLAINT LETTERS 12

Listening: Listening to short talks (5 minutes duration and fill a table, gap-filling exercise) note taking/note making- **Speaking:** Small group discussion, giving recommendations-**Reading:** Reading problem – solution articles/essays drawn from various sources- **Writing:** Making recommendations – Writing a letter/ sending an email to the Editor- note making- **Grammar:** Modals – Phrasal verbs – cause and effect sentences- **Vocabulary Development**: Connectives, use of cohesive devices in writing, technical vocabulary.

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 12

Listening: Listening to a product description (labeling and gap filling) exercises- **Speaking:** Describing a product and comparing and contrasting it with other products- **Reading**: Reading graphical material for comparison (advertisements)-**Writing:** Writing Definitions (short and long) – compare and contrast paragraphs- **Grammar:** Adjectives – Degrees of comparison - compound nouns- **Vocabulary Development**: Use of discourse markers – suffixes (adjectival endings).

TOTAL : 60 PERIODS

LEARNING OUTCOMES

At the end of the course the students will have gained,

- Exposure to basic aspects of technical English.
- The confidence to communicate effectively I various academic situations.
- Learnt the use of basic features of Technical English.

TEXT BOOK:

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

ASSESSMENT PATTERN

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5158	ENGINEERING MATHEMATI CS – I	L	T	P	C
	(Common to all branches of B.E. / B.Tech. Programmes in I Semester)	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit of function – One sided limit – Limit Laws – Continuity – left and right continuity – types of discontinuities – Intermediate Value Theorem – Derivatives of a function - Differentiation rules – Chain rule – Implicit differentiation – logarithmic differentiation – Maxima and minima – Mean value theorem – (Optional: Polar coordinate system – Differentiation in polar coordinates).

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT V MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL :60 PERIODS

COURSE OUTCOMES:

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

- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools n solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.
2. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, 6th Edition, New Delhi,2013.
3. Joel Hass, Christopher Heil and Maurice D.Weir, "Thomas' Calculus", Pearson, 14th Edition, New Delhi, 2018.
4. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education2nd Edition, 5th Reprint, Delhi, 2009.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics",Narosa Publications, 5th Edition, New Delhi, 2017.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
6. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

PH5151 ENGINEERING PHYSICS L T P C

(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

COURSE OBJECTIVES:

- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS 9

Moment of inertia (M.I) - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder , hollow cylinder , solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum - Torsional pendulum.

UNIT II ELECTROMAGNETIC WAVES 9

Gauss's law – Faraday's law - Ampere's law - The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic

waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect - reflection and refraction of light waves - total internal reflection - interference - interferometers - air wedge experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser - applications.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should able to

- Understanding the importance of mechanics.
- Express the knowledge of electromagnetic waves.
- Know the basics of oscillations, optics and lasers.
- Understanding the importance of quantum physics.
- Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education, 2017.
2. D.Halliday, R.Resnick and J.Walker. Principles of Physics. John Wiley & Sons, 2015.
3. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

REFERENCES

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson, 2016.
2. D.J.Griffiths. Introduction to Electrodynamics. Pearson Education, 2015
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications. Springer, 2012.

CY5151 ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES) L T P C 3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Structure, Properties and uses of: PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting polymers – polyaniline and polypyrrole.

UNIT II NANOCHEMISTRY 9

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties. Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Properties (optical, electrical, mechanical and magnetic) and Applications of nanomaterials - medicine, agriculture, electronics and catalysis.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law (derivation and problems). Photo physical processes – Jablonski diagram. Chemiluminescence, photo-sensitization and photoquenching – mechanism and examples. Spectroscopy: Electromagnetic spectrum - absorption of radiation - electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Atomic absorption spectroscopy, UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV ENERGY CONVERSIONS AND STORAGE 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H_2-O_2 and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY 9

Water – sources and impurities – water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD and BOD. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - zeolite (permutit) and ion exchange demineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
- To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

1. Jain P. C. & Monica Jain., "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. S.S.Dara, "A text book of Engineering Chemistry", Chand Publications, 2014.

REFERENCES:

1. Schdeva M V, "Basics of Nano Chemistry", Anmol Publications Pvt Ltd
2. B.Sivasankar, "Instrumental Methods of Analysis", Oxford University Press. 2012.
3. Friedrich Emich, "Engineering Chemistry", Scientific International Ltd.
4. V RGowariker, N V Viswanathan and Jayadev Sreedhar, "Polymer Science" New AGE International Publishers, 2009.

GE5151 ENGINEERING GRAPHICS L T P C
1 0 4 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HANDSKETCHING 14

Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 15

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

UNIT III PROJECTION OF SOLIDS 15

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

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 15

Sectioning of solids in simple vertical position when the cutting plane is inclined to the 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 cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3

Introduction to drafting packages and demonstration of their use

TOTAL (L: 15 + P: 60)=75 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

1. Bhatt, N. D.,Panchal V M and Pramod R. Ingle, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Agrawal, B. and Agrawal C.M., “Engineering Drawing”, Tata McGraw, N.Delhi, 2008.
2. Gopalakrishna, K. R., “Engineering Drawing”, Subhas Stores, Bangalore, 2007.
3. Natarajan, K. V., “A text book of Engineering Graphics”, 28th Ed., Dhanalakshmi Publishers, Chennai, 2015.
4. Shah, M. B., and Rana, B. C., “Engineering Drawing”, Pearson, 2nd Ed., 2009.
5. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age,2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9				0.9					0.6		0.6	0.6	0.9	0.6
2	0.9									0.6		0.6	0.6	0.6	
3	0.9				0.9					0.6		0.6	0.6	0.6	
4	0.9		0.6		0.9					0.6		0.6	0.6	0.6	
5	0.9		0.9		0.9					0.6		0.6	0.6	0.6	

BS5161 **BASIC SCIENCES LABORATORY** **L T P C**
(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS:

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of Young's modulus
3. Uniform bending – Determination of Young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
12. Spectrometer- Determination of wavelength using gating.
13. Photoelectric effect
14. Michelson Interferometer.
15. Estimation of laser parameters.
16. Melde's string experiment

TOTAL: 30 PERIODS

OUTCOME

Upon completion of the course, the students will be able

- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.

6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Phase change in a solid.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To determine the molecular weight of polymers by viscometric method.
- To quantitatively analyse the impurities in solution by electroanalytical techniques
- To design and analyse the kinetics of reactions and corrosion of metals

TEXT BOOKS:

1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

GE5162 WORKSHOP PRACTICES LABORATORY L T P C
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

WIRING WORK:

a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
b) Wiring Stair case light.
c) Wiring tube – light.
d) Preparing wiring diagrams for a given situation.

Wiring Study:

a) Studying an Iron-Box wiring.
b) Studying a Fan Regulator wiring.
c) Studying an Emergency Lamp wiring.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Studying a FM radio.
b) Studying an electronic telephone.

TOTAL = 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.6	0.3											0.3	0.3	
2		0.6	0.6											0.6	
3		0.6	0.3										0.6	0.6	
4		0.6	0.6	0.3										0.6	

HS5251 PROFESSIONAL COMMUNICATION L T P C
4 0 0 4

COURSE OBJECTIVES

The course entitles 'Professional Communication' aims to,

- Improve the relevant language skills necessary for professional communication.
- Develop linguistic and strategic competence in workplace context.
- Enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I TECHNICAL COMMUNICATION 12

Listening: Listening to telephone conversations (intent of the speaker and note taking exercises)- Speaking: Role play exercises based on workplace contexts, introducing oneself- Reading: Reading the interview of an achiever and completing exercises (skimming, scanning and predicting)- Writing: Writing a short biography of an achiever based on given hints- Grammar: Asking and answering questions, punctuation in writing, prepositional phrases- Vocabulary Development: use of adjectives.

UNIT II SUMMARY WRITING 12

Listening: Listening to talks/lectures both general and technical and summarizing the main points- Speaking: Participating in debates- Reading: Reading technical essays/ articles and answering comprehension questions-Writing: Summary writing-Grammar: Participle forms, relative clauses- Vocabulary Development: Use of compound words, abbreviations and acronyms.

UNIT III PROCESS DESCRIPTION 12

Listening: Listening to a process description and drawing a flowchart-Speaking: Participating in Group Discussions, giving instructions- Reading: Reading instruction manuals- Writing: Writing process descriptions- Writing instructions- Grammar: Use of imperatives, active and passive voice, sequence words- Vocabulary Development: Technical jargon

UNIT IV REPORT WRITING 12

Listening: Listening to a presentation and completing gap-filling exercises- Speaking: Making formal presentations- Reading: Reading and interpreting charts/tables and diagrams- Writing: Interpreting charts/tables and diagrams, writing a report- Grammar: Direct into indirect speech, use of phrases- Vocabulary Development: reporting words

UNIT V WRITING JOB APPLICATIONS 12

Listening: Listening to a job interview and completing gap=filling exercises- Speaking: Mock interview, telephone interviews- Reading: Reading a job interview, SOP, company profile and completing comprehension exercises- Writing: job applications and resumes and SOPs-Grammar: Present perfect and continuous tenses- Vocabulary Development: Technical vocabulary.

TOTAL : 45 PERIODS

LEARNING OUTCOMES

At the end of the second semester the learners should be able to,

- Read and comprehend technical texts effortlessly.
- Write reports of a technical kind.
- Speak with confidence in interviews and thereby gain employability

TEXT BOOK

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

ASSESSMENT PATTERN

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5252	ENGINEERING MATHEMATICS – II (Common to all branches of B.E. / B.Tech. Programmes in II Semester)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem, Stoke's theorem and Gauss divergence theorem – Verification and application in evaluating line, surface and volume integrals.

UNIT II ANALYTIC FUNCTION 12

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation $w = c + z,\ az,\ 1/z,\ z^2$.

UNIT III COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT IV DIFFERENTIAL EQUATIONS 12

Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorems – Inverse Transforms – Convolution Theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- Construct analytic functions and use their conformal mapping property in application problems.
- Evaluate real and complex integrals using the Cauchy's integral formula and residue theorem.
- Apply various methods of solving differential equation which arise in many application problems.
- Apply Laplace transform methods for solving linear differential equations.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
5. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudocodes and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements.

SUGGESTED ACTIVITIES:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

SUGGESTED EVALUATION METHODS:

- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II CONDITIONALS AND FUNCTIONS 9

Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

SUGGESTED ACTIVITIES:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Group discussion on external learning.

UNIT III SIMPLE DATA STRUCTURES IN PYTHON 10

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets.

SUGGESTED ACTIVITIES:

- Implementing python program using lists, tuples, sets for the following scenario:
  - Simple sorting techniques
  - Student Examination Report
  - Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV STRINGS, DICTIONARIES, MODULES 10

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary – Modules – Module Loading and Execution – Packages – Python Standard Libraries.

SUGGESTED ACTIVITIES:

- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student's choice) and importing into the application.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING 7

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

SUGGESTED ACTIVITIES:

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

TEXT BOOKS:

1. Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press, 2017.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/).

REFERENCES:

1. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2012.

EE5251	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING 9

Electrical circuit elements (R, L and C)-Dependent and independent sources – Ohm's Law-Kirchhoff's laws - mesh current and node voltage methods (Analysis with only independent source) - Phasors – RMS-Average values-sinusoidal steady state response of simple RLC circuits. Types of wiring- Domestic wiring - Specification of Wires-Earthing-Methods-Protective devices.

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS 9

Three phase supply – Star connection – Delta connection –Balanced and Unbalanced Loads-Power in three-phase systems – Comparison of star and delta connections – Advantages-Magnetic circuits-Definitions-MMF, Flux, Reluctance, Magnetic field intensity, Flux density, Fringing, self and mutual inductances-simple problems.

UNIT III ELECTRICAL MACHINES 9

Working principle of DC generator, motor-EMF and Torque equation-Types –Shunt, Series and Compound-Applications. Working principle of transformer-EMF equation-Operating principles of three phase and single phase induction motor-Applications. Working principles of alternator-EMF equation-Operating principles of Synchronous motor, stepper motor-Applications.

UNIT IV BASICS OF ELECTRONICS 9

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES 9

Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- To be able to understand the concepts related with electrical and magnetic circuits.
- Capable of understanding the operating principle of AC and DC machines.
- To be able to understand the working principle of electron devices and the operation of digital circuits.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014
2. Del Toro, "Electrical Engineering Fundamentals", Second edition, Pearson Education, New Delhi, 1989.
3. John Bird, "Electrical Circuit theory and technology", Routledge; 5th edition, 2013

REFERENCES:

1. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017
3 Kothari DP and I.J Nagrath, "Basic Electrical Engineering", McGraw Hill, 2010.
4 Muhammad H.Rashid, "Spice for Circuits and electronics", 4th ed., Cengage India, 2019.

GE5152 ENGINEERING MECHANICS L T P C
3 1 0 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I STATICS OF PARTICLES (9+3)

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNITII EQUILIBRIUM OF RIGID BODIES (9+3)

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES (9+3)

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration

UNIT IV FRICTION (9+3)

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance, Ladder friction.

UNITV DYNAMICS OF PARTICLES (9+3)

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force , Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

TOTAL (L: 45 + T: 15)=60 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11thEdition, 2017.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCES:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9	0.6	0.6	0.3								0.6	0.9	0.3	0.3
2	0.9	0.6	0.6	0.3								0.6	0.9	0.3	0.3
3	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6
4	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6
5	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6

PH5251 MATERIALS SCIENCE L T P C

(Common to Mechanical, Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering & Rubber and Plastics Technology) **3 0 0 3**

COURSE OBJECTIVES:

- To make the students to understand the basics of crystallography and crystal imperfections.
- To introduce various strengthening methods of materials, and also various mechanical properties and their measurement.
- To impart knowledge on the basics of phase diagrams and their applications.
- To learn about iron-carbon system, and about various ferrous and non-ferrous alloys.
- To introduce the preparation, properties and applications of ceramics, composites and nanomaterials.

UNIT I CRYSTALLOGRAPHY 9

Crystallographic directions and planes – metallic crystal structures: BCC, FCC and HCP – linear and planar densities – crystal imperfections- edge and screw dislocations, Burgers vector and elastic strain energy- surface imperfections – grain and twin boundaries – Polymorphism – phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.

UNIT II MECHANICAL PROPERTIES 9

Tensile test - plastic deformation by slip – slip systems – mechanisms of strengthening in metals: strain hardening, grain size reduction, solid solution strengthening, precipitation hardening – Creep: creep curves, stress and temperature effects, mechanisms of creep, creep-resistant materials – Fracture: ductile and brittle fractures - the Griffith criterion – fracture toughness - Fatigue failure: the S-N curve – factors that affect fatigue life – Hardness: Rockwell and Brinell hardness tests, Knoop and Vickers microhardness tests.

UNIT III PHASE DIAGRAMS 9

Basic concepts - Gibbs phase rule – Unary phase diagram (iron) - Binary phase diagrams: isomorphous systems (Cu-Ni) – determination of phase composition and phase amounts – tie line and lever rule - binary eutectic diagram with no solid solution and limited solid solution (Pb-Sn) – eutectoid and peritectic reactions - other invariant reactions – micro structural development during the slow cooling: eutectic, hypereutectic and hypoeutectic compositions.

UNIT IV FERROUS AND NONFERROUS ALLOYS 9

The Fe-Fe_3C phase diagram: phases, invariant reactions, development of microstructure in eutectoid, hypoeutectoid and hypereutectoid alloys – influence of other alloying elements in the Fe-C system - phase transformations – isothermal transformation diagram for eutectoid iron-carbon alloy – microstructures: pearlite, bainite, spheroidite and martensite – steels, stainless steels and cast irons – copper alloys – aluminum alloys – titanium alloys.

UNIT V CERAMICS, COMPOSITES AND NANO MATERIALS 9

Ceramics – types and applications- refractories, abrasives and cements – Composites: classification, role of matrix and reinforcement - Fiber reinforced composites – carbon-carbon composites – Nanomaterials: types, physical, chemical and mechanical properties - carbon nanotubes: properties and applications - synthesis of nanomaterials: sonochemical, molecular epitaxy, physical vapor deposition (PVD) and chemical vapor deposition (CVD). Characterization: Transmission electron microscopy - scanning electron microscopy - Atomic force microscopy - X-ray powder diffraction - Nanoparticle size calculation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will

- Understand the basics of crystallography and its importance in materials properties
- Understand the significance of dislocations, strengthening mechanisms, and tensile, creep, hardness and fracture behavior of materials
- Gain knowledge on binary phase diagrams, and also will be able to determine the phase composition and phase amount.
- Understand about the Fe-C system and various microstructures in it, and also about various ferrous and non-ferrous alloys.
- Get adequate understanding on the preparation, properties and applications of ceramics, composites and nanomaterials.

REFERENCES

1. W.D.Callitser and D.G.Rethwish. Materials Science and Engineering. John Wiley & Sons, 2014.
2. V.Raghavan. Materials Science and Engineering: A First Course. PHI Learning, 2015.
3. M.F.Ashby, P.J.Ferreira and D.L.Schodek. Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers, 2011.
4. J.F.Shackelford. Introduction to Materials Science for Engineers. Pearson, 2015.
5. D.R. Askeland and W.J.Wright. Essentials of Materials Science and Engineering, Cengage Learning, 2013.
6. W.F.Smith, J.Hashemi and R.Prakash. Materials Science and Engineering. McGraw Hill Education, 2017.

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries.

9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

1. To impart hands on experience in verification of circuit laws and measurement of circuit parameters
2. To train the students in performing various tests on electrical motors.
3. It also gives practical exposure to the usage of CRO, power sources & function generators

LIST OF EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
4. Measurement power in three phase circuits by two-watt meter method.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
8. Characteristics of PN diode and Zener diode
9. Characteristics of Zener diode
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

TOTAL: 60 PERIODS

COURSE OUTCOMES:

1. To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
2. Ability to perform speed characteristic of different electrical machines
3. Ability to use logic gates and Flip flops

MA5355 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS **L T P C 3 1 0 4**

COURSE OBJECTIVES:

- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- To introduce Fourier series analysis which is central to many applications in engineering :
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange's Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

At the end of the course, students will be able to

- Solve partial differential equations which arise in application problems.
- Analyze the functions as an infinite series involving sine and cosine functions.
- Obtain the solutions of the partial differential equations using Fourier series.
- Obtain Fourier transforms for the functions which are needed for solving application problems.
- Manipulate discrete data sequences using Z transform techniques.

TEXT BOOKS:

1. Erwin kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
4. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, 11th Reprint, New Delhi, 2010.

ME5251 MANUFACTURING PROCESSES L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the working principles of various metal casting processes.
2. Applying the working principles of various metal joining processes.
3. Analyzing the working principles of bulk deformation of metals.
4. Applying the working principles of sheet metal forming process.
5. Applying the working principles of plastics molding.

UNIT I METAL CASTING PROCESSES 9

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Molding sand Properties and testing – Cores –Types and applications – Molding machines – Types and applications– Melting furnaces – Principle of special casting processes- Shell, investment – Ceramic mould – Pressure die casting – Centrifugal Casting - CO casting - Defects in Sand casting process – Stir casting - Defects in Sand casting.

UNIT II METAL JOINING PROCESSES 9

Fusion welding processes – Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding, Electrodes, Coating and specifications – Principles and types of Resistance welding – Gas metal arc welding – Submerged arc welding – Electro slag welding – Gas Tungsten arc welding – Principle and application of special welding processes – Plasma arc welding – Thermit Welding – Electron beam welding – Friction welding – Friction stir welding – Diffusion welding – Weld defects – Brazing and soldering – methods and process capabilities – Adhesive bonding, Types and application

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the processes – Typical forging operations – rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes - Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning – Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming – Incremental forming.

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Molding of thermoplastics – working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – introduction to blow molding – Rotational molding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply the working principles of various metal casting processes.
2. Apply the working principles of various metal joining processes.
3. Analyze the working principles of bulk deformation of metals.
4. Apply the working principles of sheet metal forming process.
5. Apply the working principles of plastics molding.

TEXT BOOKS:

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006.
2. Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.

REFERENCES:

3. Gowri.S, P. Hariharan, A.SureshBabu, Manufacturing Technology I, Pearson Education, 2008.
4. HajraChouldhary S.K. and Hajra Choudhury. A. K., Elements of Workshop Technology, Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
5. Paul Degarma E., Black J.T. and Ronald A. Kosher, Materials and Processes, in Manufacturing, Eight Edition,Prentice Hall of India, 1997.
6. Rao. P. N., Manufacturing Technology Foundry, Forming and Welding, 2nd Ed.Tata McGraw Hill, 2003.
7. Sharma, P.C., A Textbook of Production Technology, S.Chand and Co. Ltd., 2004.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9						0.6					0.3	0.6	0.3	0.3
2	0.9						0.6					0.3	0.6	0.3	0.3
3	0.9						0.6					0.3	0.6	0.3	0.3
4	0.9						0.6					0.3	0.6	0.3	0.3
5	0.9						0.6					0.3	0.6	0.3	0.3

AU5351 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
3 1 0 4

COURSE OBJECTIVES:

i. To impart knowledge of basic principles of thermodynamics via real world engineering examples
ii. To analyse and evaluate cardinal air standard cycles
iii. To analyse and evaluate cardinal Steam power cycles
iv. Summarize the governing concepts of Refrigeration and Air conditioning
v. To introduce various modes of heat transfer, related to real time scenarios of thermodynamics applied in engineering practice

UNIT I BASIC THERMODYNAMICS 12

Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth low, First law. Steady flow energy equation. Engineering Applications of Steady flow energy equation Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Availability and Un Availability. Properties of gases and vapours

UNIT II AIR STANDARD CYCLES AND COMPRESSORS 12

Cycle, Carnot cycle, Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Comparison of cycles, Efficiency versus compression ratio, For the same compression ratio and the same heat input Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION 12

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface

Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 12

Principles of refrigeration, Vapour compression – Types of VCR system with respect to condition of vapour, Problems, Vapour absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V HEAT AND MASS TRANSFER 12

Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Heat conduction through hollow and composite cylinders, spheres. Basics of Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat- exchangers, Logarithmic Mean Temperature Difference (LMTD) for parallel flow and Arithmetic Mean Temperature Difference (AMTD) counter flow heat exchangers.

TOTAL: 45 PERIODS

(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)

COURSE OUTCOMES:

i. Will demonstrate understanding of the nature of the thermodynamic processes for pure substances of ideal gases
ii. Will interpret First Law of Thermodynamics and its application to systems and control volumes
iii. Will solve any flow specific problem in an engineering approach based on basic concepts and logic sequences.
iv. Will compare and contrast between various types of refrigeration cycles
v. Will get exposed to the basics and modes of heat transfer

TEXT BOOKS:

1. Chattopadhyay. P Engineering Thermodynamics", oxford University Press, New Delhi, 2010.
2. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
3. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics" Prentice-Hall India, 2005.

REFERENCES:

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Mathur& Sharma Steam Tables, Jain Publishers, New Delhi.
4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006

AU5352 **MECHANICS OF SOLIDS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The objective of this course is

1. To know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
2. To apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force deformation, and stress-strain relationships to the solid and structural mechanics problems
3. To analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
4. To have physical insight into distribution of stresses and strains in structural members
5. To identify the biaxial stresses in acting in a body or an element.

UNIT I STRESS - STRAIN, AXIAL LOADING 9

Stress and strain, elastic limit, Hooke's law, factor of safety, shear stress, shear strain, relationship between elastic constants. Stresses in stepped bars, uniformly varying sections, composite bars due to axial force. Lateral strain, Poisson's ratio, volumetric strain, changes in dimensions and volume. Thermal stresses and impact loading.

UNIT II STRESSES IN BEAMS 9

Beam – Definition, types of end supports, types of beam, types of loading. Shear force diagram and bending moment diagram for cantilever, simply supported and overhanging beams under point load, UDL, UVL and moments. Euler beam theory - Bending equation, section modulus, Bending stress in beams – Shear stress in beams.

UNIT III DEFLECTION OF BEAMS AND COLUMNS 9

Governing differential equation - Problems on Double integration method - Macaulay's Method – Moment area method. Concepts of Conjugate Beam method and Method of superposition. Columns – different end conditions – buckling load – Euler's theory – Rankine's formula.

UNIT IV TORSION AND SPRINGS 9

Theory of torsion and assumptions - torsion equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft, shafts in series and parallel, deflection in shafts fixed at the both ends. Springs – types, Deflection expression for closed coiled helical spring – Stress in springs - design of springs.

UNIT V BIAXIAL STRESS 9

Principal stresses, normal and tangential stresses, maximum shear stress - analytical and graphical method. Stresses in combined loading. Thin walled cylinder under internal pressure – changes in dimensions – volume. spherical shells subjected to internal pressure – deformation in spherical shells – Lame's theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students are expected to

i. Know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
ii. Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force-deformation, and stress-strain relationships to the solid and structural mechanics problems
iii. Analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
iv. Have physical insight into distribution of stresses and strains in structural members
v. Identify the biaxial stresses in acting in a body or an element.

TEXT BOOKS:

1. James M Gere, Barry J Goodno, "Mechanics of Materials, SI Edition", Ninth Edition, Cengage Learning, 2018
2. Russell C. Hibbeler, "Mechanics of Materials", Tenth Edition, Pearson education, 2017
3. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, 3rd edition, 2004.

REFERENCES:

1. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer publishers, 2013
2. Roy R Craig, "Mechanics of Materials", Third Edition, John Wiley & Sons, 2011
3. R.K.Rajput, 'Strength of Materials', S Chand; 4th Rev. Edition 2007.
4. Timothy A. Philpot, "Mechanics of Materials: An Integrated Learning System," 3rd Edition, Wiley, 2012.
5. William A. Nash, Merle C. Potter, "Schaum's Outline of Strength of Materials", 6th Edition, McGraw Hill Education, 2014

AU5301 AUTOMOTIVE ENGINES L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To impart knowledge on basics of automotive SI and CI engines consisting of types, construction, working
ii. To Understand the actual engine working principle and its thermochemistry of fuel-air mixtures
iii. To learn the properties of gasoline and diesel fuel and combustion process involved in diesel engines
iv. To solve basic design problems of various operating parameters of the engine
v. To analyze the performance and pollution characteristics of SAI and CI engine and learn modern developments in IC engine

UNIT I ENGINE FUNDAMENTALS 9

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

UNIT II INDUCTION AND IGNITION SYSTEM 9

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

UNIT III FUEL PROPERTIES AND COMBUSTION OF FUELS 9

Hydrocarbon fuels- Gasoline and Diesel fuel properties. Ignition quality. Octane and cetane number. Laboratory tests for diesel fuel. Combustion stoichiometry - Combustion reactions-

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

UNIT IV ENGINE COOLING, LUBRICATING SYSTEMS AND SUPERCHARGING, TURBOCHARGING 9

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

UNIT V ENGINE HEAT TRANSFER, TESTING AND RECENT DEVELOPMENTS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, Student can able to,

i. Define engine glossaries, identify various components of SI and CI engines and its sub-systems Ignition, cooling and lubrication
ii. Understand the actual engine working principle and its thermochemistry of fuel-air mixtures
iii. Understand basic knowledge on SI and CI engine combustion and its related parameters
iv. Student can able to apply their knowledge in analyzing the engine performance and pollution characteristics.
v. Exposed to gain knowledge on recent developments of prime sources

TEXT BOOKS

1. John B.Heywood , " Internal Combustion Engines" , McGraw-Hill Book Company, ISBN No: 0-07-100499-8
2. M.L. Mathur and R.P.Sharma, Internal Combustion Engine, Dhanpath Rai Publications (P) Ltd, New Delhi 110002
3. V. Ganesan, Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 2010.

REFERENCES

1. Heinz Hesiler, Advanced engine technology. Butterworth Heinmann publications
2. Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta,
3. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
4. Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
5. Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co.,Scranton, Pennsylvania, 1988.

AU5361 MECHANICAL SCIENCES LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES

i. To Understand the Various physical characterization and mechanical properties of materials.
ii. To Examine the Various testing methods of mechanical properties.
iii. To Evaluate the Basics of internal combustion engine and its performance characteristics.
iv. To Measure the Performance characteristics of pumps.
v. To Evaluate the flash and fire point of various fuels which may be used as an alternative fuel in IC engine.

LIST OF EXPERIMENTS

1. Tension Test
2. Torsion Test
3. Testing of springs
4. Impact test i) Izod, ii) Charpy
5. Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
6. Deflection of Beams
7. Performance test on a 4 stroke diesel engine
8. Mass Moment of inertia of connecting rods
9. Valve timing of a 4 stroke engine
10. Port timing of a 2 stroke engine.
11. Determination of kinematic and dynamic viscosity of given oil blend
12. Determination of flash point and fire point of given fuel sample

TOTAL: 60 PERIODS

COURSE OUTCOMES

i. Students can able to perceive,
ii. Understand the Various physical characterization and mechanical properties of materials.
iii. Examine the Various testing methods of mechanical properties.
iv. Evaluate the Basics of internal combustion engine and its performance characteristics.
v. Measure the Performance characteristics of pumps.
vi. Evaluate the flash and fire point of various fuels which may be used as an alternative fuel in IC engine.

ME5461 MANUFACTURING TECHNOLOGY LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Selecting appropriate tools, equipments and machines to complete a given job.
2. Performing various welding process using GMAW.
3. Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling.
4. Fabricating gears using gear making machines.
5. Analyzing the defects in the cast and machined components. .

LIST OF EXPERIMENTS

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.

3. Casting aluminum parts using stir casting machine.
4. Reducing the thickness of the plates using rolling machine.
5. Reducing the diameter of on circular parts using wire drawing process machine.
6. Taper Turning and Eccentric Turning on circular parts using lathe machine.
7. Knurling, external and internal thread cutting on circular parts using lathe machine.
8. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
9. Drilling and Reaming using vertical drilling machine.
10. Milling contours on plates using vertical milling machine.
11. Cutting spur and helical gear using milling machine.
12. Generating gears using gear hobbing machine.
13. Generating gears using gear shaping machine.
14. Grinding components using cylindrical, surface and centerless grinding machine.
15. Broaching components using broaching machine.

TOTAL = 60 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Select appropriate tools, equipments and machines to complete a given job.
2. Perform various welding process using GMAW.
3. Perform various machining process such as rolling, drawing, turning, shaping, drilling, milling.
4. Fabricate gears using gear making machines.
5. Analyze the defects in the cast and machined components.

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9						0.3					0.3	0.3	0.6	0.6
2	0.9						0.3					0.3	0.3	0.6	0.6
3	0.9						0.3					0.3	0.3	0.6	0.6
4	0.9						0.3					0.3	0.3	0.6	0.6
5	0.9						0.3					0.3	0..3	0.6	0.6

GE5251 ENVIRONMENTAL SCIENCES L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and 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 – food chains, food webs and ecological pyramids – 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 – bio geographical 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. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

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 over-utilization of surface and ground water, floods, drought, conflicts over 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. case studies – Land resources: Land as a resource, land 47 degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.

- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
- To demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers (2018).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2016).
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005).
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

AU5401	**AUTOMOTIVE CHASSIS**	**L T P C**
		3 1 0 4

COURSE OBJECTIVES:

i. To understand the basic knowledge about various vehicle frames, front axles, steering systems and understand the conditions for true rolling motion of wheels during steering.
ii. To recognize the construction and working principle of drive line, final drive and differential systems
iii. To review the knowledge about the constructional feature of rear axle, wheels and tyres.
iv. To evaluate the working principles of both conventional and independent suspension system.
v. To demonstrate working principle of braking system used in automobile.

UNIT I INTRODUCTION, FRAME, STEERING SYSTEM 12

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, EPAS.

UNIT II PROPELLER SHAFT AND FINAL DRIVE 12

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, limited speed differential, Differential locks.

UNIT III AXLES AND TYRES 12

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types – Lift axle, Dead axle, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

UNIT IV SUSPENSION SYSTEM 12

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details.

UNIT V BRAKING SYSTEM 12

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Anti–Lock Braking System, Constructional Details.

TOTAL = 60 PERIODS

COURSE OUTCOMES

At the end of this course the student will be able to

i. Identify the different types of frame and chassis used in Automotive.
ii. Relate different types of drive lines and drives used in Automotive.
iii. Acquire knowledge about different types of front axle and rear axles used in motor vehicles.
iv. Examine the working principle of conventional and independent suspension systems.
v. Apply knowledge on working principles of brake and its subsystems.

TEXT BOOKS:

1. Kirpal Singh, Automobile Engineering, Standard Publisher, New Delhi , 2017
2. K.K.Ramalingam, "Automobile Engineering", scitech publication (India), 2011.
3. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited, 2015

REFERENCES:

1. Heinz Hazler, Modern Vehicle Technology, Butterworth, London, 2005.
2. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
3. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
4. N.K. Giri, Automotive Mechanics, Kanna Publishers, 2007
5. William. H. Crows – Work shop Manuel – 2005

AU5402 VEHICLE BODY ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

Impart knowledge in the construction of

i. car body
ii. bus body and commercial vehicle details
iii. Vehicle aerodynamics and body materials

UNIT I CAR BODY DETAILS 10

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car –car body terminology - Visibility- regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car Body Construction - Various panels in car bodies. Safety: Safety design, safety equipment for cars.

UNIT II BUS BODY DETAILS 9

Types of bus body: based on capacity, distance travelled and based on construction. – Bus body lay out, floor height, engine location, entrance and exit location. Types of metal sections used – Regulations – Constructional details: Conventional and integral.

UNIT III COMMERCIAL VEHICLE DETAILS 8

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of Flat platform body, Tipper body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design.

UNIT IV VEHICLE AERODYNAMICS 9

Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel balance.

UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR 9

Types and properties of materials used in body construction and insulation -Such as steel sheet, timber, plastics and GRP, Insulation materials. Body trim items-body mechanisms. Hand tools-power tools for body repair. Vehicle corrosion - Anticorrosion methods - Modern painting process procedure.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will acquire knowledge on

i. Different aspects of car body,
ii. bus body and commercial vehicle bodies.
iii. Role of various aerodynamic forces and moments, measuring instruments in vehicle body design.
iv. Material used in body building,
v. Tools used in body repairs and command over vehicle body engineering applications.

TEXT BOOKS:

1. Dieler Anselm., The passenger car body, SAE International, 2000
2. James E Duffy, Body Repair Technology for 4-Wheelers, Cengage Learning,2009.

3. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.

REFERENCES:

1. Braithwaite, J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1997.
2. Giles, G.J., Body construction and design, Illiffe Books Butterworth & Co., 1991.
3. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1992.

AU5403 FLUID MECHANICS FOR AUTOMOTIVE APPLICATIONS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To learn the basics of fluid statics and dynamics
ii. To solve numerical related to equations of fluid motion
iii. To solve numerical related to flow measurement in pipes
iv. To get expose to dimensional analysis and model studies
v. To investigate hydraulic machinery used in vehicles

UNIT I BASIC CONCEPTS 9

Classification of fluids and their properties – Measurement of pressure and viscosity – Fluid statics and force on submerged bodies – Stability of floating bodies.

UNIT II EQUATIONS OF FLUID FLOW 9

Kinematics – Motion of a fluid particle – Fluid deformation – Navier Stokes equation and Euler's equation – Basic laws of fluid motion in integral form and differential form - Linear momentum equation.

UNIT III INCOMPRESSIBLE INVISCID AND VISCOUS FLOWS 9

Bernoulli's equations – Applications –– Flow measurement – Orifice plate – Venturi meter –Fully developed laminar flow between parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow – Calculation of head loss Pipe flow problems – Hydraulic and energy grade lines.

UNIT IV DIMENSIONAL ANALYSIS AND MODEL STUDIES 9

Dimensional analysis – The Buckingham-Pi theorem – Significant dimensionless groups – Flow similarity and model studies.

UNIT V HYDRAULIC MACHINERY FOR VEHICLE APPLICATIONS 9

Impact of jets - Euler's equation - Classification of turbines – heads and efficiencies – velocity triangles. Turbochargers – selection of type, working principle - Reciprocating pump, Rotary pumps –classification and working principle. Fuel pumps – selection of type and working principle.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course,

i. students will be familiar with all basic concepts of fluids statics
ii. summarize the concepts of flow governing equations
iii. generate solutions to complex pipe flow problems
iv. Interpret the results of dimensional analysis
v. expose to the applications of fluid machinery in vehicles

TEXT BOOKS:

1. R.K. Bansal, “A textbook of fluid mechanics and hydraulic machines”, Laxmi Publications (P) Ltd, Revised Ninth Edition.

REFERENCES:

1. E. Rathakrishnan, “Fluid Mechanics: An Introduction”, Prentice Hall of India (II Ed.), 2007.
2. Robert L. Mott, Joseph A. Untener, “Applied Fluid Mechanics”, Pearson Publications (2014), Seventh edition.

PR5451 KINEMATICS AND DYNAMICS OF MACHINES L T P C
3 1 0 4

COURSE OBJECTIVES:

- To impart knowledge on various types of mechanisms and synthesis.
- To impart skills and analyze the position, velocity and acceleration of mechanisms.
- To understand the effects of friction in motion in transmission and machine components.
- To familiarize higher pairs like cams and gears.
- To study the undesirable effects of unbalances resulting from prescribed motions in mechanisms.

UNIT I MECHANISMS 9+3

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint and motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION 9+3

Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (Flat and V) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III GEARS AND CAMS 9+3

Gear – Types and profile – nomenclature of spur and helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV VIBRATION 9+3

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multi-rotor systems – geared shafts – critical speed of shafts.

UNIT V BALANCING 9+3

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi-cylinder engines – Governors and Gyroscopic effects.

TOTAL:60PERIODS

COURSE OUTCOMES:

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

CO1: Apply the kinematics and dynamics of machinery in design and analysis of engineering problems.

CO2: Demonstrate the ability to synthesize and analysis mechanisms

CO3: Design and analyze cam and their motion.
CO4: Select the gears and gear trains for their applications.
CO5: Examine the concept of free, forced and damped vibrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	√	√	√	√	√				√				
CO2	√	√	√	√	√				√				
CO3	√	√	√	√	√				√				
CO4	√	√	√	√	√				√				
CO5	√	√	√	√	√				√				

TEXT BOOKS:

1. Bansal R.K., “Theory of Machines”, Laxmi Publications Pvt Ltd., New Delhi, 20th edition 2009.
2. Rattan S.S., “Theory of machines”, Tata McGraw Hill publishing Co., New Delhi, 2nd edition 2011.

REFERENCES:

1. Gosh A and Mallick A.K., “Theory of Machines and Mechanisms”, Affiliated East West press, 2009.
2. Malhotra D.R. and Gupta H.C ,“The Theory of machines”, Satya Prakasam, Tech. India Publications, 2008.
3. Rao J.S. and Dukkipati R.V., “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Limited, 2006.
4. Shigley J.E. and Uicker J.J., “Theory of Machines and Mechanisms”, McGraw Hill, 2006.
5. Ambekar A.G., “Mechanism and Machine Theory”, PHI India Pvt Ltd, 2007

AU5411 VEHICLE COMPONENTS LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

i. To assemble and disassemble the parts of an IC engine.
ii. To identify the various component of an IC engine.
iii. To identify the various components in transmission systems of an automobile.
iv. To assemble and disassemble the various components of transmission system.
v. To study all the functions of automobile components

LIST OF EXPERIMENTS

1. To assemble and disassemble 1000CC engine
2. To assemble and disassemble Bus engine
3. To assemble and disassemble V8 engine
4. To assemble and disassemble CRDI engine
5. To assemble and disassemble MPFI engine
6. To assemble and disassemble Single plate, Diaphragm Clutch.
7. To assemble and disassemble Constant mesh, Sliding mesh gear box
8. To assemble and disassemble Transfer case
9. To assemble and disassemble Differential, Rear axle
10. To assemble and disassemble Front axle.
11. To Study different chassis layouts
12. To Study braking system
13. To Study Steering system
14. To Study Suspension system

TOTAL: 60 PERIODS

COURSE OUTCOMES:

i. Dismantle and Assemble the automobile chassis and Engine components
ii. Identify & differentiate components of SI & CI engines
iii. Understand working of braking, steering, clutch, transmission, Suspension systems.
iv. Differentiate various subsystems of two, three & Four wheeler vehicles
v. Develop skills in Dismantling and assembling of chassis components.
vi. Correct minor repairs and trouble shoots the breakdowns

AU5412 FUELS AND LUBRICANTS LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVE:

i. To impart basic knowledge on properties testing procedure for fuels and Lubricants.

LIST OF EXPERIMENTS:

1. To determine the viscosity of lubrication oil by Redwood Viscometer.
2. To determine the Viscosity Index of lubricating oil by Saybolt Viscometer
3. To find out the Flash and Fire points of given sample of fuel.
4. To find out the Flash and Fire points of given sample of lubricants.
5. To determine the Cloud and pour point of fuel sample.
6. To draw a curve by performing ASME distillation test of fuels (gasoline / diesel).
7. To determine the Carbon residue on given sample of lubrication oil.
8. To determine the Calorific value of liquid fuel by using bomb calorimeter.
9. To find out the consistency of grease using Penetration test.
10. To find out the Density test of different fuels

TOTAL PERIODS: 60

COURSE OUTCOMES:

i. Student would have basic understanding of various testing methods adopted to assess quality of fuels and lubricants like
    a. Viscosity
    b. Importance of flash, fire point
    c. Cloud and pour point
    d. Calorific value
    e. Density

GE5552 ENGINEERING MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Explaining basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Applying various functions of management in professional organization.
3. Applying organizational theory in professional organization.
4. Applying the principles of productivity and operations management in professional organization.
5. Applying modern concepts and marketing in management in professional organization.

UNIT I INTRODUCTION TO MANAGEMENT 9

Definition and functions of Management - Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Corporate Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Pros and cons.

UNIT II FUNCTIONS OF MANAGEMENT 9

Planning: Characteristics; Nature; Importance; Steps; Limitation – Organizing: Features; Process; Principles; Types – Departmentalization: Functional – Divisional (Product; Customer; Geographic) – Staffing: Systems Approach; Recruiting and Selection Process – Directing (Leading): Traits; Style; Managerial Grid (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Types; Audit (External, Internal, Merits) – Decision Making: Elements; Characteristics; Process; Classification – Controlling techniques.

UNIT III ORGANIZATION THEORY 9

Human Resource Development (HRD): Goals – Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Need and Motivation Theories: Maslow's Hierarchy of Needs Theory; Herzberg's Motivation-Hygiene Theory; McClelland's Needs Theory of Motivation – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT IV PRODUCTIVITY AND OPERATIONS MANAGEMENT 9

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Operations Management Tools: (Simple problems in) Transportation Model (Balanced); Assignment Model (Hungarian); Network Model (Shortest path); Critical Path Method; Decision Trees.

UNIT V MODERN CONCEPTS AND MARKETING MANAGEMENT 9

Concept, features, merits and demerits of: SWOT Analysis; Business Process Re-engineering (BPR); Supply Chain Management (SCM) – Marketing: Concept; Functions; Importance; Segmentation; Mix; Problems of Marketing in Small Enterprise; Competitive Analysis and Advantage – E-marketing.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Apply various functions of management in professional organization.
3. Apply organizational theory in professional organization.
4. Apply the principles of productivity and operations management in professional organization.
5. Apply modern concepts and marketing in management in professional organization.

TEXT BOOKS:

1. Koontz. H. and Weihrich. H., Essentials of Management: An International Perspective, 8th Edition, Tata McGrawhill, New Delhi, 2010.
2. M. Govindarajan and S. Natarajan, Principles of Management, Prentice Hall of India, New Delhi, 2009.

REFERENCES:

1. Joseph J, Massie, 'Essentials of Management' Prentice Hall of India Pvt. Ltd., 1985.
2. M. Govindarajan, Marketing Management, Prentice Hall of India, New Delhi, 2010.
3. R. Panneerselvam, Operations Research, Prentice Hall of India, New Delhi, 2013.
4. S.Chandran, Organizational Behaviours, Vikas Publishing House Pvt. Ltd., 1994.
5. Saxena, P.K., Principles of Management: A Modern Approach, Global India Publications, 2009.

CO	PO												PSO		
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1						0.6		0.6				0.3	0.3		
2						0.6		0.6				0.3	0.3		
3						0.6		0.6	0.9	0.9		0.3	0.3		
4	0.9	0.9	0.9	0.9		0.6		0.3			0.9	0.3	0.6		
5						0.6		0.6			0.3	0.3	0.6		

AU5501 ENGINEERING DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To understand the various steps involved in the Design Process
ii. To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
iii. To learn the use of standard practices in design.
iv. To understand the techniques used for fastening the machine parts
v. To discriminate the basis on which the components have to be designed.

(Use of P S G Design Data Book is permitted)

UNIT I FUNDAMENTAL CONCEPTS IN DESIGN 10

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties –Machine part: simple stresses – Torsional and bending stress – variable stresses – Preferred numbers, fits and tolerances – Fatigue failure

UNIT II DESIGN OF SHAFTS AND SPRINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines Spring material- Types –Design of closed coiled helical springs and leaf springs. Design of lever

UNIT III DESIGN OF JOINTS 8

Cotter and knuckle joint– Design of Cotter Joint - Knuckle Joint – ¬Riveted joint – Types and uses – Design of riveted joints. Welded joint – Types and uses – Design of Welded joints

UNIT IV DESIGN OF FLYWHEEL AND BEARINGS 9

Introduction- Coefficient of Fluctuation of Speed - Fluctuation of Energy - Coefficient of Fluctuation of Energy. Design of Flywheel Rim, Flywheel Arms. Design of Hub - Key

Sliding contact bearings –Rolling contact bearings – types –materials .Bearing life–lubrication –. Design of journal bearings - Ball and Roller bearings

UNIT V DESIGN OF GEARS 9

Types of gears - Terminology of gears- Design considerations – strength of gear teeth – Lewis equation —Dynamic tooth load – Design of spur gears – helical gears – herringbone gears – bevel gears and worm gears.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

i. Demonstrate knowledge on designing machine elements to withstand the loads and deformations.
ii. Approach a design problem successfully, and take decisions whenever needed.
iii. Apply their knowledge in new product development.

iv. Demonstrate their skill in developing modern joining techniques for future electric vehicles
v. Interpret the design of components and create new methods with considering the impact on environment

TEXT BOOKS:

1. Bhandari V, “Design of Machine Elements”, 15thReprint, Tata McGraw-Hill Book Co, 2014.
2. Jain,R.K., Machine Design, Khanna Publishers, 1992.
3. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill , 2008.

REFERENCES:

1. Ansel Ugural, “Mechanical Design – An Integral Approach”, 1st Edition, Tata McGraw-Hill Book Co, 2003.
2. “Design Data Hand Book”, PSG College of Technology, 2013- Coimbatore.
3. M F. Spotts, Terry E. Shoup and Lee E. Hornberger, “Design of Machine Elements” 8th Edition, Printice Hall, 2003.
4. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2006.
5. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine component Design”,5th Edition, Wiley, 2011

AU5551 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To define the glossary related to vehicle electrical and electronic system.
ii. To understand the need for starter batteries, starter motor and alternator in the vehicle.
iii. To differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols.
iv. To list common types of sensor and actuators used in vehicles.
v. To understand networking in vehicles

UNIT I INTRODUCTION AND AUTOMOTIVE BATTERIES 9

Introduction - Overview of vehicle electrical systems- Electrical circuits - Electrical power supply in conventional vehicle- Dimensioning of wires- Circuit diagrams and symbols - Electromagnetic Compatibility and interference suppression. Batteries – Battery design – Method of operation – Lead acid battery construction – Battery ratings and testing- Maintenance -free batteries – Battery – Substitute, versions, special cases

UNIT II STARTING AND CHARGING SYSTEM 9

Alternators – Generation of electrical energy in vehicle- physical principles- Alternator and voltage regulations versions – power losses – characteristics curve- Alternator operation in the vehicle- Alternator circuitry. Starter Motors – Development and Starting requirements in the IC engines- starter motor design – Starter motor design variations – starter motor control and power circuits

UNIT III IGNITION, LIGHTING AND AUXILLARY SYSTEM 9

Ignitions System - Ignition fundamentals- Electronic ignition- Programmed ignition- Distributor less ignition -Direct ignition - Spark plugs. Automotive lighting Technology – Technical demands – Development of lighting technology- Light sources – physical principles – Front and rear lighting system- Interior lighting system – Special purpose lamps – Adaptive Lighting system - Instrument clusters - Wiper and Washer systems- electric horns

UNIT IV AUTOMOTIVE ELECTRONICS AND SENSORS AND ACTUATORS 9

Automotive Electronics- overview and demands- Basic principles of semiconductor technology -Electronic Components- semiconductor components- Microcontrollers - Sensor-Signal Processing - Data Processing in the vehicle - Glossary for automotive microelectronics. Automotive Sensors – Basics – Sensors : Position, speed, Acceleration/Vibrational , Force/Torque, Flow meters, Gas/ Concentration , Temperature- Measured Quantities, Measuring Principles and automotive applications Automotive Actuators - Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings for electrical machines

UNIT V VEHICLE NETWORKING 9

Data transfer between automotive Electronics systems - Basic principles of networking- Network topology- Network organization- OSI reference model- Control mechanisms - communication protocols in embedded systems- - Vehicle Communication Protocols – Cross-system functions - Requirements for bus systems- Classification of bus systems- Applications in the vehicle - Coupling of networks- Examples of networked Vehicles - Bus system- CAN, LIN, Flexray – MOST etc.

TOTAL:45 PERIODS

COURSE OUTCOMES:

i. Define the glossary related to vehicle electrical and electronic system
ii. Understand the need for starter batteries, starter motor and alternator in the vehicle.
iii. Differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols
iv. List common types of sensor and actuators used in vehicles.
v. Understand networking in vehicles.

TEXT BOOKS:

1. Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 978-3-658-01783-5

REFERENCES:

1. Barry Holembeak, “Automotive Electrical and Electronics” , Delmar Publishers, Clifton Park,USA,2010
2. James D Halderman, “ Automotive Electrical and Electronics” , Prentice Hall, USA, 2013
3. Tom Denton, “Automotive Electrical and Electronics Systems,” Third Edition, 2004, SAE International
4. William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.

AU5502 AUTOMOTIVE TRANSMISSION L T P C
3 0 0 3

COURSE OBJECTIVES:

To impart knowledge in

i. Detailed concept, construction and principle of mechanical transmission components,
ii. Hydrodynamic devices, hydrostatic devices, automatic transmission system
iii. Electric drive used in road vehicles.

UNIT I CLUTCH 9

Requirement of transmission system, Types of transmission system, Requirement of Clutches – Functions-Types of clutches, construction and operation of Single plate, multi plate and Diaphragm spring clutches. Centrifugal clutch, Electronic clutch.

UNIT II GEAR BOX 9

Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes, Automatic manual transmission. Introduction to epicycle gear trains, Numerical examples on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear ratios for different vehicle applications.

UNIT III HYDRODYNAMIC TRANSMISSION 9

Fluid coupling – principles - Performance characteristics – advantages – limitations – drag torque – reduction of drag torque. Torque converter - principles - Performance characteristics – advantages – limitations – multistage and polyphase torque converters.

UNIT IV HYDROSTATIC DRIVE 9

Hydrostatic drive; various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive.

UNIT V AUTOMATIC TRANSMISSION AND ELECTRIC DRIVE 9

Wilson gear box-Cotal electric transmission. Chevrolet “Turboglide” transmission. – Four speed longitudinally mounted automatic transmission -Hydraulic control systems of automatic transmission. Continuously Variable Transmission (CVT) – types – Operations. Electric drive-types- Principle of early and modified Ward Leonard Control system-Advantages & limitations. Modern electric drives.

TOTAL:45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will Acquire knowledge in the

i. Clutch
ii. Gear box
iii. Hydrodynamic
iv. Hydrostatic devices
v. Electric drives.

TEXT BOOKS:

1. Heinz Heisler, Advanced Vehicle Technology,2nd Edition,2002, Butterworth-Heinemann
2. Motor Vehicle, T. K. Garrett K. Newton W. Steeds, 13th Edition, 2000, Butterworth-Heinemann

REFERENCES:

1. Crouse,W.H., Anglin,D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1976.
2. Heldt,P.M., Torque converters, Chilton Book Co., 1962.
3. Iqbal Husain, Electric And Hybrid Vehicles Design Fundamentals, CRC PRESS Boca Raton London New York Washington, D.C.

AU5511 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

i. To understand the working principle of Electrical circuits in automobile.
ii. To evaluate the working principle of Battery, and starter motor.
iii. To understand the working principle of auxiliary systems used in automobiles.
iv. To understand the use of sensors in an automobile.
v. To develop a programing knowledge on Microprocessor

LIST OF EXPERIMENTS:

Electrical System

1. Layout of an Automotive Electrical System – Study
2. Testing of Battery – Hydrometer, Load test, Individual Cell voltage test, Jump Start
3. Testing of Starter Motor – Continuity test, Insulation Test, Load test.
4. Testing of Alternator – Continuity test, Insulation Test, Load test.
5. Study of Voltage regulator, solenoids, Horn and wiper mechanism.
6. Study of Vehicle lighting system
7. Study of an Ignition system

Electronic System

1. Visualization of Engine Sensor Signals and fault Diagnosis using OBD Kit
2. Interface of Seven segment display
3. Interfacing of ADC for a sensor and Interfacing of DAC for an actuator
4. Interface circuit like amplifier, filter, Multiplexer and De Multiplexer
5. Basic microprocessor programming like arithmetic and Logic operation, code conversion,
6. waveform generation, look up table etc.
7. Study of Aurdino Programming
8. EPROM Programming
9. Study of Virtual Instrumentation and Communication Protocols (CAN, LIN, MOST etc.)
   Mini – Project

TOTAL: 60 PERIODS

COURSE OUTCOMES:

1. Understand the working principle of Electrical circuits in automobile.
2. Evaluate the working principle of Battery, and starter motor.
3. Understand the working principle of auxiliary systems used in automobiles.
4. Understand the use of sensors in an automobile.
5. Develop a programing knowledge on Microprocessor

AU5512 VEHICLE TESTING LABORATORY L T P C
0 0 2 1

COURSE OBJECTIVES:

i. To impart the knowledge on maintenance of vehicle and subsystems.

LIST OF EXPERIMENTS:

Study on layout of automotive service station.
Tightening and adjustment of wheel bearing.
Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel orientation.

Wheel alignment in four wheelers.
Minor and major tune up of gasoline and diesel engines.
Calibration of Fuel injection pump
Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system.
Removal and fitting of tyre.
Engine fault diagnosis using scan tool
Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
Tinkering and painting of passenger car door.
Performance test on chassis dynamometer.

TOTAL: 30 PERIODS

COURSE OUTCOME:

i. End of the course student would have deep practical knowledge on maintenance and testing.

AU5601 AUTOMOTIVE POLLUTION AND CONTROL L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To discuss the harmful effects of major pollutants on living beings and the environment
ii. To analyse the formation of major pollutants like UBHC, CO, NOx, particulate matter and smoke.
iii. To design various control techniques to reduce pollutants in combustion
iv. To determine the various after treatment process to minimize emissions
v. To demonstrate the various devices used to measure pollutants and discuss the Emission standards followed in various nations

UNIT I EMISSION FROM AUTOMOBILES 5

Sources of Pollution. Various emissions from Automobiles — Formation — Effects of pollutants on environment human beings. Emission control techniques – Emission standards.

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL 12

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NOx, Smoke — Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL 12

Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design.

UNIT V TEST PROCEDURES AND EMISSION MEASUREMENTS 8

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

By the end of this course, students will be able to

i. Differentiate the various emissions formed in IC engines
ii. Analyze the effects of pollution on human health and environment
iii. Design the control techniques for minimizing emissions
iv. Categorize the emission norms
v. Identify suitable methods to reduce the noise emissions.

TEXT BOOKS:

1. B.P Pundir , Engine Emissions, Narosa publications 2nd edition 2017
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. G.P.Springer and D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.

REFERENCES:

1. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.
3. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
4. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint,2005.
5. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., New york 1993.

AU5602 DYNAMICS OF GROUND VEHICLES L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To Develop physical and mathematical models to predict the dynamic response of vehicles
ii. To Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response
iii. To Use dynamic analyses in the design of vehicles.
iv. To understand the principle behind the lateral dynamics.
v. To Evaluate the longitudinal dynamics and control in an automobile

UNIT I CONCEPT OF VIBRATION 9

Definitions, 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 ratio, Base excitation. Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed

UNIT II TYRES 9

Tyre axis system, tyre forces and moments, tyre marking, tyre structure, hydroplaning, wheel and rim. Rolling resistance, factors affecting rolling resistance, Longitudinal and Lateral force at various slip angles, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tyres. Various test carried on a tyre.

UNIT III VERTICAL DYNAMICS 9

Human response to vibration, Sources of Vibration. Suspension requirements – types. State Space Representation. Design and analysis of Passive, Semi active and Active suspension using Quarter car, Bicycle Model, half car and full car vibrating model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law. Suspension optimization techniques. Air suspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic forces and moments. Equation of motion. Load distribution for three-wheeler and four-wheeler. Calculation of maximum acceleration, tractive effort and reaction forces for different drive vehicles. Power limited acceleration and traction limited acceleration. Estimation of CG location. Stability of vehicles resting on slope. Driveline dynamics. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

UNIT V LATERAL DYNAMICS 9

Steady state handling characteristics. Steady state response to steering input – Yaw velocity gain, Lateral acceleration gain, curvature response gain. Testing of handling characteristics. Transient response characteristics. Steering dynamics. Direction control of vehicles. Roll center, Roll axis. Stability of vehicle on banked road, during turn. Effect of suspension on cornering. Minuro Plot for Lateral Transient Response.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the courses, the students can able to

i. Develop physical and mathematical models to predict the dynamic response of vehicles
ii. Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response
iii. Use dynamic analyses in the design of vehicles.
iv. Understand the principle behind the lateral dynamics.
v. Evaluate the longitudinal dynamics and control in an automobile

TEXT BOOKS:

1. J. Y. Wong, "Theory of Ground Vehicles", Fourth Edition, Wiley-Interscience, 2008
2. Singiresu S. Rao, "Mechanical Vibrations," Fifth Edition, Prentice Hall, 2010
3. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014

REFERENCES:

1. Dean Karnopp, "Vehicle Dynamics, Stability, and Control", Second Edition, CRC Press, 2013
2. Hans B Pacejka, "Tyre and Vehicle Dynamics," Second edition, SAE International, 2005
3. John C. Dixon, "Tyres, Suspension, and Handling, " Second Edition, Society of Automotive Engineers Inc, 1996
4. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004
5. R. Nakhaie Jazar, "Vehicle Dynamics: Theory and Application", Second edition, Springer, 2013

AU5651 ELECTRIC AND HYBRID VEHICLES L T P C
3 0 0 3

COURSE OBJECTIVES:

The course should enable the students to:

i. General aspects of Electric and Hybrid Vehicles (EHV), including architectures, modeling, sizing, sub system design and hybrid vehicle control.
ii. Understand about vehicle dynamics,
iii. Design the required energy storage devices,
iv. Select the suitable electric propulsion systems and
v. Understand of hybrid electric vehicles.

UNIT I NEED FOR ALTERNATIVE SYSTEM 10

Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. Case study on specification of electric and hybrid vehicles.

UNIT II DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES 9

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems.

UNIT III ENERGY SOURCES 9

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors. Battery Management System.

UNIT IV MOTORS AND CONTROLLERS 9

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/DC converters.

UNIT V SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES 8

Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle- Economy of hybrid Vehicles. Steering and Suspension system. Choice of Tires.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students able to understand

i. Electric and hybrid vehicle operation and architectures
ii. Design of hybrid and electric vehicles.
iii. Energy requirement for vehicles.
iv. Vehicle characteristics, operating modes, and performance parameters of the vehicle
v. Different subsystems of hybrid and electric vehicles

TEXT BOOKS:

1. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
2. Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press,2005.

REFERENCES:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003
2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005
3. Ron HodKinson, "Light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005

AU5611 ENGINE TESTING AND EMISSION MEASUREMENT LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

The main objective of this course is to

i. Impart knowledge in automotive Emission measurement and methods of testing engines.
ii. The detailed measuring techniques of pollutants like UBHC, CO, NOx, CO^2 and smoke for both SI and CI engines will be taught and compared with the emission standards.
iii. The knowledge about the instruments used for measurement of pollutants, engine performance and combustion parameters are to be explained with live example.
iv. At the end of the course the students will have knowledge about methods to test the engine and emission.

LIST OF EXPERIMENTS:

1. Study and use of IC engine testing Dynamometers.
2. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
3. Performance study on petrol engine.
4. Performance study on diesel engine.
5. Determine the Frictional power on petrol engines.
6. Heat balance test on an automotive diesel engine.
7. Study of NDIR Gas Analyzer and FID.
8. Study of Chemiluminescent NOx analyser.
9. Measurement of HC, CO, CO2, O2 and NOx using exhaust gas analyzer.
10. Diesel smoke measurement.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

By the end of this course, students will be able to

i. Understand the various emission measuring instruments
ii. Understand the various engine testing instruments
iii. Understand the procedure to measure the emission
iv. Understand the procedure for measuring the engine performance and combustion parameters
v. Understand the emission norms

TEXT BOOKS:

1. Giles,J.G., Vehicle Operation and performance, Illiffe Books Ltd., London, 1989.
2. Patterson D.J and Henin N.A , ‘Emission from Combustion Engine and their control’, Anna Arbor Science Publication,1985.
3. Pundir B.P , Engine Emissions, Narosa publications 2nd edition 2017

REFERENCES:

1. BIS Code Books, IS-10000 series, 1988.
2. Crouse,W.H. and Anglin,D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
3. Crouse and Anglin, ‘Automotive Emission Control’, McGraw Hill company., New York 1993.
4. Ganesan,V., Internal Combustion engines, Tata McGraw Hill Co., 1994.

AU5701 DESIGN OF VEHICLE COMPONENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To understand the various steps involved in the design of automotive components
ii. To show their knowledge in designing engine components.
iii. To complete design exercise and arrive at important dimensions of chassis components.
iv. To learn the use of standard practices in design.
v. To determine the dimensions of front and rear axles

(Use of P S G Design Data Book is permitted)

UNIT I DESIGN OF CYLINDER, PISTON AND CONNECTING ROD 10

Choice of material for cylinder and piston, design of cylinder, design of piston, piston pin, piston rings and piston assembly. Material for connecting rod, design of connecting rod assembly. Case study on piston for car.

UNIT II DESIGN OF CRANK SHAFT AND VALVES 9

Material for crankshaft, design of crankshaft under bending and twisting. Design aspects of intake & exhaust manifolds, inlet & exhaust valves, valve springs, tappets and valve train. Design of cam & camshaft. Design of rocker arm. Cam profile generation.

UNIT III DESIGN OF CLUTCHES AND GEARS 10

Design of single plate clutch, multiplate clutch and cone clutch assembly. Torque capacity of clutch. Design of clutch components. Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes.

UNIT IV DESIGN OF VEHICLE FRAME AND SUSPENSION 6

Study of loads-moments and stresses on frame members. Design Of frame for passenger and commercial vehicle - Design of leaf Springs-Coil springs and torsion bar springs. Case study on development of frame for ATV

UNIT V DESIGN OF FRONT AND REAR AXLE 10

Design of propeller shaft. Design details of final drive gearing. Design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings. Analysis of loads-moments and stresses at different sections of front axle. Determination of optimum dimensions and proportions for steering linkages, Design of front axle beam.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

i. Analyse the stress and strain imparted on automotive components
ii. Compute the design and find the dimension of the vehicle components.
iii. Identify optimal design solutions to real-world problems in compliance with industry standards.
iv. Demonstrate the design skill by creating new design strategy with the application of the knowledge.
v. Interpret the modern system in vehicle and would help in developing the system with less impact to the environment.

TEXT BOOKS:

1. Giancarlo Genta, Lorenzo Morello, “The Automotive Chassis Volume 1, Components Design”, Springer International Edition.2014
2. Khurmi. R.S. & Gupta. J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001.
3. Stokes , “Manual gearbox design”, Butterworth-Heinemann 1992

REFERENCES:

1. "Design Data Hand Book", PSG College of Technology, 2013- Coimbatore.
2. Dean Averns, "Automobile Chassis Design", Illife Book Co., 2001.
3. Kolchin-Demidov , "Design of Automotive Engines"-Mir Publishers (1984)
4. Lukin P G G and Rodionov V, "Automobile Chassis Design and Calculations", Mir Publishers, Moscow, 1989.
5. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",6th Edition, Wiley, 2017

AU5702 IC ENGINE PROCESS MODELING L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To impart knowledge on simulation of IC engine components.
ii. To understand the principle behind the stoichiometric ratio and adiabatic flame temperature.
iii. To develop a model on simulation of SI engine models.
iv. To understand the concept of gas exchange process in SI engine.
v. To impart knowledge on simulation of CI engine.

UNIT I INTRODUCTION TO SIMULATION 9

Introduction to Simulation, Advantages of computer simulation, Classification of engine models. Intake and exhaust flow models – Quasi steady flow -Filling and emptying -Gas dynamic Models. Thermodynamic based in cylinder models. Step by step approach in SI engine simulation.

UNIT II STOICHIOMETRY AND ADIABATIC FLAME TEMPERATURE 9

Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air, excess air and stoichiometric air required for combustion. Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state.

UNIT III SI ENGINE SIMULATION 9

SI Engine simulation with air as working medium, deviation between actual and ideal cycle. Fuel air cycle analysis - Temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation. SI Engines simulation with progressive combustion. Models for mass burnt fraction.

UNIT IV SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 9

Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

UNIT V CI ENGINE SIMULATION 9

Zero, one and multizone models for diesel engine combustion. Wiebe's Model, Whitehouse model and Watson model for diesel combustion. Heat release rate and heat transfer models. Equilibrium calculations. Parametric studies on simulated engine performance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to

i. Acquire knowledge on simulation of IC engine components.
ii. Understand the principle behind the stoichiometric ratio and adiabatic flame temperature.
iii. Develop a model on simulation of SI engine models.
iv. Understand the concept of gas exchange process in SI engine.
v. Acquire knowledge on simulation of CI engine.

TEXT BOOKS:

1. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.

REFERENCES:

1. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986.
2. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
3. John. B. Heywood, 'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.
4. Ramoss.A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.

AU5711 COMPUTER AIDED VEHICLE COMPONENTS DESIGN LABORATORY L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To familiarise the students to use modelling software for modelling engine components
ii. To design chassis components with dimensions and strength requirements.
iii. To learn the use of standard practices in modelling of components.
iv. The use of modelling software to control the quality of the final engineered product.
v. To visualize the complete assembly of the various system.

LIST OF ENGINE DESIGN EXPERIMENTS

1. Design and modelling of piston, piston pin and piston rings.
2. Design modelling of the connecting rod assembly.
3. Design of crankshaft, balancing weight calculations and modelling of the crankshaft assembly.
4. Design and modelling of flywheel
5. Design and modelling of the inlet and exhaust valves.
6. Design and modelling of cam and camshaft.
7. Design and modelling of combustion chamber.

LIST OF CHASSIS DESIGN EXPERIMENTS

1. Design and modelling of frame
2. Design and modelling of clutch assembly.
3. Design and modelling of constant mesh gearbox
4. Design and modelling of sliding mesh gearbox
5. Design and modelling of propeller shaft with universal joint.
6. Design and modelling of rear axle

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Students will be able to visualize the automotive components with the help of modeling software.

i. make the modifications instantly if required at the initial stage itself
ii. Demonstrate the knowledge on designing components to withstand the loads and deformations.
iii. synthesize, analyze and document the design of the various components
iv. demonstrate the ability to use engineering techniques for developing vehicle components with industry standards

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.NO	NAME OF THE EQUIPMENT	QUANTITY
1	COMPUTER NODES	30
2	MODELLING SOFTWARE	30 LICENCES

AU5001 ENGINE MANAGEMENT SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

The objective of the course is to make the student to

i. Analyze the need and role of components used in an engine management system.
ii. Apply the function of various sensors and actuators in an engine.
iii. Categorize the different available ignition system,
iv. Design of injection system for SI and CI engines,
v. Distinguish various engine control algorithm used during engine operation.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II SENSORS AND ACTUATORS 9

Working principles, construction and location of sensors to measure speed, load, air flow, temperature, pressure, lambda, throttle position, knock, etc. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc. Design constraints.

UNIT III SI ENGINE MANAGEMENT 9

Layout, types and working of SI engine management systems (K, KE, Mono Jetronic, L, LH, Motronic). GDI. Development of ignition system – Transistor assisted, Contactless, Distributor less, CDI, Ignition Map, Knock control. Flowcharts for combined fuel injection and ignition control. Introduction to LASER Ignition system.

UNIT IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Electronically controlled Unit Injection system. Common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter.

UNIT V DIGITAL ENGINE CONTROL SYSTEM 9

Control algorithm for different operating modes of engine. Pollution control devices. Integrated engine control system, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – On-board diagnosis system.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should able to

i. differentiate between the mechanical and electronic engine management working
ii. apply the function, construction and operation of various sensors and actuators
iii. categorize different ignition and injection systems,
iv. design different injection systems
v. apply various engine control algorithm used during engine operation.

TEXT BOOKS:

1. Bosch, "Automotive Sensors", Robert Bosch GmbH, 2001.
2. William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.

REFERENCES:

1. Allan W. M. Bonnick, "Automotive Computer Controlled Systems", Butterworth-Heinemann, 2001.
2. Eric Chowanietz, “Automobile Electronics,” SAE, 1995.
3. Diesel Engine Management by Robert Bosch, SAE Publications, 3rd Edition, 2004.
4. Tom Denton, “Advanced Automotive Fault Diagnosis,” Second edition, Elsevier Butterworth- Heinemann, 2006

AU5002	MEASUREMENT SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

i. To understand the different degree of accuracy obtained from different types of instruments
ii. To understand the process of reducing uncertainties in measurements
iii. To identify the various instruments used for linear and angular measurements
iv. To interpret the working of pressure force and torque measurement devices
v. To brief the measurement of flow and temperature using various instruments.

UNIT I SCIENCE OF MEASUREMENT 8

Mechanical measurement – direct comparison and indirect comparison – the generalized measurement system – types of input quantities – measurement standards – calibration – uncertainty –errors– classifications of errors– zero, Sensors – transducers. Resistive, Capacitive and Inductive Sensors – Static characteristics– Dynamic characteristics of instruments.

UNIT II LINEAR AND ANGULAR MEASUREMENT 8

Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometer, optical flats, limit gauges – Comparators: Mechanical, pneumatic and electrical types, applications. Angular measurements: -Sine bar, optical bevel protractor, angle Decker–Taper measurements, coordinate measuring machine (CMM), Blue Line Scanner.

UNIT III FORM MEASUREMENT 8

Measurement of screw threads – Thread gauges, floating carriage micrometer – measurement of gears –tooth thickness-constant chord and base tangent method – Gleason gear testing machine – radius measurements – surface finish, straightness, flatness and roundness measurements.

UNIT IV PRESSURE, FORCE AND TORQUE MEASUREMENT 11

Bourdon tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement – potentiometer, strain gauges, LVDT,piezo electric and piezo resistive transducers. Low pressure measurement – Mc leod gauge, Pirani gauge, thermal conductivity type pressure measurement. Force measuring devices – Balances, platform scales, weigh bridges, load cells,

proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers –types.

UNIT V MEASUREMENT OF TEMPERATURE AND FLOW 10

Measurement of temperature – liquid in glass thermometer –partial and total immersion thermometers – resistance thermometers – thermistor –thermocouples – pyrometers. Measurement of flow – orifice plate, Venturi meter, flow nozzles, pitot static tube, rotameter – theory and constructional details – magnetic flow meters – hotwire anemometers-turbine flow meter - ultrasonic flow meter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The Students will be able to

i. Demonstrate their knowledge about different measurement method and devices used in industries.
ii. Design measuring equipment's for the measurement of pressure force, temperature and flow.
iii. Generate new ideas in designing measuring instruments for automotive application.
iv. Demonstrate their learned skill to develop new system that would help in keeping the environment sustainable.
v. Have the ability to handle and interpret measurement data, to estimate measurement uncertainties

TEXT BOOKS:

1. Ernest O Doeblin, "Measurement systems", McGraw Hill Publishers, 2011.
2. R. K . Jain, "Engineering Metrology", Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. Beckwith Thomas G, "Mechanical Measurements", Pearson Education, 2008.
2. I.C Gupta, "Engineering Metrology", Danpat Rai Publications, 2005.
3. N.V. Raghavendra & L. Krishnamurthy, "Engineering Metrology and Measurements", Oxford 2013
4. S K Singh "Industrial Instrumentation & Control" , McGrawHill , 2009

AU5003 THEORY OF FUELS AND LUBRICANTS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To understand the basic of refinery of fuels and lubricants
ii. Properties of fuels and lubricants for the design and operation of the I.C engines.
iii. Testing knowledge on fuel properties

UNIT I REFINERY OF FUELS AND LUBRICANTS 9

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

UNIT II THEORY OF LUBRICATION 9

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

UNIT 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 PROPERTIES AND TESTING OF FUELS 9

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

UNIT V 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, fuel additives – specifications of fuels. ASTM and SAE standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Student would have basic understanding and analysis of

i. Various refinery processes
ii. Theory of lubricants
iii. Properties and testing of fuels
iv. Fuel ratings
v. Additive mechanisms

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co., New Delhi, 2017
2. George E. Totten, Editor, Fuels and Lubricants Handbook: Technology, Properties, Performance, and Testing, ASTM International.

REFERENCES:

1. Paul Richards “Automotive fuels reference book” SAE International, Third edition 2014
2. Roger Frederick Haycock, John Hillier, Arthur J. Caines “Automotive lubricants Reference book”, SAE International, Second edition 2004
3. Wilfrid Francis– Fuels and Fuel Technology, Vol. I & II

AU5004 TRANSPORT MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES:

The students are able

i. To understand transport management and fleet organisation.
ii. To learn about various transport systems and their advantages
iii. To understand scheduling and fare structure.
iv. To learn the need and requirement of documentation and certification.
v. To learn the importance of transport management.

UNIT I INTRODUCTION 9

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

UNIT II TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

UNIT III SCHEDULING AND FARE STRUCTURE 9

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

UNIT IV MOTOR VEHICLE ACT 9

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

UNIT V MAINTENANCE 9

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

i. Understand transport management and fleet organisation.
ii. Learn about various transport systems and their advantages
iii. Understand scheduling and fare structure.
iv. Learn the need and requirement of documentation and certification.
v. Learn the importance of transport management.

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCE BOOKS:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date

AU5005 AUTOMOTIVE SAFETY L T P C
3 0 0 3

COURSE OBJECTIVES:

The course should enable the students to:

i. Know about the basics about the vehicle.
ii. Understand the safety aspects in the vehicle.
iii. Know and understand the various safety aspects.
iv. To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle.
v. To know about the comfort and convenience system.

UNIT I INTRODUCTION 9

Automotive safety: Introduction, Types. Active safety: driving safety, conditional safety, Perceptibility safety, operating safety. Passive safety: exterior safety, interior safety. NCAP

UNIT II PASSIVE SAFETY CONCEPTS 9

Design of body for safety, deceleration of vehicle, passenger. Concept of crumble zone, Safety Cage. Optimum crash pulse, deceleration on impact with stationary and movable obstacles. Deformation behaviour of vehicle body. Barrier test. Crash tests. Deformation behaviour of Lightweight materials.

UNIT III PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM 9

Seat belt, Seat belt tightener system and importance, collapsible steering column. Air bags and its activation. Designing aspects of automotive bumpers and materials for bumpers. Adaptive front lighting, central locking system, Tire pressure control system, rain sensor system with automated wiper system.

UNIT IV ACTIVE SAFETY 9

Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System. ADAS, DAT.

UNIT V VEHICLE INTEGRATION AND NAVIGATION SYSTEM 9

Looking out sensors and Looking in sensors, Intelligent vision system, Vehicle Integration system. Global Positioning System. Vehicle Navigation System. Road Network.V2V, SAE levels of automation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students should be able to:

i. Understand the concept of crumble zone and can calculate the amount of energy absorbed and transferred during a crash.
ii. Design and validate the vehicle structure with respect to crash worthiness
iii. Know the various types of safety aspects such as active and passive safety, the active safety components and the working passive safety components such as air bags, seatbelts
iv. Design a bumper with respect to safety.
v. Know about various object detection system and working of various comfort, convenience system and environment information system.

TEXT BOOKS:

1. Ljubo Vlacic, Michel Parent, Fumio Harashima – “Intelligent Vehicle Technologies Theory and Applications” -Butterworth-Heinemann, 2001
2. Robert Bosch GmbH - “Safety, Comfort and Convenience Systems”- Wiley; 3rd edition, 2007

REFERENCES:

1. ARAI Safety standards
2. Bosch, “Automotive HandBook”, 6th edition, SAE, 2004.
3. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - “Sensors for Automotive Applications “ -WILEY-VCH Verlag GmbH & Co. 2003
4. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., -1999.

ME5075 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Explaining the types, characteristics of entrepreneurship and its role in economic development.
2. Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
3. Selecting the appropriate form of business ownership in setting up an enterprise.
4. Applying the fundamental concepts of finance and accounting to enterprise.
5. Identifying sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise.

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth – Economic, Non Economic, Government Actions.

UNIT II MOTIVATION 9

Entrepreneurial Motivation: Theories and Factors, Achievement Motivation –Entrepreneurial Competencies – Entrepreneurship Development Programs – Need, Objectives – Business Game, Thematic Apperception Test, Self Rating, Stress management.

UNIT III BUSINESS 9

Small Enterprises – Definition, Characteristics, Project Identification and selection – Project Formulation: Significance, content, formulation of project report – Project Appraisal: Concept and method – Ownership Structures: Selection & Pattern.

UNIT IV FINANCING AND ACCOUNTING 9

Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management: Significance, Assessment, Factors, Sources, Management.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business: Concept, Signals, Symptoms, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in Small Scale Enterprise – Institutional Support to Entrepreneurs: Need and Support – Taxation Benefits to Small Scale Industry: Need, Depreciation, Rehabilitation, Investment.

TOTAL = 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Explain the types, characteristics of entrepreneurship and its role in economic development.
2. Apply the theories of achievement motivation and the principles of entrepreneurship development program.
3. Select the appropriate form of business ownership in setting up an enterprise.
4. Apply the fundamental concepts of finance and accounting to enterprise.
5. Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.

TEXT BOOKS:

1. S.S.Khanka, “Entrepreneurial Development” S.Chand& Co. Ltd. Ram Nagar New Delhi,1999.
2. Kurahko&Hodgetts, “ Entrepreneurship – Theory, process and practices”, Thomson learning 6th edition.

REFERENCES:

1. Charantimath, P. M., Entrepreneurship Development and Small Business Enterprises, Pearson, 2006.
2. Hisrich R D and Peters M P, “Entrepreneurship” 5th Edition Tata McGraw-Hill, 2002.
3. Mathew J Manimala,” Entrepreneurship theory at cross roads: paradigms and praxis” Dream tech, 2nd edition 2006.
4. Rabindra N. Kanungo, “Entrepreneurship and innovation”, Sage Publications, New Delhi, 1998.
5. Singh, A. K., Entrepreneurship Development and Management, University Science Press, 2009.

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3						0.6	0.6	0.6	0.3	0.3	0.9	0.3		0.3	
4						0.6	0.3	0.6		0.3	0.3	0.3		0.3	
5						0.6	0.6	0.3		0.3		0.3		0.3	

AU5006 FINITE ELEMENT TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To Understand and perform engineering analysis of structural members using FEM.
ii. To evaluate and interpret FEA analysis results for design and evaluation purposes
iii. To understand the computer codes for FEM Elements.
iv. To derive the characteristics equation of Iso parametric elements.
v. To Imply knowledge towards Modal analysis in a vibrating element analytically.

UNIT I INTRODUCTION 9

Engineering design analysis. Basic concepts of FEM. Steps in FEM. Advantages and limitations of FEM. Handling of simultaneous equations – Gaussian elimination method – Gaussian Jordan method. Numerical integration. Commercial FEM packages.

UNIT II DISCRETE ELEMENTS 9

Spring Element. Bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions – Use of local and natural coordinates. Computer codes for discrete elements.

UNIT III CONTINUUM ELEMENTS 9

Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector. Computer codes for CST and LST elements.

UNIT IV ISOPARAMETRIC ELEMENTS 9

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector.

UNIT V MODAL ANALYSIS 9

Equations of motion for vibration problems. Consistent and lumped mass matrices. Formulation of element mass matrices. Free vibration problem formulation. Case study – FEM in structural analysis, heat transfer and fluid flow problems with respect to Automotive industries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students can able to

i. Understand and perform engineering analysis of structural members using FEM.
ii. Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes
iii. Develop computer codes for FEM Elements.
iv. Derive the characteristics equation of Iso parametric elements.
v. Apply knowledge towards Modal analysis in a vibrating element analytically.

TEXT BOOKS:

1. Daryl L Logan, "A First Course in the Finite Element Method", 5th Edition, CL Engineering, 2010
2. David V Hutton, "Fundamentals of finite element analysis", 1st Edition, McGraw Hill Education, 2004
3. Singiresu S. Rao, "The Finite Element Method in Engineering", Fifth Edition, Butterworth Heinemann, 2010.

REFERENCES:

1. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Reddy J.N., “An Introduction to Finite Element Method”, Third edition, McGraw Hill, 2000.
4. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, John Wiley and Sons, Inc., 2001.
5. Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – Printice Hall India, Third Edition, 2003.

AU5007 PRINCIPLES OF CONTROL SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To understand the methods of representation of system and their transfer function models
2. To provide adequate knowledge in the time response of systems and steady state error analysis
3. To give basic knowledge in obtaining the open loop and closed loop frequency responses of systems
4. To understand the concept of stability of control system and methods of stability analysis
5. To study the three way of designing compensators for a control system

UNIT I SYSTEM AND THIER REPRESENTATION 9

Basic elements in control systems-Open loop and Closed loop system-Feedback characteristics-Effects of feedback-mathematical modeling of physical systems:- mechanical, Thermal, hydraulic and Pneumatic systems-Transfer function- AC and DC servomotor- Block diagram reduction techniques- signal flow graph- control system components – computer simulation.

UNIT II TIME RESPONSE ANALYSIS 9

Time response- Types of test inputs- First and second order responses- Error coefficient-Generalized error series- Steady state error- Time domain specifications- Problems related to automotive domain- Computer simulation.

UNIT III FREQUENCY RESPONSE ANALYSIS 12

Frequency response- Frequency domain specifications-Bode plot-Polar plot- Determination of phase margin and gain margin- Constant M and N circles-Nichols chart- Determination of closed loop responses from open loop response- Problems related to automotive domain Computer simulation.

UNIT IV STABILITY OF CONTROL SYSTEM 6

Concepts of stability- Location of roots in S-plane for stability- Routh Hurwitz criterion- Root locus techniques- Construction-Nyquist stability criterion- Problems related to automotive domain - Computer simulation.

UNIT V CONTROL SYSTEM DESIGN 9

PID controllers –Performance criteria- Selection of controller modes-lag, Lead, and lag-Lead networks- Compensator design for desired response using root locus and Bode diagrams-Problems related to automotive domain -Computer simulation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

i. To understand the methods of representation of system and their transfer function models
ii. To provide adequate knowledge in the time response of systems and steady state error analysis
iii. To give basic knowledge in obtaining the open loop and closed loop frequency responses of systems
iv. To understand the concept of stability of control system and methods of stability analysis
v. To study the three way of designing compensators for a control system

TEXT BOOKS:

1. Gopal, M., "Control System, Principles and Design", Tata McGraw-Hill Pub. Co., 2nd Edition, New Delhi, 2006.
2. Nagrath, I.J. and Gopal,M., "Control System Engineering", New Age International(p),4th Edition, Tata McGraw Hill, 2004

REFERENCES:

1. Dorf Bishop, "Modern Control System", Prentice Hall,2004
2. Kuo, B.C., "Automatic Control System' Prentice Hall of India Ltd., New Delhi,2003
3. Ogata, K., "Modern Control Engineering", Prentice hall of India Ltd., 4th Edition, New Delhi,2006

AU5008 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To understand the principle of combustion in thermodynamics.
ii. To identify the kinetics behind the chemical reaction of combustion of fuels.
iii. To progress an idea to understand the properties of flame inside a combustion chamber.
iv. To understand the principle of conduction, convection and radiation in IC engines.
v. To understand the concept of cylinder pressure measurement.

UNIT I THERMODYNAMICS OF COMBUSTION 9

Premixed and diffusion combustion process in IC engines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT II CHEMICAL KINETICS OF COMBUSTION 9

Fundamentals of combustion kinetics, rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for Normal Combustion.

UNIT III FLAMES 9

Laminar premixed – flame speed correlations- quenching, flammability, and ignition, flame stabilization, laminar diffusion flames, turbulent premixed flames - Reynolds and Damkohler numbers and their significance.

UNIT IV HEAT TRANSFER IN IC ENGINES 9

Engine Heat transfer and heat Balance. Measurement of Instantaneous heat transfer rate. Heat transfer modelling. Heat transfer coefficients, radiative heat transfer.

UNIT V EXPERIMENTS IN IC ENGINES 9

Cylinder pressure measurement. Rate of heat release calculation – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to

i. Understand the principle of combustion in thermodynamics.
ii. Identify the kinetics behind the chemical reaction of combustion of fuels.
iii. Understand the properties of flame inside a combustion chamber.
iv. Understand the principle of conduction, convection and radiation in IC engines.
v. Understand the concept of cylinder pressure measurement.

TEXT BOOKS:

1. John. B. Heywood,'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.

REFERENCES:

1. Ashley Campbel, "Thermodynamic analysis of combustion engine", John book company, Newyork, 1979.
2. Spalding.D.B., "Some fundamental of Combustion", Butterworth Science Publications, London, 1985.
3. Taylor. E.F. "The Internal Combustion Engines ", International Text Book Co., Pennsylvania, 1982.
4. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.

AU5009 HYDRAULIC AND PNEUMATICS SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To understand the basics of hydraulic and pneumatic systems
ii. To examine the working of hydraulic power drives
iii. To apply knowledge on fluid power elements
iv. To design hydraulic and pneumatic systems.
v. To evaluate the concept of programming in PLC circuits.

UNIT I INTRODUCTION TO FLUID POWER 9

Introduction to fluid power control- Hydraulic 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- working principle and construction details of gear, vane and piston pumps, hydraulic motor, Hydrostatic transmission drives and characteristics - Hydraulic Supply Components- Pneumatic power supply- Compressor, air distribution, air motors. Case study related to automotive application.

UNIT III FLUID POWER ELEMENTS 9

Control valves- pressure, flow 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 related to automotive application.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 9

Design of Hydraulic and Pneumatic circuits for automation, Selection and specification of circuit components, sequencing circuits, cascade and Karnaugh- Veitch map method- Regenerative, speed control, Synchronizing circuits. Case study related to automotive application.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 9

Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming- Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to;

i. Understand the basics of hydraulic and pneumatic systems
ii. Examine the working of hydraulic power drives
iii. Apply knowledge on fluid power elements
iv. Design hydraulic and pneumatic systems.
v. Evaluate the concept of programming in PLC circuits.

TEXT BOOKS:

1. Anthony Esposito, " Fluid power with applications" , 5th Edition, Pearson Education 2003.
2. Majumdar, " Oil Hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Prinicples and maintenance", Tata McGraw Hill,2004

REFERENCES:

1. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH,2004
2. William W.Reaves, "Technology of Fluid Power", Delmer Publishers,1997
3. Peter Rohner," Fluid Power Logic circuit Design" MacMillion Press Ltd., 1990.
4. Andrew Parr, " Hydraulics & Pneumatics" Jaico Publishing House,2004

AU5010 SPECIAL PURPOSE VEHICLES L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To enhance the knowledge of the students about the various equipment's used in earth moving, applications.
ii. To understand the construction and working of the vehicle for constructional application
iii. To describe the working nature of farm equipment's based on their application.
iv. To discriminate the various industrial vehicles based on the purpose.
v. To acquire the knowledge on the functioning of military vehicle.

UNIT I EARTH MOVING EQUIPMENTS 9

Construction layout, capacity and applications of dumpers, articulated haulers, front-end loaders, backhoe loaders, bulldozers, scrappers, motor graders, skid steer loaders ,excavator, hydraulic shovels, bucket conveyors , surface miners – highwall Miners. Selection criteria of prime mover for dumpers.

UNIT II CONSTRUCTIONAL EQUIPMENTS 9

Construction layout, capacity and applications of cranes – types , Articulated Trucks ,concrete ready mixer ,trenchers , Asphalt Pavers , road reclaimers , Compactors – types , draglines, drillers , borewell machine .

UNIT III FARM EQUIPMEMTS 9

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment –- Top lifting harvesters. General description, working, specification and functions paddy harvesting machines, Sugarcane harvesting, feller bunchers, forest machines.

UNIT IV INDUSTRIAL VEHICLES 9

Constructional features, capacity and working of fork lifts, Utility vehicles, towing vehicles, man-lift chassis, scissor lift trucks, material handlers, reclaimers, Street sweepers.

UNIT V MILITARY AND COMBAT VEHICLES 9

Special features and constructional details of Main Battle tank, gun carriers, transport vehicles, Armoured vehicle-launched bridge, amphibious bridging vehicle, communication vehicles.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

i. Demonstrate their understanding about the operation of the various special purpose vehicle
ii. Understand the construction layout of earth moving equipment's.
iii. Have the ability to apply the knowledge to design a new concept for construction application.
iv. Demonstrate their skill in developing modern techniques for future farming vehicles
v. Distinguish the various military vehicle and infer their particular technology.

TEXT BOOKS:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
3. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.
4. Peurifoy R.L "Construction Planning, Equipment and Methods", Tata McGraw-Hill, New Delhi, 2002.
5. Wong J " Terramechanics and Off-Road Vehicle Engineering", Butterworth-Heinemann, 2009

AU5072 VEHICLE CONTROL SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To understand the basics of control system used in automobiles
ii. To recognize the electronically controlled system used in driving mechanics.
iii. To understand the working principle of driver modelling and power train control systems.
iv. To identify the control system used in hybrid and electrical vehicles.
v. To illustrate the need of automated transport systems.

UNIT I INTRODUCTION TO VEHICLE CONTROL SYSTEM 9

Trends, overview and examples of vehicle control system- Sensors, actuators and controller modules-Vehicle communication Network-System Engineering V-diagram- Algorithm Development - Steps in vehicle control system design- Degree of freedom for vehicle control- selection of controlled, manipulated, measured disturbance variables- classification of the variables in various automotive systems like engines, suspension, braking, air conditioning – General types of vehicle controller configurations- Feedback, Inferential, Feed-Forward, Ratio control.

UNIT II CONTROL SCHEMES, CRUISE AND HEADWAY CONTROL 9

Feed - Forward control - Cascade control- Design considerations for cascade control, Time delay compensation, Inferential control- Nonlinear control- Adaptive control etc. Cruise control design- Autonomous cruise control- Anti locking brakes- Traction control system- Vehicle stability control linear and non-linear vehicle model- VSC Design Principles – four-wheel steering – Goals of 4WS Algorithms – active suspensions.

UNIT III DRIVER MODELING AND POWERTRAIN CONTROL SYSTEMS 9

Driving simulators- percentage of road departure- Driver modeling- Transfer function models- Preview/ Predictive models- longitudinal driver models Control oriented engine modeling- Air intake model- Fuel dynamics model- Air Fuel ratio dynamics- Engine Control Loops- Air Fuel Ratio control- EGR Control- Spark Timing control- Idle speed control- Knock control-Adaptive knock control- Combustion torque estimation- Transmission control.

UNIT IV CONTROL OF HYBRID AND FUEL CELL VEHICLES 9

Series-Parallel- Split Hybrid Configurations- Hybrid Vehicle Control Hierarchy- Control Concepts of Series Hybrids- Equivalent Consumption minimization strategy- control concepts for split hybrid modelling of fuel cell systems- fuel stack model- control of fuel cell system.

UNIT V HUMAN FACTORS AND INTELLIGENT TRANSPORT SYSTEM 9

Human factors in vehicle automation- cross over model principle- Risk- Homeostatic Theory- Driving simulators- percentage of road departure Advanced traffic management system- Advanced traveller information system- commercial vehicle operation- Advanced vehicle control system- Preventing collisions- Longitudinal motion control and platoons- Site specific information- comparison of longitudinal control approaches- String stability- Automated steering and lateral control – Lane sensing- automated lane change and follow control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the student will be able to:

i. Understand the basics of control system used in automobiles
ii. Recognize the electronically controlled system used in driving mechanics.
iii. Understand the working principle of driver modelling and power train control systems.
iv. Identify the control system used in hybrid and electrical vehicles.
v. Illustrate the need of automated transport systems.

TEXT BOOKS:

1. Galip Ulsoy , Automotive Control System, Cambridge University Press, 2012
2. Uwe Kiencke and Lars Nielson, Automotive Control System, SAE Publications, 2006

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition,2004
2. Benjamin C.Kuo and Farid Golnaraghi, Automatic Control System, John Wiley & Sons, Eight edition, 2003.
3. Katsuhiko Ogata, System Dynamics, Prentice Hall International, Inc. Third Edition,1998
4. Richard C.Dorf and Robert H.Bishop, Modern Control Systems, Pearson Prentice Hall,2008

AU5011 NOISE, VIBRATION AND HARSHNESS L T P C
3 0 0 3

COURSE OBJECTIVES:

The course should enable the students to:

i. Understand the various types of vibration with damping and without damping.
ii. Understand the Various types of noise and its measurement and analysis techniques.
iii. Understand the various sources of noise from automobiles.
iv. Understand the various noise controlling techniques.
v. Understand the various noise from mechanical components and its suppressing techniques.

UNIT I FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION 8

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

UNIT II EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE 7

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

UNIT III ENGINE NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL 9

Introduction to ENGINE Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers.

UNITIV TRANSPORTATION NOISE AND VIBRATION SOURCES-PREDICTION AND CONTROL 9

Introduction to Transportation Noise and Vibration Sources, Tire/Road Noise—Generation, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

UNIT V NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES 12

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, 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:

The students should be able to understand:

i. Classification of vibration of free, forced, Undamped, damped, linear, nonlinear Vibration Response of damped and Undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, Determination of natural frequencies.

ii. Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise engine radiated noise, intake and exhaust noise, Assessment of mechanical noise, accessory contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.
iii. Vibration isolation by tuned absorbers, untuned viscous dampers. Damping treatments, application dynamic forces generated by IC engines, engine isolation, Crank shaft damping, Modal analysis of the mass elastic model shock absorbers.
iv. The application of engineering techniques, tools, for measurement methods in order to learn to control and solve complex Vehicle vibrations behaviour /as well as performance problems.
v. Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis. Noise Suppressing Techniques like palliative treatments and enclosures, automotive noise control principles. Sound in enclosures, sound energy absorption, sound transmission through barrier.

TEXT BOOKS:

1. McConnell K, “Vibration Testing Theory and Practice”, John Wiley, 1995.
2. Norton M P, Fundamental of Noise and Vibration, Cambridge University Press,1989

REFERENCES:

1. Allan G. Piersol , Thomas L. Paez “Harris’ shock and vibration hand book” , McGraw-Hill , New Delhi, 2010
2. Clarence W. de Silva , “Vibration Monitoring, Testing, and Instrumentation “,CRC Press, 2007
3. David A.Bies and Colin H.Hansen “Engineering Noise Control: Theory and Practice “ Spon Press, London . 2009
4. Colin H Hansen “Understanding Active Noise Cancellation “ , Spon Press , London .2003
5. Matthew Harrison “Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles “, Elsevier Butterworth-2004

AU5012 MANUFACTURING OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To compare and analyse the different casting process
ii. To design various machining process according to the requirement
iii. Analysis of suitable process related to forming
iv. To differentiate the effect of powder metallurgy on selective components
v. To impart knowledge on recent trends of automotive components

UNIT I CASTING 10

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburetor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - fly wheel - Honing of cylinder bores – Copy turning and profile grinding machines. Melting practice of alloys.

UNIT II MACHINING 10

Special consideration of machining of various components such as flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston.

UNIT III FORGING AND EXTRUSION PROCESS 10

Forging materials - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, steering column. Extrusions: Basic process steps, extrusion of transmission shaft, housing spindle, steering worm blanks, piston pin and valve tappets. Hydro forming - Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing – forming of wheel disc and rims. Stretch forming - Process, stretch forming of auto body panels –Super plastic alloys for auto body panels.

UNIT IV POWDER METALLURGY AND PROCESSING OF PLASTICS 6

Powder metallurgy process, process variables, Manufacture of friction lining materials for clutches and brakes – plastics-raw material –automobile components – molding – injection, compression and blow – PU foam molding - Machining of plastics.

UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS 10

Powder injection molding - Production of aluminium MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming –Squeeze Casting of pistons - aluminium composite brake rotors. Sinter diffusion bonded idler sprocket – gas injection molding of window channel – cast con process for auto parts.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

By the end of this course, students will be able to

i. Identify the methods to manufacture the vehicle components
ii. Analyze the requirements of each component and material
iii. Differentiate between the casting and forming process
iv. Design the process for manufacturing vehicle components
v. Understand the advanced techniques used for manufacturing Automobile components

TEXT BOOKS:

1. Heldt. P.M., " High Speed Combustion Engines ", Oxford Publishing Co., New York, 1990.
2. Rusinoff, " Forging and Forming of metals ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.

REFERENCES:

1. Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.
2. High Velocity "Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990 HMT handbook
3. Sabroff.A.M. & Others, "Forging Materials & Processes ", Reinhold Book Corporation, New York, 1988.
4. Upton, "Pressure Die Casting ", Pergamon Press, 1985.

AU5013 NON TRADITIONAL MACHINING TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES:

At the end of this course the students are expected to

i. To understand the principles behind mechanical energy based processes.
ii. To learn the working principle of chemical and electro chemical processes.
iii. To study ultrasonic machining principles, equipment used, process parameters and applications.
iv. To study electrical discharge machining principles, equipment used, process parameters and applications.
v. To study laser beam machining, electron beam machining and electro chemical machining principles, equipment used, process parameters and applications.

UNIT I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Introduction to non-traditional machining processes, need for non-traditional machining, classification of non-traditional machining processes, their applications, advantages, limitations. Abrasive jet machining, abrasive water jet machining, ultrasonic machining their working principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9

Chemical machining, electro-chemical machining, electro-chemical honing, electro-chemical grinding, electro-chemical deburring their working principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT III THERMO-ELECTRIC ENERGY BASED PROCESSES 9

Electric discharge machining, wire electric discharge machining, laser beam machining, plasma arc machining, electron beam machining, Ion beam machining their working principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT IV ADVANCED NANO FINISHING PROCESSES 9

Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT V RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES 9

Recent developments in non-traditional machining processes, their working principles, equipment, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course the students are expected to

i. Understand the differences between conventional machining and unconventional machining
ii. Understand the principles of unconventional machining, transfer medium used, mechanism involved, equipment used.
iii. Understand the principles of abrasive jet machining, water jet machining, electrical discharge machining principles, equipment used, process parameters and applications.
iv. Understand the principles of laser beam machining, electron beam machining and electro chemical machining principles, equipment used, process parameters and applications
v. Understand the principle behind the mechanical energy-based machining.

TEXT BOOKS:

1. M. Adithan, “Unconventional Machining Processes”, Atlantic, New Delhi, 2009.
2. V. K. Jain, “Introduction to Micromachining”, Narosa publishing House, New Delhi, 2014.

REFERENCES:

1. Benedict, G.F., “Non-traditional Manufacturing Processes”, Marcel Dekker Inc., New York 1987.
2. Brahem T. Smith, “Advanced machining”, I.F.S., U.K, 1989.
3. Serope Kalpakjian and Steven R. Schmid, “Manufacturing Engineering and Technology”, Prentice Hall, 2013.
4. Serope Kalpakjian and Stevan R. Schemid, “Manufacturing Processes for Engineering Materials”, Pearson Education, 2008.
5. V. K. Jain, “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., New Delhi, 2002.

AU5014 ROAD VEHICLE AERODYNAMICS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To learn the basics of fluid mechanics on vehicle motion.
ii. To expose to the shape optimization techniques followed in passenger car industry.
iii. To relate the influence of rolling resistance and air resistance of various commercial vehicles upon drag force.
iv. To interpret the relation between motorcycle shape and coefficient of drag.
v. To give insight to wind tunnel and road testing techniques practiced in industry.

UNIT I SCOPE OF ROAD VEHICLE AERODYNAMICS 9

Introduction, Properties of Incompressible Fluids, Flow Phenomena Related to Vehicles, Overall Forces and Moments, Resistances to Vehicle Motion, Performance, Fuel Consumption and Fuel Economy, Strategy for Lowest Fuel Consumption.

UNIT II AIR RESISTANCE ON PASSENGER CARS 9

Car as a Bluff Body, Drag and Lift, Drag Fractions and Their Local Origins - Front End, Windshield and A-Pillar, Roof, Rear End, Plan View and Side Panels, Underbody, Wheels and Wheel Housings, Front Spoiler, Rear Spoiler. Strategies for Body Shape Development – Objectives, Detail Optimization, Shape Optimization, Facelift, Adaptation of Attachments.

UNIT III AERODYNAMIC DRAG ON COMMERCIAL VEHICLES 9

Relation between Tractive Resistance, Drag Reduction and Fuel Consumption, Aerodynamic Drag Coefficients of Various Commercial Vehicles, Drag Minimization on Trucks, Buses. Add- on devices for drag reduction. Reduction of Vehicle Soiling.

UNIT IV MOTORCYCLE AERODYNAMICS 9

Development of Motorcycle Aerodynamics, Riding Dynamics and its Relationship with Aerodynamics, Methods of Measurement in Road Tests, Rider Influences - Rider and Pillion Passenger, Clothing and Helmets. Case Studies on Concept models.

UNIT V WIND TUNNELS, MEASUREMENT AND TEST TECHNIQUES 9

Fundamentals of Wind Tunnel Technique, Tests with Reduced-Scale Models - Details of Model Construction and Test Technique, Reynolds Number Effects, Climatic Tunnels. Measuring Equipment and Transducers - Measurement of Aerodynamic Forces and Moments, Pressure Measurements, Measurement of the Airflow Velocity, Temperature Measurement.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

i. Knowledge upon the forces & moments influencing drag.
ii. Solve exercises related to fuel economy & drag.
iii. Appraise upon the techniques of shape based optimization practiced in industry.
iv. Awareness about the influence of rider position in motorcycle aerodynamics.
v. Expose to fundamentals of Experimental testing.

TEXT BOOKS:

1. Alan Pope, Jewel B. Barlow, William H. Rae “Low speed wind tunnel testing”, John Wiley & Sons, Third edition, 1999
2. Hucho. W.H. – “Aerodynamic of Road Vehicles – From Fluid Mechanics to Vehicle Engineering”, Society of Automotive Engineers, U.S, Fourth edition, 1998

REFERENCES:

1. R.H.Barnard - “Road vehicle aerodynamic design, An Introduction” , Mechaero publications, Third edition, 2010
2. T. Yomi Obidi - “Theory and Applications of Aerodynamics for Ground Vehicles” , SAE International, 2014

AU5015 ALTERNATIVE AND ADVANCED FUELS FOR IC ENGINES L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines.
ii. To develop knowledge all, the possible way of using alcohols as a fuel IN IC engines.
iii. To understand the challenges and difficulties in using vegetable oil as an alternative fuel in internal combustion engines.
iv. To identify the uses of hydrogen as fuel in IC engines as an alternative for fossil fuels.
v. To understand the usefulness of natural acquiring gases towards IC engines.

UNIT I ALTERNATIVE FUELS, PROPERTIES AND TESTING METHODS OF FUELS 9

Need for alternative fuels. World and Indian energy scenario on alternative fuels. Production technologies for biofuels for internal combustion engines- Pyrolysis, gasification, digestion.

UNIT II ALCOHOLS AS FUELS 9

Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.

UNIT III VEGETABLE OILS AS FUELS 9

Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines. Role of Nano fluids, additives and cetane improvers for performance improvement of vegetable oils as fuel.

UNIT IV HYDROGEN AS ENGINE FUEL 9

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

UNIT V BIOGAS, LPG AND NATURAL GAS AS FUELS 9

Production methods of Biogas, Natural gas and LPG. Properties studies. CO^2 and H_2S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The end of the course the student will be able to

i. Acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines.
ii. Develop knowledge in all the possible ways of using alcohols as a fuel in IC engines.
iii. Understand the challenges and difficulties in using vegetable oil as an alternative fuel in internal combustion engines.
iv. Identify the uses of hydrogen as fuel in IC engines as an alternative for fossil fuels.
v. Understand the usefulness of natural acquiring gases towards IC engines.

TEXT BOOKS:

1. Donald Klass, Biomass for Renewable Energy, Fuels, and Chemicals, 1998, Academic Press, ISBN: 978-0-12-410950-6.
2. Richard L Bechtold P.E., Alternative Fuels Guide book, Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.

REFERENCES

1. Ayhan Demirbas, ' Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008,ISBN-13: 9781846289941
2. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS Press Champaign, Illinois 2005.
3. Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) on biofuels.
4. Technical papers of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.)

ME5072 COMPUTATIONAL TECHNIQUES FOR FLUID DYNAMICS L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Applying the fundamentals of CFD, and developing case specific governing equations.
2. Performing finite difference and finite volume based analysis for steady and transient diffusion problems.
3. Implementing various mathematical schemes under finite volume method for convention diffusion.
4. Solving complex problems in the field of fluid flow and heat transfer with the support of high speed computers.
5. Applying the various discretization methods, solution procedure and the concept of turbulence modeling.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations– Continuity, Momentum and Energy equations – Chemical species transport –Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9

Derivation of finite difference equations– General Methods for first and second order accuracy – Finite volume formulation for steady and transient diffusion problems –Example problems– Use of Finite Difference and Finite Volume methods

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes, properties of discretization schemes, Hybrid, Power-law, QUICK Schemes, Conservativeness, Boundedness, Transportiveness.

UNIT IV FLOW FIELD ANALYSIS 9

Stream function and vorticity, Representation of the pressure gradient term, Staggered grid – Momentum equations, Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V TURBULENCE MODELS AND MESH GENERATION 9

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models, Mesh Generation and refinement Techniques-software tools.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Apply the fundamentals of CFD, and develop case specific governing equations.
2. Perform finite difference and finite volume based analysis for steady and transient diffusion problems.
3. Implement various mathematical schemes under finite volume method for convention diffusion.
4. Solve complex problems in the field of fluid flow and heat transfer with the support of high speed computers.
5. Apply the various discretization methods, solution procedure and the concept of turbulence modeling.

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W.,"An Introduction to Computational Fluid Dynamics": The finite volume Method, Pearson Education, 2014
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill, 1998.

REFERENCES:

1. John. F. Wendt, "Computational Fluid Dynamics – An Introduction", Springer, 2013.
2. K.Muralidhar&T.Sundararajan, Computational Fluid Flow and Heat Transfer, Narora Publishing House, 1994.
3. Suhas V, Patankar, "Numerical Heat transfer and Fluid flow", Taylor & Francis, 2009.
4. Uriel Frisch, Turbulence, Cambridge University Press, 1999.
5. YogeshJaluria& Kenneth E. Torrance, "Computational Heat Transfer", CRC press, 2002.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9	0.6	0.3	0.3	0.6							0.6	0.9	0.3	
2	0.9	0.6	0.6	0.3	0.6							0.3	0.9	0.3	
3	0.9	0.6	0.9	0.6	0.6							0.3	0.9	0.3	
4	0.9	0.9	0.9	0.9	0.6							0.3	0.9	0.3	
5	0.9	0.9	0.9	0.9	0.6							0.3	0.9	0.3	

GE5451 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service

Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓										✓
CO2						✓						✓
CO3					✓				✓			
CO4		✓			✓	✓	✓	✓				✓
CO5			✓			✓	✓	✓				

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,MaryB.Sacre,HemantUrdhwareshe and RashmiUrdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E. Ross, "Total Quality Management – Text and Cases",Routledge.,2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
4. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .

AU5016 NEW PRODUCT DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To introduce the importance of product design
ii. To understand the needs of a customer towards a product
iii. To initiate the idea of creativeness on product
iv. To understand the decision-making concepts.
v. To design a product based on cost frame and need of the customer.

UNIT I INTRODUCTION 9

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process – various phases of product development-planning for products –establishing markets- market segments- relevance of market research.

UNIT II CUSTOMER NEEDS 9

Identifying customer needs –voice of customer –customer populations- hierarchy of human needs-need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies.

UNIT III CREATIVE THINKING 9

Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition – functional representation –morphological methods-TRIZ- axiomatic design.

UNIT IV DECISION MAKING AND PRODUCT ARCHITECTURE 9

Decision making –decision theory –utility theory –decision trees –concept evaluation methods – Pugh concept selection method- weighted decision matrix –analytic hierarchy process – introduction to embodiment design –product architecture – types of modular architecture –steps in developing product architecture.

UNIT V DESIGN AND COST ANALYSIS 9

Industrial design – human factors design –user friendly design – design for serviceability – design for environment – prototyping and testing – cost evaluation –categories of cost – overhead costs – activity based costing –methods of developing cost estimates – manufacturing cost –value analysis in costing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

i. Introduce the importance of product design
ii. Understand the needs of a customer towards a product
iii. Initiate the idea of creativeness on product
iv. Understand the decision-making concepts.
v. Design a product based on cost frame and need of the customer.

TEXT BOOKS:

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development “, 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9
2. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint 2015, Pearson Education, ISBN 9788177588217

REFERENCES:

1. Clive L.Dym, Patrick Little, “Engineering Design: A Project-based Introduction”, 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7.
2. George E.Dieter, Linda C.Schmidt, “Engineering Design”, McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9.
3. Yousef Haik, T. M. M. Shahin, “Engineering Design Process”, 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141

AU5017 ADVANCED THEORY OF IC ENGINES L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To impart knowledge in modern trends and developments in internal combustion engines.
ii. To understand the air standard cycles of an internal combustion engine.
iii. To acquire complete knowledge in engine modelling and combustion analysis of internal combustion engines.
iv. To develop knowledge in non-conventional engines and their operation in detail.
v. To examine the processes involved in internal combustion 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 and atomization.

UNIT II ENGINE CYCLE ANALYSIS 9

Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.

UNIT III ADVANCED CONCEPTS IN IC ENGINES 9

Concept of Low Temperature Combustion. Homogeneous Charge Compression Ignition Engine. Reactivity Controlled Compression Ignition Engine. Premixed Charge Compression Ignition Engine. Recent Developments.

UNIT IV NON CONVENTIONAL IC ENGINES 9

Concept of L.H.R. engine and its recent developments. Variable compression ratio engine and its use in engine research. Wankel rotary combustion engine. Dual fuel engine concept for multi fuel usage in CI engines - performance studies on 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 the course the student will be able to

i. Acquire knowledge in modern trends and developments in internal combustion engines.
ii. Examine the air standard cycles of an internal combustion engine.
iii. Evaluate engine modeling and combustion analysis of internal combustion engines.
iv. Employ the non-conventional engines and their operation.
v. Understand the processes involved in internal combustion engines.

TEXT BOOKS:

1. John, B., Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Co., New York, 2011.
2. Ramalingam. K.K., Internal combustion engines, Scitech publications, Chennai, 2003.

REFERENCES:

1. Ganesan, V., Internal combustion engines, Tata McGraw Hill Publishing Co., 2015.
2. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.

3. Ganesan,V., Computer Simulation of Compression Ignition engine process, Universities Press (India) Ltd., Hyderabad, 1996.
4. Benson, R.S., Whitehouse, N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

AU5018 AUTOMOTIVE MATERIALS L T P C
3 0 0 3

COURSE OBJECTIVES:

i. Knowledge on properties of engineering materials
ii. To select suitable materials for design
iii. Materials selection criteria for engine and transmission systems
iv. Different materials used for automotive structures.
v. Different electronic materials for automotive applications

UNIT I ENGINEERING MATERIALS AND THEIR PROPERTIES 9

Classes of engineering materials - the evolution of engineering materials, Definition of materials properties, displaying material properties using materials selection charts, Forces for change in materials selection and design, Materials and the environment-selection of materials for automotive applications.

UNIT II BASIS OF MATERIAL SELECTION 9

Selection strategy, Attribute limits and Material indices, structural index Selection procedure: Design process - types of design, design requirements, Function, Material attributes, Shape and Manufacturing processes. Systematic process selection, Energy consumption for production, Material costs, Availability, Recyclability, Environmental consideration. Computer aided selection.

UNIT III MATERIALS FOR ENGINES AND TRANSMISSION SYSTEMS 9

Materials selection for IC engines: Piston, piston rings, cylinder, Engine block, Connecting rod, Crank shaft, Fly wheels, Gear box, Gears, Splines, Clutches.

UNIT IV MATERIALS FOR AUTOMOTIVE STRUCTURES 9

Materials selection for bearings, leaf springs, chassis & frames, Bumper, shock absorbers, wind screens, panels, brake shoes, Disc, wheels, differentials, damping and antifriction fluids, Tires and tubes.

UNIT V ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS 9

Materials for sensors and electronic devices meant for Engine Speed and Crank Position, Throttle position sensor, Manifold Absolute Pressure, Temperature Sensor, Oxygen Sensor, Piezoelectric Sensor, Ultrasonic Sensor and Dew Sensor. Sensor Materials and Technologies

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The student will be able to:

i. Gain knowledge on different class of materials and their applications
ii. Understand the Selection criteria for various components and importance.
iii. Understand different materials used for automotive engines and transmission.
iv. Select proper material for Automobile applications
v. Understand different materials used for sensors in a vehicle

TEXT BOOKS:

1. Gladius Lewis, “Selection of Engineering Materials”, Prentice Hall Inc. New Jersey USA, 1995.
2. Hiroshi Yamagata,” The Science and Technology of Materials in Automotive Engines”, Woodhead Publishing,2005

REFERENCES:

1. ASM Handbook. “Materials Selection and Design”, Vol. 20- ASM Metals Park Ohio.USA, 1997.
2. ASM Handbook, “Selection of Materials Vol. 1 and 2”, ASM Metals Park, Ohio. USA, 1991.
3. Cantor,“ Automotive Engineering: Lightweight, Functional, and Novel Materials”, Taylor & Francis Group, London, 2006
4. James A. Jacobs, Thomas F. Kilduff., “Engineering Materials Technology: Structure, Processing, Properties & Selection”, Prentice Hall, USA, 1996.
5. M F Ashby, “Materials Selection in Mechanical Design”, third edition, Butterworth-Heineman, New York, 2005.

AU5019 TWO AND THREE WHEELER TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

The objective of this course is to make the students to

i. design the power unit
ii. analyse different frames used in two wheelers
iii. apply the design aspects of transmission system
iv. analyse the suspension system used in two wheelers.
v. design three wheelers for different application

UNIT I POWER UNIT 9

Types of engines. Two stroke and four stroke engines. Single, twin and multi cylinder engines. Air cooled and liquid cooled engines. Carburetted, fuel injected engines. Engine design criteria. Advance mechanisms. Battery coil ignition, magneto ignition and electronic ignition.

UNIT II CHASSIS AND SUB – SYSTEMS 9

Main frame for two wheelers and its types. Materials for frames. Design analysis of frame. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres. Drum and disc Brakes. Antilock braking system. Lighting system.

UNIT III TRANSMISSION SYSTEM 9

Pre-unit, gearbox and final drive. Design of clutch. Types of clutches and gear boxes. CVT. Gear change mechanism. Belt, chain and shaft drive. Freewheeling devices, starting systems.

UNIT IV TYPES OF MOTORCYCLES AND ALL TERRAIN VEHICLESS 9

Classification of motorcycles based on usage. Motor cycles, Scooters and Mopeds. Street bike, sports bike and race bike. Electric bikes. All-terrain vehicles. Maintenance of two wheelers.

UNIT V INTRODUTION TO THREE-WHEELERS 9

Autorickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission, wheel types, wheel mountings attachment, tyre types. Brake systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course students will be able to:

i. design the power unit used in two wheelers
ii. analyse different frames used in two wheelers
iii. analyse the transmission system
iv. analyse the suspension system used in two wheelers.
v. design three wheelers for different application

TEXT BOOK:

1. Edward Abdo, Modern motor cycle technology by 3rd Edition, 2015
2. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.

REFERENCES:

1. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai
2. Motorcycle Basics Tech book by Haynes 2nd Edition, 2015
3. Motorcycle mechanics, By George Lear,1977
4. Motorcycle Owner's Manual By Hugo Wilson 1997
5. The Essential Guide to Motorcycle Maintenance By Mark Zimmerman2016

AU5020 VEHICLE MAINTENANCE L T P C
3 0 0 3

COURSE OBJECTIVES:

To import knowledge on

i. Maintenance procedure
ii. Engine and subsystem maintenance
iii. Transmission system maintenance

UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS 9

Need for Maintenance – importance, classification of maintenance work-basic problem diagnosis. Automotive service procedures – workshop – types - operations – workshop manual -. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments –Scheduled maintenance services – service intervals - On-board diagnostics.

UNIT II ENGINE AND SUBSYSTEM MAINTENANCE 9

Engine service- Dismantling of Engine components - Engine tuning - repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE 9

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of universal joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT IV STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE 9

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage, steering column, steering gear box service- Rack and pinion, Recirculating ball and Worm type and Power steering system.

UNIT V AUTO ELECTRICAL, AIR CONDITIOING AND VEHICLE BODY MAINTENANCE 9

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault Diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon the completion of the course student can able to understand

i. The importance of maintenance
ii. sub systems of engine
iii. Transmission
iv. Electric system
v. Body repair

TEXT BOOKS:

i. Ed May, Automotive Mechanics Volume One , Mc Graw Hill Publications, 2006
ii. Ed May, Automotive Mechanics Volume Two , Mc Graw Hill Publications, 2006

REFERENCES:

i. Bosch Automotive Handbook, Tenth Edition,2018
ii. Vehicle Service Manuals from different manufactures
iii. William Crouse, Donald Anglin Automotive Mechanics

AU5071 AUTOMOTIVE INSTRUMENTATION AND TESTING L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To provide theoretical and applicative knowledge in automobile test instrumentation.
ii. To identify the various instruments for measuring force, torque, pressure, temperature, fluid flow, velocity and rotational speed.
iii. To enhance the knowledge of students regarding the experimental methods followed in industries.
iv. To familiarize the students on standard test codes.
v. To impart skills on the testing procedure followed for evaluating brake, engine and vehicle.

UNIT I MECHANICAL MEASUREMENT 9

Introduction to measurements – Construction, principle, working of Instruments for measuring force, torque, pressure, temperature, fluid flow, velocity, rotational speed.

UNIT II VIBRATION AND BODY TEST 9

Vibration measurement instrument – accelerometer and signal conditioning. Dynamic simulation sled testing, methodology, vehicle acceleration measurement and documentation. Dolly roll over test, dolly role over fixture, photographic / video coverage. Vehicle roof strength test –. Door system crush test – wind tunnel tests.

UNIT III CRASH AND BRAKE TEST 9

Crash tests –standards – road hazard impact test for wheel and tyre assemblies, test procedures, failure and performance criteria. Bumpers - types of tests, pendulum test, fixed collision barrier test, procedure, performance criteria. Air and hydraulic brake test, air brake actuator, valves test, performance requirements.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES 9

I.S Code for Engine testing – Instruments for performance testing of engine, Instrumentation for measuring noise, vibration in cylinder, different types of engine tests are performed within the industry.

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES 9

Laboratory tests- test tracks - Endurance Tests - Dynamic cornering fatigue, dynamic radial fatigue tests – procedure, bending moment and radial load calculations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

i. Demonstrate the understanding of engine testing procedures.
ii. Develop a measurement strategy for temperature, pressure, mass flow, velocity.
iii. Understand sensors and instrumentation, and to analyse and interpret test data.
iv. Develop new system that would help in keeping the environment sustainable.
v. Demonstrate the understanding of brake testing procedures

TEXT BOOKS:

1. Crouse W H and Anglin D L., "Automotive Mechanics"' Tata McGraw Hill Publishing Company, 2004.
2. J.G .Giles, Vehicle Operation & Testing. Volume 7 of Automotive technology series, Iliffe,1969
3. Richard D. Atkins, "An Introduction to Engine Testing and Development", SAE International 2009.

REFERENCES:

1. Beckwith TG and Buck N L, "Mechanical Measurements", Addition Wesley Publishing Company Limited, 1995.
2. Jain R K "Mechanical and Industrial Measurements", Khanna Publishers, Delhi, 1999.
3. Stockel M W, "Auto Mechanics Fundamentals", Good Heart-Wilcox Co., Inc., 2000.

AU5021 INTRODUCTION TO OPERATIONS RESEARCH L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To introduce the concepts in optimization of resources for manufacturing and service-based industries.
ii. To introduce students to use quantities methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.
iii. Enlighten the students with the various optimization techniques to understand and apply in industrial operations
iv. To Introduce the concepts in optimization of resources for manufacturing and service-based industries

UNIT I LINEAR PROGRAMMING PROBLEMS 9

OR-Definition - Phases - models, LP problems formulation – Graphical solution, GLPP, Standard and Canonical forms of LPP- simplex methods- Big M, Two phase methods, Alternate optimal solutions, Duality in LP.

UNIT II TRANSPORTATION 9

Transportation problems- Basic feasible solution, Optimal solution By MODI method, Balanced and Unbalanced TP, Degeneracy, Production problems. Assignment problems – Hungarian method Traveling salesman problems - Sequencing models- Johnson algorithm, n job 2 machines, n job 3 machines and n job m machines.

UNIT III INVENTORY CONTROL 9

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Purchase and Production models with and without shortages-EOQ with price breaks - Stochastic inventory problems - Multi product problems - Systems of inventory control (P and Q Systems) - Determination of buffer stock and re-order levels -Selective inventory control techniques (ABC, VED, SDE, etc.)

UNIT IV QUEUING THEORY 9

Queuing system - Characteristics - symbols - Poisson process and exponential distribution -Single server queuing models - Multiserver queuing models, Simulation Monte Carlo technique- Inventory & Queuing problems.

UNIT V PROJECT MANAGEMENT AND REPLACEMENT MODELS 9

Project management: Network logic – Ford-Fulkerson's rule - AON diagram - CPM and PERT techniques, Critical path and float calculations Replacement models -types of failures – Gradual failures-replacement of items: Efficiency deteriorates with time, sudden failures- individual and group replacement policies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

i. Recognize the importance and value of Operations Research and mathematical modelling in solving practical problems in industry;
ii. Formulate a managerial decision problem into a mathematical model;
iii. Understand Operations Research models and apply them to real-life problems;
iv. Understand and apply the operations research techniques in industrial operations.
v. Introduce the concepts in optimization of resources for manufacturing and service-based industries

TEXT BOOKS:

1. Hamdy Ataha, "Operations research an introduction", 9th edition 2011, PHI/Pearson education.
2. Wayne.L.Winston, "Operations research applications and algorithms",4th edition, 2007,Thomson learning.

REFERENCES:

1. Frederick. S. Hiller and Gerald.J.Lieberman, "Operations research concepts and cases", 8th edition (SIE) 2008,TMH.
2. G.Srinivasan, "Operations research principles and applications", 2nd edition EEE 2010, PHI.
3. J.K.Sharma, "Operations research theory and applications",5Th edition 2013, Macmillan India.
4. R.Pannerselvam, "Operations research", 2nd edition 2009, PHI
5. Ravindran, Phillips and Solberg, "Operations research principles and practice", 2nd edition 2007, Wiley India.

AU5022 RENEWABLE SOURCES OF ENERGY L T P C
3 0 0 3

COURSE OBJECTIVES:

The objective of the courses is to develop in-depth knowledge for the following:

i. Various renewable energy resources available at a location and assessments of its potential, using tools and techniques.
ii. Solar energy radiation, its interactions, measurement and estimation
iii. Properties critical for Bio-energy resource assessment, pathway selection, biomass supply
iv. Site selection for wind turbines, wind systems, measurements and instruments
v. Geothermal, wave, tidal and OTEC resources, site selection

UNIT I INTRODUCTION TO RENEWABLE ENERGY SOURCES 9

World energy usage -reserves for world energy resources. Principles of renewable energy – renewable energy resources and their importance. Conventional and non-conventional fuels. Review of possible renewable energy resources. Scientific principles, technical implications, and social implications.

UNIT II SOLAR ENERGY 9

Solar radiation: Extraterrestrial solar radiation - Measurement and estimation of solar radiation. Solar heating devices. Systems with separate storage. Selective surfaces. Solar concentrators and other devices. Steam generation and solar thermal-electricity. Recent advancements in solar power generation. Photovoltaic Devices and Systems. Types and usage of photovoltaic systems. Grid connection; system design and RAPS (remote area power supply) applications.

UNIT III BIOMASS AND BIOENERGY 9

Biomass resources - Reviews the use of agricultural crops and solid biomass wastes in the production of alternative fuels. Available Technologies for biomass energy production. Incineration, pyrolysis, gasification and other thermo-chemical processes. Ethanol and biogas production technologies. Recent advancements in Biomass energy production.

UNIT IV WIND ENERGY 9

Basics of Wind Energy. Current and Future Technologies - Benefits and Drawbacks of Wind Energy - Wind Turbine and its components- Loads on the wind turbine. Forces acting on-wind turbines and calculation of wind turbine efficiency. Process of electricity generation and supply to the grid (wind farms). Current and Potential Uses - Issues, Challenges, and Obstacles.

UNIT V OTHER RENEWABLE ENERGIES 9

Introduction to Geothermal, Ocean thermal and tidal energies. Working principles of Geothermal, Ocean thermal and tidal power plants. Binary cycle power generation. Advantages and drawbacks. Current trends in geothermal, ocean thermal and tidal power technologies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

i. Know the importance of renewable energy sources utilization and various renewable energy technologies.
ii. Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.
iii. Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications

iv. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
v. Acquire the knowledge of wave power, tidal power and geothermal principles and applications.

TEXT BOOKS:

1. G.D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
2. Twidell, J.W. & Weir, A., “Renewable Energy Resources”, EFN Spon Ltd., UK, 2005.

REFERENCES:

1. B.H. Khan, “Non-Conventional Energy Resources”, The McGraw Hill companies, 2009
2. G.N. Tiwari, “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science Intl Ltd, 2015.
3. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
4. J. Dewulf and Herman Van Langenhove, ‘Renewables Based Technology: Sustainability Assessment’. 2006 John Wiley & Sons, Ltd. ISBN: 0-470-02241-8
5. Neil Schlager and Jayne Weisblatt, Alternative Energy, Thomson Gale sales ISBN 1- 4414-0507 3, 2006

AU5023 VEHICLE AIR-CONDITIONING L T P C
3 0 0 3

COURSE OBJECTIVES:

i. To solve the simple problems related to psychrometry and refrigerant.
ii. To understand the operation of the individual components of the A/System, sensors, actuators and electronic control.
iii. To understand the range of techniques that can be used in diagnosing
iv. To identify faults which affect system performance.
v. To provide adequate knowledge in safe working practice. Understanding the correct procedures for A/C service and repair.

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 drive ability- 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 the course the student will be able to

i. Solve the simple problems related to psychrometry and refrigerant
ii. Understand the operation of the individual components of the A/System, sensors, actuators and electronic control
iii. Understand the range of techniques that can be used in diagnosing
iv. Identify faults which affect system performance
v. Provide adequate knowledge in safe working practice. Understanding the correct procedures for A/C service and repair

TEXT BOOKS:

1. Warren Farnell and James D.Halderman, Automotive Heating, Ventilation, and Air Conditioning systems, Classroom Manual, Pearson Prentice Hall,2004
2. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.

REFERENCES:

1. Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.
2. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
3. Mitchell Information Services, Inc., Mitchell Automatic Heating and Air Conditioning Systems, Prentice Hall Inc., 1989.
4. Paul Weisler, Automotive Air Conditioning, Reston Publishing Co. Inc., 1990.

AD5091 CONSTITUTION OF INDIA L T P C
3 0 0 0

COURSE OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION 9

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 9

Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties

UNIT III ORGANS OF GOVERNANCE 9

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS 9

Emergency Provisions - National Emergency, President Rule, Financial Emergency

UNIT V LOCAL ADMINISTRATION 9

District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

TEXT BOOKS:

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.
3. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government Publication,1950

AD5092 VALUE EDUCATION L T P C

3 0 0 0

COURSE OBJECTIVES:

- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgements

UNIT II IMPORTANCE OF VALUES 9

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III INFLUENCE OF VALUE EDUCATION 9

Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION 9

Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT 9

Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓	✓			✓
CO3							✓	✓	✓			✓
CO4							✓	✓				✓
CO5							✓	✓				✓

REFERENCES:

1. Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

AD5093 PEDAGOGY STUDIES L T P C
3 0 0 0

COURSE OBJECTIVES:

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY: 9

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions **-** Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW 9

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES 9

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT 9

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS 9

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												✓
CO2												✓
CO3												✓
CO4												✓
CO5												✓

REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

AD5094 STRESS MANAGEMENT BY YOGA L T P C
3 0 0 0

COURSE OBJECTIVES:

- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do's and Don't's in life through Yam
- Categorize Do's and Don't's in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA 9

Definitions of Eight parts of yog. (Ashtanga)

UNIT II YAM 9

Do's and Don't's in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III NIYAM 9

Do's and Don't's in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN 9

Various yog poses and their benefits for mind & body

UNIT V PRANAYAM 9

Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do's and Don't's in life through Yam
CO3 – Learn Do's and Don't's in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓				✓
CO3							✓	✓				✓
CO4							✓	✓				✓
CO5							✓	✓				✓

REFERENCES:

1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P C
3 0 0 0

COURSE OBJECTIVES:

- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9

Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9

Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV STATEMENTS OF BASIC KNOWLEDGE – I 9

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA 9

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

COURSE OUTCOMES:

CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

REFERENCES:

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari's ThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata, 2016

AD5097 ESSENCE OF INDIAN KNOWLEDGE TRADITION L T P C
3 0 0 0

COURSE OBJECTIVES

The course will introduce the students to

- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 9

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45PERIODS

COURSE OUTCOMES

After successful completion of the course the students will be able to

- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C
3 0 0 0

COURSE OBJECTIVES:
The main learning objective of this course is to make the students an appreciation for:
1. Introduction to Sanga Tamil Literature.
2. 'Agathinai' and 'Purathinai' in Sanga Tamil Literature.
3. 'Attruppadai' in Sanga Tamil Literature.
4. 'Puranaanuru' in Sanga Tamil Literature.
5. 'Pathitrupaththu' in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATURE AN INTRODUCTION 9
Introduction to Tamil Sangam – History of Tamil Three Sangams – Introduction to Tamil Sangam Literature – Special Branches in Tamil Sangam Literature - Tamil Sangam Literature's Grammar - Tamil Sangam Literature's parables.

UNIT II 'AGATHINAI' AND 'PURATHINAI' 9
Tholkappiyar's Meaningful Verses – Three literature materials – Agathinai's message - History of Culture from Agathinai – Purathinai – Classification – Mesaage to Society from Purathinai.

UNIT III 'ATTRUPPADAI'. 9
Attruppadai Literature – Attruppadai in 'Puranaanuru' - Attruppadai in 'Pathitrupaththu' – Attruppadai in 'Paththupaattu'.

UNIT IV 'PURANAANURU' 9
Puranaanuru on Good Administration, Ruler and Subjects – Emotion & its Effect in Puranaanuru.

UNIT V 'PATHITRUPATHTHU' 9
Pathitrupaththu in 'Ettuthogai' – Pathitrupaththu's Parables – Tamil dynasty: Valor, Administration, Charity in Pathitrupaththu - Mesaage to Society from Pathitrupaththu.

TOTAL (L: 45) = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate 'Agathinai' and 'Purathinai' in their personal and societal life.
3. Appreciate and apply the messages in 'Attruppadai' in their personal and societal life.
4. Appreciate and apply the messages in 'Puranaanuru' in their personal and societal life.
5. Appreciate and apply the messages in 'Pathitrupaththu' in their personal and societal life.

REFERENCES:

1. Sivaraja Pillai, The Chronology of the Early Tamils, Sagwan Press, 2018.
2. Hank Heifetz and George L. Hart, The Purananuru, Penguin Books, 2002.
3. Kamil Zvelebil, The Smile of Murugan: On Tamil Literature of South India, Brill Academic Pub, 1997.
4. George L. Hart, Poets of the Tamil Anthologies: Ancient Poems of Love and War, Princeton University Press, 2015.
5. Xavier S. Thani Nayagam, Landscape and poetry: a study of nature in classical Tamil poetry, Asia Pub. House, 1967.

	P												PS		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1									0.9						0.6
2									0.9						0.6
3									0.9						0.6
4							11		0.9						0.6
5									0.9						0.6

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION L T P C
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- ✓ To familiarize students with the concept of communication using linguistic and non linguistic resources.
- ✓ To help students ask critical questions regarding facts and opinions.
- ✓ To provide students with the material to discuss issues such as language and power structures.
- ✓ To help students think critically about false propaganda and fake news.

Learning Outcomes

- ➢ Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
- ➢ Students will be able to analyse communication in terms of facts and opinions.
- ➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III POWER STRUCTURE AND LANGUAGE USE: 9

a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV MEDIA COMMUNICATION: 9

a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9

a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Austin, 1962, J.L. How to do things with words. Oxford: Clarendon Press. Grice, P.1989. Studies in the way of words. Cambridge, M.A: Harvard University Press.
2. Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge. Chomsky, N.2006. Language and Mind, Cambridge University Press.
3. Hymes. D.N. 1972, On communication competence in J.B. Pride and J.Holmes (ed), Sociolinguistics, pp 269-293, London Penguin.
4. Gilbert, H.Harman, 1976. Psychological aspect of the theory of syntax in Journal of Philosophy, page 75-87.
5. Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.
6. Stangley, J. 2007. Language in Context. Clarendon press, Oxford. 7. Shannon, 1942. A Mathematical Theory of Communication. 8. Searle, J.R. 1969. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press.

HU5172	VALUES AND ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I DEFINITION AND CLASSIFICATION OF VALUES 9

Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II CONCEPTS RELATED TO VALUES 9

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III IDEOLOGY OF SARVODAYA 9

Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV SUSTENANCE OF LIFE 9

The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V VIEWS ON HIERARCHY OF VALUES 9

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓			✓
CO2								✓	✓			✓
CO3								✓	✓			✓
CO4								✓	✓			✓
CO5								✓	✓			✓

TEXT BOOKS:

1. Awadesh Pradhan :Mahamanake Vichara. (B.H.U., Vanarasi-2007)
2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
3. William, K Frankena: Ethics (Prentice Hall of India, 1988)

HU5173 HUMAN RELATIONS AT WORK L T P C
3 0 0 3

OBJECTIVES:

- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9

Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9

Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9

Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, and Developing Good Work Habits.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓		✓	✓			✓
CO2									✓	✓		✓
CO3						✓		✓	✓			✓
CO4								✓				✓
CO5								✓	✓	✓		✓

TEXT BOOK:

1. Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts, Applications, and Skills, 11th Ed. Upper Saddle River, NJ: Pearson.

REFERENCES:

1. Greenberg, J. S. (2017). Comprehensive stress management (14th edition), New York: McGraw Hill.
2. Udai, Y. (2015). Yogasanaurpranayam. New Delhi: N.S. Publications.

HU5174 PSYCHOLOGICAL PROCESSES L T P C
3 0 0 3

COURSE DESCRIPTION

Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people's psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES

The major objectives of this course is

- To develop students' awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT I INTRODUCTION

What is psychology? - Why study psychology? - Psychology as science – Behavior and its role in human communication – socio-cultural bases of behaviour – Biological bases of behavior - Brain and its functions – Principles of Heredity – Cognition and its functions Fields of psychology – Cognitve and Perceptual – Industrial and Organizational.

UNIT II SENSORY & PERCEPTUAL PROCESSES

Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT III COGNITION & AFFECT

Learning and memory – philosophy of mind – concepts - words – images – semantic features – Association of words – Repetition – Retrieval – Chunking - Schemata - Emotion and motivation – nature and types of motivation – Biological & Psychosocial motivation – nature and types of emotions – physiological & cognitive bases of emotions – expressions of emotions – managing negative emotions - enhancing positive emotions.

UNIT IV THINKING, PROBLEM-SOLVING & DECISION MAKING

Thinking skills – Types of thinking skills – Concrete & Abstract thinking – Convergent & Divergent - Analytical & Creative thinking – Problem & Possibility thinking – Vertical & Lateral thinking – Problem solving skills – stages of problem solving skills – Decision making - intuition and reasoning skills - Thinking and language - The thinking process- concepts, problem solving, decision-making, creative thinking; language communication.

UNIT V PERSONALITY & INTELLIGENCE

Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

REFERENCES

1. Morgan, C.T.and King, R.A (1994) Introduction to Psychology, Tata McGraw Hill Co Ltd, New Delhi.
2. Robert A. Baron (2002), Psychology, 5th Edition, Prentice Hall, India.
3. Michael W.Passer, Ronald E.smith (2007), Psychology: The science of mind and Behavior,3rd Edition Tata McGraw-Hill Edition.
4. Robert S.Feldman (2004) Understanding Psychology 6th Edition Tata McGraw – Hill.
5. Endler, N. S., & Summerfeldt, L. J. (1995). Intelligence. personality. psychopathology. and adjustment. In D. H. Saklofske & M. Zeidner (Eds.). International handbook of personality and intelligence (pp. 249-284). New York: Plenum Press.
6. Ford, M. E. (1994). A living systems approach to the integration of personality and intelligence. In R. J. Sternberg. & P. Ruzgis (Eds.). Personality and intelligence (pp. 188-21 7). New York: Cambridge University Press.
7. De Bono, E (1990) Lateral Thinking, Harper Perennial, New York.

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY L T P C
3 0 0 3

COURSE DESCRIPTION

This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:

The course aims

- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES

By the end of the course, learners will be able to

- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM

Gurukul to ICT education – Teacher as facilitator – Macaulay's Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

Learning Theories – Behaviorism – Cognitivism – Social Constuctivism – Humanism Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

UNIT III TECHNOLOGICAL ADVANCEMENTS

Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY

Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS

Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL:45 PERIODS

TEACHING METHODS

Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION

As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)

(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY L T P C
3 0 0 3

OBJECTIVES

- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one's self and others.

UNIT I KNOWLEDGE 9

Knowledge (Vidya) Versus Ignorance (Avidya)- Brihadaranyaka Upanishad. Unity and Multiplicity – Isha Upanishad. What is True Knowledge? Ways to True Knowledge. Introduction to Philosophy of Yoga, Socratic Debate, Plato's Views. Asking and Answering Questions to Stimulate Critical Thinking and to Draw Ideas. Argumentative Dialogues. Dialectical Methods to Arrive at Conclusions.

UNIT II ORIGIN 9

Origin of Universe And Creation – 'Nasidiya Sukta' in Relation With Big Bang Theory. Greek Concept of Chaos. The Concept of Space – Space as the Final Goal – Udgitha. Relationship Between Teacher And Student – The Knowledge Of Combinations, Body And Speech – Siksha Valli – Taittriya Upanishad.

UNIT III WORD 9

Aum- Speech and Breath as Pair – Chandogya Upanishad and Brihadaryanaka Upanishad. Significance of Chants, Structure of Language and Cosmic Correspondences. The Non-Dual Word – Bhartrihari's Vakyapadiyam. Sphota-Ultimate Reality Expressed Through Language. Intention. Thought 'Sabdanaor' and Speaking.

UNIT IV KNOWLEDGE AS POWER/OPPRESSION 9

Power- as Self-Realization in Gita. Krishna's Advice to Arjuna on How to Conquer Mind. Francis Bacon – Four Idols – What Prevents One From Gaining Knowledge? Michel Foucault- Knowledge as Oppression. Panopticon. Rtam (Truth) and Satyam (Eternal Truth).

UNIT V SELF KNOWLEDGE/BRAHMAN 9

Knowledge about Self, Transcendental Self. The Different Chakras and the Stages of Sublimation. Philosophy of Yoga and Siva for Union of Mind and Body. Concept of Yin/Yang. Aspects of the Feminine / Masculine.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:

1. Swami Nikhilananda: The Upanishads, Swami Nikhilananda, Advaita Ashrama, Kolkata.
2. Swamy Tapasyananda: Srimad Bhagavad Gita, The Scripture of Mankind, Sri Ramakrishna Math, Chennai.
3. Subrahmanyam, Korada: Vakyapadiyam of Bhartrhari Brahmakanda, Sri Garib Dass series.
4. Swami Lokeswarananda: Chandogya Upanishad, Swami Lokeswarananda, Ramakrishna Mission Institute of Culture, Kolkata.
5. Brahma, Apuruseya: The Four Vedas: Translated in English.
6. Haich, Elizabeth: Sexual Energy and Yoga. [11]
7. Bacon, Francis: Power as Knowledge

8. Vlastos, Gregory: Socrates Ironist and Moral Philosopher.
9. Plato: The Republic, Penguin.
10. Gutting, Garry: Foucault A Very Short Introduction, Oxford.

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE **L T P C**
3 0 0 3

UNIT I INTRODUCTION **7**
Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS **9**
Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH **11**
Abnormality, symptoms and causes psychological disorders

UNIT IV PSYCHOLOGY AND COUNSELING **7**
Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V PSYCHOLOGY AND SOCIAL BEHAVIOUR **11**
Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS

1. Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). New Jersey:Pearson/Prentice Hall
2. Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). New York: Pearson
3. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education
4. Aronson, E., Wilson, T. D., & Akert, R. M. (2010). Social Psychology (7th Ed.). Upper Saddle River, NJ: Prentice Hall

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271 GENDER, CULTURE AND DEVELOPMENT L T P C
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives

- ✓ To familiarize students with the concepts of sex and gender through literary and media texts.
- ✓ To help students ask critical questions regarding gender roles in society.
- ✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- ✓ To help students think critically about gender based problems and solutions.

Learning Outcomes

- ➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
- ➢ Students will be able to analyse current social events in the light of gender perspectives.
- ➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender

- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:

1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations

- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:

1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)
2. Video: Witness: Freeing Women From Cleaning Human Waste (2014, HRW, Manual Scavenging, India)

UNIT III: Gender Development Issues

- Identifying Gender Issues
- Gender Sensitive Language

- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:

1. The Many Faces of Gender Inequality (Essay, Amartya Sen, Frontline, Volume 18 - Issue 22, Oct. 27 - Nov. 09, 2001)
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence

- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:

1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture

- Gender and Film
- Gender, Media and Advertisement

Texts:

1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:

Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE L T P C
3 0 0 3

OBJECTIVES:

- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE

The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT

Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:

Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE

Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

Science, Technology, Consumerism, Relation with Nature and Environment, New dimension of Global Harmony: Democracy, Equality, Social Justice

TOTAL:45 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273 LAW AND ENGINEERING L T P C

3 0 0 3

UNIT I THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE 9

Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS 9

Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III BUSINESS ORGANISATIONS 9

Sole traders (Business has no separate identity from you, all business property belongs to you).

Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors– Their Powers and Responsibilities/Liabilities.

UNIT IV LAW AND SOCIETY 9

Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence**.**

UNIT V CASE STUDIES 9

Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274 FILM APPRECIATION L T P C
3 0 0 3

COURSE DESCRIPTION

This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:

- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS 9

Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM 9

History of Films – Early Cinema – Silent Movies – Talkies – Film Language, Form, Movement – Film Theories – Realist, Auteurists, Feminist, Psychonalyic, Idealogical Theories.

UNIT III FILMS ACROSS THE WORLD 9

European Films – Russian Films – Japanese Films – Korean Films – Hollywood Film – Studio Culture – All Time Great Movies.

UNIT IV INDIAN FILMS 9

The Early Era – History Of Indian Cinema – Movies for Social Change – Hindi Movies that Created Impact – Regional Movies – Documentaries – Cultural Identity.

UNIT V INTERPRETING FILMS 9

Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students will be able to:

- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods

- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation

- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)

- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment2 : Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion : Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983
5. The Encyclopedia of Indian Cinema Edited by Ashish Rajadhyaksha and Paul Willemen, BFI, 1994.

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS L T P C
3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS : -

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW 9

Language and Linguistics-Linguistic Knowledge-Knowledge of Sound Systems & Words – Creativity of Language – Relationship of form and meaning. Grammar – descriptive, prescriptive, universal-Human Language – Animal Language – Sign Language- Computers and Language.

UNIT II MORPHOLOGY - WORDS OF LANGUAGE 9

Content and function words – morphemes -free & bound –prefixes – suffixes – roots and stems – inflectional and derivational morphology-compound words and their formation – malapropisms – slips of the tongue.

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE 9

Syntax : Rules of Syntax- Sentence Structure-Structural Ambiguity-Syntactic Categories. Semantics: Lexical Semantics – Anomaly-Metaphors- Idioms- Synonyms – Antonyms – Homonyms -Pragmatics– Speech Acts

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE 9

Speech sounds- Introduction to branches of Phonetics- The Phonetic Alphabet – IPA – Consonants - Vowels – Diphthongs- Tone and Intonation.

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE 9

Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods:

Lectures, discussion.

Evaluation Internal and External:

Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES:

1. Victoria Fromkin, Robert Rodman, Nina Hyams.2019.An Introduction to Language.USA.CENGAGE.11th edition
2. Cook. G,2003. Applied linguistics.UK: Oxford University Press.

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE L T P C
3 0 0 3

OBJECTIVES

- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

UNIT I INTRODUCTION

Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral -Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II READING CULTURE

Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel's ' The night of the Scorpion' . 'Nothing's Changed'- Tatamkhulu Afrika-Apartheid. Ruskin Bond- 'Night train at Deoli'- How real life is different from movies.

UNIT III IDENTIFYING MEANING

Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar's 'Jagat Mithya'- the world as an illusion. The Indian version as 'meaninglesss meaning'.

UNIT IV POST MODERNISM

'If on a winter's night a traveler'- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V RETURNING TO PICTURES

Literature of the present- Emphasis on the visual world. Twitterature. SMS. Whatsapp language. Consumer culture. Change in fixed gender notions. Interactive sessions. Introspection.

READING LIST

1. Bond, Ruskin: 'Night train at Deoli'
2. Ezekiel, Nissim: 'The Night of the Scorpion'
3. Afrika, Tatamkhulu: 'Nothing's Changed'
4. Barthes, Roland: *Mythologies*
5. Shankaracharya: *Viveka Chudamani*
6. Camus, Albert- *The Myth of Sisyphus*
7. Calvino, Italo: *If on a winter's night a traveler*
8. Farrell, Edmund J: 'Listen, my children, and you shall read'

OUTCOMES:

- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.