ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS REGULATIONS – 2015 CHOICE BASED CREDIT SYSTEM

B.E. AUTOMOBILE ENGINEERING

Vision and Mission of 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

PEO 1: Excel in their professional career in automobile industry.

PEO 2: Exhibit research with highest professional and ethical standards.

PEO 3: Acquire knowledge in basics of automobile engineering to apply in growth of the industry.

PEO 4: Showcase professionalism, team work in their chosen profession

PEO 5: Update themselves to recent trends, technologies and industrial scenarios by pursuing lifelong learning.

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CORRELATION BETWEEN POs AND PEOs

Sl. No.	Programme Outcomes (POs)	Programme Educational Objectives				
		1	2	3	4	5
1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	✓	✓	✓	✓	✓
2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	✓	✓	✓	✓	✓
3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	✓	✓	✓	✓	✓
4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	✓	✓	✓	✓	✓
5	5**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	✓	✓	✓	✓	✓
6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	✓	✓			

7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	✓	✓			
8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	✓		✓	✓	
9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	✓	✓	✓	✓	
10	1**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	✓	✓	✓	✓	✓
11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	✓	✓	✓		
12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	✓	✓	✓		✓

Program Specific Outcomes (PSOs):

PSO 1: The graduate will be able to apply mathematical, scientific, engineering concepts to deliver environmentally friendly and workable products in the automotive engineering domain as a part of a multidisciplinary team using modern tools.

PSO 2: The graduate will be able to undertake a successful engineering career, higher studies, research, entrepreneur through lifelong learning and maintaining professional ethics.

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs) AND PROGRAM SPECIFIC OUTCOMES (PSOs)

Year	Semester	Courses	POs												PSOs	
			1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	I	Foundation English	2	-	-	-	1	-	-	1	3	1	-	3	2	2
		Mathematics-I	3	2	2	2	1	-	-	1	1	1	-	2	2	2
		Engineering Physics	3	2	2	2	1	-	-	1	1	1	-	2	2	2
		Engineering Chemistry	3	1	2	2	1	-	-	1	1	1	-	2	2	2
		Engineering Graphics	3	3	3	3	3	-	-	1	1	1	-	3	3	3
		Basic Sciences Laboratory	3	2	2	2	2	1	-	1	3	2	-	3	3	3
		Engineering Practices Laboratory	3	2	2	2	1	1	-	1	3	2	-	3	3	3
	II	Technical English	2	-	-	-	1	-	-	1	3	1	-	3	2	2
		Mathematics-II	3	2	2	2	1	-	-	1	1	1	-	2	2	2
		Computing Techniques	3	3	3	3	2	-	-	1	1	1	-	3	2	2
		Materials Science	3	2	2	2	1	-	-	1	1	1	-	2	2	2
		Engineering Mechanics	3	3	3	3	2	-	-	1	1	1	-	3	3	3
		Production Processes	3	3	2	2	3	-	-	1	1	1	-	3	3	3
		Computer Practices Laboratory	3	2	2	2	3	-	-	2	3	2	-	3	2	2
		Production Processes Laboratory	3	2	2	2	3	-	-	2	3	2	-	3	3	3

Year	Semester	Courses	POs												PSOs	
			1	2	3	4	5	6	7	8	9	10	11	12	1	2
2	III	Environmental Science and Engineering	2	1	-	-	1	2	3	1	1	1	-	3	2	2
		Numerical Methods	3	2	1	1	1	-	-	1	1	1	-	3	2	2
		Mechanics of Solids	3	3	2	2	1	2	2	1	2	1	-	2	3	3
		Thermodynamics and Thermal Engineering	2.2	2.2	2.2	1	1	1	1.4	1	1	2.2	-	2	2.8	2.8
		Electrical and Electronics Engineering	3	2	2	2	1	1	1	1	1	1	-	2	2	2
		Automotive Petrol Engines	3	3	3	3	1	1	1.4	1	1	2.2	-	2	3	3
		Mechanical Testing and IC Engines Laboratory	3	3	2	3	3	3	3	1	3	3	2	3	3	3
		Electrical and Electronics Engineering Laboratory	3	3	2	3	3	3	3	1	3	3	2	2	2	2
	IV	Engineering Fluid Mechanics and Machinery	3	3	2	3	2	1	2	1	2	1	-	3	3	3
		Kinematics and Dynamics of Machines	3	3	3	3	3	2	1	1	2	2	-	3	3	3
		Theory of Fuels and Lubricants	3	3	2	2	3	3	3	2	2	2	-	3	3	3

		Automotive Diesel Engines	3	3	3	3	1	2	2	1	2	2	-	3	3	3
		Automotive Chassis	3	3	3	3	3	2	1	1	2	2	1	3	3	3
		Metrology and Measurement System	3	3	3	1	3	2	1	1	2	2	-	3	2	2
		Automotive Engine and Chassis Components Laboratory	3	3	3	3	3	2	1	2	3	3	1	3	3	3
		Fuels and Lubricants Laboratory	3	3	3	3	3	2	1	2	3	3	1	3	3	3

Year	Semester	Courses	POs												PSOs	
			1	2	3	4	5	6	7	8	9	10	11	12	1	2
3	V	Automotive Component Design	3	3	3	3	3	2	2	1	1	1	-	3	3	3
		Automotive Transmission	3	3	3	3	2	1	1	1	2	2	-	3	3	3
		Electronic Engine Management System	3	3	3	3	2	1	2	1	1	1	-	3	3	3
		Automotive Electrical and Electronics Systems	3	3	3	3	2	1	1	1	2	2	-	3	3	3
		Automotive Electrical and Electronics Laboratory	3	3	3	3	3	1	1	1	3	3	-	3	3	3

		Simulation of Engine and chassis Components Laboratory	3	3	3	3	3	1	1	3	3	3	1	3	3	3
	VI	Automotive Pollution and Control	3	3	3	3	3	3	3	2	1	1	-	3	3	3
		Vehicle Body Engineering	3	3	3	3	3	1	2	1	1	1	-	3	3	3
		Vehicle Control System	3	3	3	3	3	1	1	1	1	1	-	3	3	3
		Hybrid and Electric Vehicles	3	3	3	3	3	3	3	1	1	1	-	3	3	3
		Creative and Innovative Project	3	3	3	2	2	2	2	3	3	3	3	3	3	3
		Engine Testing and Emission Measurement Laboratory	3	3	3	3	3	3	3	3	3	2	1	3	3	3

Year	Semester	Courses	POs												PSOs	
			1	2	3	4	5	6	7	8	9	10	11	12	1	2
4	VII	Hydraulic and Pneumatic Systems	3	3	3	3	3	1.2	1.6	1	1	-	1.6	1.2	2.8	2.8
		Vehicle Dynamics	3	3	3	3	3	-	-	1	2	1	-	3	3	3
		Engineering Ethics and Human Values	2	1	1	3	-	3	3	3	1	1	1	3	3	3

		Industrial Training and Seminar	3	3	3	3	3	1	2	2	-	3	1	3	3	3
		Vehicle Testing Laboratory	3	3	3	3	3	3	1	1	3	1	-	3	3	3
	VIII	Project Work	3	3	3	3	3	2	2	2	3	3	3	3	3	3

SL. NO.	**COURSE TITLE**	**POs**												**PSOs**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	1	2
1.	Advanced Theory of IC Engines	3	3	3	3	3	1	1	1	2	1	-	3	3	3
2.	Advanced Vehicle Technology	3	3	3	3	3	1	1	1	3	3	-	3	3	3
3.	Alternative Fuels and Energy System	3	3	3	3	3	2	2	2	2	2	1	3	3	3
4.	Automotive Aerodynamics	2.2	2.6	2.6	2.2	2	-	3	1.6	2	1	-	2.4	3	3
5.	Automotive Automation	2	2	2	2	2	1	-	2	1	1	-	3	2	2
6.	Automotive Materials	3	3	2	-	1	1	2	1	2	1	-	3	3	3
7.	Automotive Test Instrumentation	2.8	3	1.6	2.8	2	-	2.8	2.8	2.6	2.8	2.6	2.2	2	2
8.	Combustion Thermodynamics and Heat Transfer	3	3	3	3	3	1	2	1	1	1	-	3	3	3
9.	Computational Fluid Mechanics	3	3	3	3	3	-	-	1	1	1	-	3	3	3
10.	Finite Element Techniques	3	3	3	3	3	1	1	1	2	1	-	3	3	3
11.	Manufacturing of	3	3	3	3	3	3	2	1	1	1	1	2	2	2

	Automotive Components														
12.	Noise, Vibration and Harshness	2.6	2.6	2.6	2.6	2.4	2.4	2.4	1	1	1	-	3	3	3
13.	Off Highway Vehicles	2	2	2	2	2	2.8	2	1	1	1	-	3	3	3
14.	Polymer Components in Automotive Applications	2	1	1	1	-	1	2	1	1	1	-	3	3	3
15.	Principles of Control Systems	2	2	2	2	2	-	-	1	1	1	-	2	2	2
16.	Quality Control and Reliability	2	1	1	1	1	1	1	1	1	1	-	2	2	2
17.	Simulation of IC Engines	3	3	3	3	3	1	1	1	1	1	-	3	3	3
18.	Two and Three Wheeler Technology	2	1	2	1	1	1	-	1	1	1	-	3	3	3
19.	Vehicle Air-Conditioning	3	3	3	3	3	1	1	1	1	1	-	3	3	3
20.	Vehicle Maintenance	3	-	2	2	3	1	1	1	1	1	1	3	3	3
21.	Vehicle Multiplexing	3	3	2	2	2	-	-	1	1	1	-	3	3	3
22.	Virtual Instrumentation in Automobile Engineering	3	3	2	2	1	-	-	1	1	1	-	2	3	3
23.	Disaster Management	3	2	2	2	1	3	2	1	1	1	-	2	2	2
24.	Fundamentals of Nano Science	3	3	3	3	1	1	1	1	1	1	-	3	3	3
25.	Human Rights	2	-	-	-	-	3	2	2	2	1	-	2	2	2
26.	Total Quality Management	3	3	2	1	1	3	2	3	2	1	3	3	2	2
27.	Quantitative Techniques in Management	3	2	1	1	1	1	1	3	2	1	3	3	2	2
28.	Foundation Skills in Integrated Product Development	3	3	2	2	2	-	-	3	2	1	-	2	2	2

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

B.E. AUTOMOBILE ENGINEERING

REGULATIONS – 2015

CHOICE BASED CREDIT SYSTEM

CURRICULA AND SYLLABI I - VIII SEMESTERS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS7151	Foundational English	HS	4	4	0	0	4
2.	MA7151	Mathematics – I	BS	4	4	0	0	4
3.	PH7151	Engineering Physics	BS	3	3	0	0	3
4.	CY7151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE7152	Engineering Graphics	ES	5	3	2	0	4
PRACTICAL								
6.	BS7161	Basic Sciences Laboratory	BS	4	0	0	4	2
7.	GE7162	Engineering Practices Laboratory	ES	4	0	0	4	2
			TOTAL	**27**	**17**	**2**	**8**	**22**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS7251	Technical English	HS	4	4	0	0	4
2.	MA7251	Mathematics - II	BS	4	4	0	0	4
3.	GE7151	Computing Techniques	ES	3	3	0	0	3
4.	PH7251	Materials Science	BS	3	3	0	0	3
5.	GE7153	Engineering Mechanics	ES	4	4	0	0	4
6.	PR7251	Production Processes	ES	3	3	0	0	3
PRACTICAL								
7.	GE7161	Computer Practices Laboratory	ES	4	0	0	4	2
8.	PR7261	Production Processes Laboratory	ES	4	0	0	4	2
			TOTAL	**29**	**21**	**0**	**8**	**25**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AE7352	Mechanics of Solids	ES	3	3	0	0	3
2.	AU7301	Automotive Petrol Engines	PC	3	3	0	0	3
3.	AU7302	Thermodynamics and Thermal Engineering	ES	4	4	0	0	4
4.	EI7306	Electrical and Electronics Engineering	ES	3	3	0	0	3
5.	GE7251	Environmental Science and Engineering	HS	3	3	0	0	3
6.	MA7354	Numerical Methods	BS	4	4	0	0	4
PRACTICAL								
7.	AU7311	Mechanical Testing and IC Engines Laboratory	BS	4	0	0	4	2
8.	EE7261	Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2
			TOTAL	**28**	**20**	**0**	**8**	**24**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AE7351	Engineering Fluid Mechanics and Machinery	ES	3	3	0	0	3
2.	AU7401	Automotive Chassis	PC	3	3	0	0	3
3.	AU7402	Automotive Diesel Engines	PC	3	3	0	0	3
4.	AU7403	Metrology and Measurement System	PC	3	3	0	0	3
5.	AU7404	Theory of Fuels and Lubricants	PC	3	3	0	0	3
6.	PR7451	Kinematics and Dynamics of Machines	ES	4	4	0	0	4
PRACTICAL								
7.	AU7411	Automotive Engine and Chassis Components Laboratory	PC	4	0	0	4	2
8.	AU7412	Fuels and Lubricants Laboratory	PC	4	0	0	4	2
			TOTAL	**27**	**19**	**0**	**8**	**23**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AU7501	Automotive Components Design	PC	3	3	0	0	3
2.	AU7502	Automotive Electrical and Electronics Systems	PC	3	3	0	0	3
3.	AU7503	Automotive Transmission	PC	3	3	0	0	3
4.	AU7504	Electronic Engine Management System	PC	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
6.		Professional Elective II	PE	3	3	0	0	3
PRACTICAL								
7.	AU7511	Automotive Electrical and Electronics Laboratory	PC	4	0	0	4	2
8.	AU7512	Simulation of Engine and Chassis Components Laboratory	PC	4	0	0	4	2
			TOTAL	**26**	**18**	**0**	**8**	**22**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AU7601	Automotive Pollution and Control	PC	3	3	0	0	3
2.	AU7602	Hybrid and Electric Vehicles	PC	3	3	0	0	3
3.	AU7603	Vehicle Body Engineering	PC	3	3	0	0	3
4.	AU7604	Vehicle Control System	PC	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
6.		Open Elective- I*	OE	3	3	0	0	3
PRACTICAL								
7.	AU7611	Creative and Innovative Project	EEC	4	0	0	4	2
8.	AU7612	Engine Testing and Emission Measurement Laboratory	PC	4	0	0	4	2
			TOTAL	**26**	**18**	**0**	**8**	**22**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	AU7701	Hydraulic and Pneumatics Systems	PC	3	3	0	0	3
2.	AU7702	Vehicle Dynamics	PC	3	3	0	0	3
3.	GE7351	Engineering Ethics and Human Values	HS	3	3	0	0	3
4.		Professional Elective IV	PE	3	3	0	0	3
5.		Professional Elective V	PE	3	3	0	0	3
6.		Open Elective- II*	OE	3	3	0	0	3
PRACTICAL								
7.	AU7711	Vehicle Testing Laboratory	PC	4	0	0	4	2
8.	AU7712	Industrial Training and Seminar	EEC	4	0	0	4	2
			TOTAL	**26**	**18**	**0**	**8**	**22**

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Professional Elective VI	PE	3	3	0	0	3
2.		Professional Elective VII	PE	3	3	0	0	3
PRACTICAL								
3.	AU7811	Project work	EEC	20	0	0	20	10
			TOTAL	**26**	**6**	**0**	**20**	**16**

TOTAL NO. OF CREDITS:176

***Course from the curriculum of other UG Programmes**

HUMANITIES AND SOCIAL SCIENCES (HS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS7151	Foundational English	HS	4	4	0	0	4
2.	HS7251	Technical English	HS	4	4	0	0	4
3.	GE7251	Environmental Science and Engineering	HS	3	3	0	0	3
4.	GE7351	Engineering Ethics and Human Values	HS	3	3	0	0	3

BASIC SCIENCES (BS)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA7151	Mathematics – I	BS	4	4	0	0	4
2.	PH7151	Engineering Physics	BS	3	3	0	0	3
3.	CY7151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS7161	Basic Sciences Laboratory	BS	4	0	0	4	2
5.	MA7251	Mathematics - II	BS	4	4	0	0	4
6.	PH7251	Materials Science	BS	3	3	0	0	3
7.	MA7354	Numerical Methods	BS	4	4	0	0	4
8.	AU7311	Mechanical Testing and IC Engines Laboratory	BS	4	0	0	4	2

ENGINEERING SCIENCES (ES)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE7152	Engineering Graphics	ES	5	3	2	0	4
2.	GE7162	Engineering Practices Laboratory	ES	4	0	0	4	2
3.	GE7153	Engineering Mechanics	ES	4	4	0	0	4
4.	PR7251	Production Processes	ES	3	3	0	0	3
5.	PR7261	Production Processes Laboratory	ES	4	0	0	4	2
6.	AE7352	Mechanics of Solid	ES	3	3	0	0	3
7.	AU7302	Thermodynamics and Thermal Engineering	ES	4	4	0	0	4
8.	EI7306	Electrical and Electronics Engineering	ES	3	3	0	0	3
9.	EE7261	Electrical and Electronics Engineering Laboratory	ES	4	0	0	4	2
10.	AE7351	Engineering Fluid Mechanics and Machinery	ES	**3**	3	0	0	3
11.	PR7451	Kinematics and Dynamics of Machines	ES	4	4	0	0	4
12.	GE7161	Computer Practice	ES	4	0	0	4	2

		Laboratory						
13.	GE7151	Computing Techniques	ES	3	3	0	0	3

PROFESSIONAL CORE (PC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AU7301	Automotive Petrol Engines	PC	3	3	0	0	3
2.	AU7404	Theory of Fuels and Lubricants	PC	3	3	0	0	3
3.	AU7402	Automotive Diesel Engines	PC	3	3	0	0	3
4.	AU7401	Automotive Chassis	PC	3	3	0	0	3
5.	AU7403	Metrology and Measurement System	PC	3	3	0	0	3
6.	AU7411	Automotive Engine and Chassis Components Laboratory	PC	4	0	0	4	2
7.	AU7412	Fuels and Lubricants Laboratory	PC	4	0	0	4	2
8.	AU7501	Automotive Components Design	PC	3	3	0	0	3
9.	AU7503	Automotive Transmission	PC	3	3	0	0	3
10.	AU7504	Electronic Engine Management System	PC	3	3	0	0	3
11.	AU7502	Automotive Electrical and Electronics Systems	PC	3	3	0	0	3
12.	AU7511	Automotive Electrical and Electronics Laboratory	PC	4	0	0	4	2
13.	AU7512	Simulation of Engine and Chassis Components Laboratory	PC	4	0	0	4	2
14.	AU7601	Automotive Pollution and Control	PC	3	3	0	0	3
15.	AU7603	Vehicle Body Engineering	PC	3	3	0	0	3
16.	AU7604	Vehicle Control System	PC	3	3	0	0	3
17.	AU7602	Hybrid and Electric Vehicles	PC	3	3	0	0	3
18.	AU7612	Engine Testing and Emission Measurement Laboratory	PC	4	0	0	4	2
19.	AU7701	Hydraulic and Pneumatic Systems	PC	3	3	0	0	3
20.	AU7702	Vehicle Dynamics	PC	3	3	0	0	3
21.	AU7711	Vehicle Testing Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AU7001	Advanced Theory of IC Engines	PE	3	3	0	0	3
2.	AU7002	Advanced Vehicle Technology	PE	3	3	0	0	3
3.	AU7003	Alternative Fuels and Energy System	PE	3	3	0	0	3
4.	AU7004	Automotive Aerodynamics	PE	3	3	0	0	3
5.	AU7005	Automotive Automation	PE	3	3	0	0	3
6.	AU7006	Automotive Materials	PE	3	3	0	0	3
7.	AU7007	Automotive Test Instrumentation	PE	3	3	0	0	3
8.	AU7008	Combustion Thermodynamics and Heat Transfer	PE	3	3	0	0	3
9.	AU7009	Computational Fluid Mechanics	PE	3	3	0	0	3
10.	AU7010	Finite Element Techniques	PE	3	3	0	0	3
11.	AU7011	Manufacturing of Automotive Components	PE	3	3	0	0	3
12.	AU7012	Noise, Vibration and Harshness	PE	3	3	0	0	3
13.	AU7013	Off Highway Vehicles	PE	3	3	0	0	3
14.	AU7014	Polymer Components in Automotive Applications	PE	3	3	0	0	3
15.	AU7015	Principles of Control Systems	PE	3	3	0	0	3
16.	AU7016	Quality Control and Reliability	PE	3	3	0	0	3
17.	AU7017	Simulation of IC Engines	PE	3	3	0	0	3
18.	AU7018	Two and Three Wheeler Technology	PE	3	3	0	0	3
19.	AU7019	Vehicle Air-Conditioning	PE	3	3	0	0	3
20.	AU7020	Vehicle Maintenance	PE	3	3	0	0	3
21.	AU7021	Vehicle Multiplexing	PE	3	3	0	0	3
22.	AU7022	Virtual Instrumentation in Automobile Engineering	PE	3	3	0	0	3
23.	GE7071	Disaster Management	PE	3	3	0	0	3
24.	GE7073	Fundamentals of Nano Science	PE	3	3	0	0	3
25.	GE7074	Human Rights	PE	3	3	0	0	3
26.	GE7652	Total Quality Management	PE	3	3	0	0	3
27.	PR7452	Quantitative Techniques in Management	PE	4	4	0	0	4
28.	GE7072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	AU7611	Creative and Innovative Project	EEC	4	0	0	4	2
2.	AU7712	Industrial Training and Seminar	EEC	4	0	0	4	2
3.	AU7811	Project work	EEC	20	0	0	20	10

SUMMARY

SL. NO.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HS	04	04	03	00	00	00	03	00	14
2.	BS	12	07	06	00	00	00	00	00	25
3.	ES	06	14	12	07	00	00	00	00	39
4.	PC	00	00	03	16	16	14	08	00	57
5.	PE	00	00	00	00	06	03	06	06	21
6.	OE	00	00	00	00	00	03	03	00	06
7.	EEC	00	00	00	00	00	02	02	10	14
	Total	22	25	24	23	22	22	22	16	176
8.	Non Credit / Mandatory									

HS7151 FOUNDATIONAL ENGLISH L T P C
4 0 0 4

COURSE DESCRIPTION:

- This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:

- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students' communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS

UNIT I GREETING AND INTRODUCING ONESELF 12

Listening- Types of listening – Listening to short talks, conversations; **Speaking** – Speaking about one's place, important festivals etc. – Introducing oneself, one's family/ friend; **Reading** – Skimming a passage– Scanning for specific information; **Writing**- Guided writing - Free writing on any given topic (My favourite place/ Hobbies/ School life, writing about one's leisure time activities, hometown, etc.); **Grammar** – Tenses (present and present continuous) -Question types - Regular and irregular verbs; **Vocabulary** – Synonyms and Antonyms.

UNIT II GIVING INSTRUCTIONS AND DIRECTIONS 12

Listening – Listening and responding to instructions; **Speaking** – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; **Reading** – Reading and finding key information in a given text - Critical reading - **Writing –**Process description(non-technical)- **Grammar** – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - **Vocabulary** – Compound words – Word formation – Word expansion (root words).

UNIT III READING AND UNDERSTANDING VISUAL MATERIAL 12

Listening- Listening to lectures/ talks and completing a task; **Speaking** –Role play/ Simulation – Group interaction; **Reading** – Reading and interpreting visual material; **Writing**- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative);**Grammar** – Tenses (perfect), Conditional clauses –Modal verbs; **Vocabulary** –Cause and effect words; Phrasal verbs in context.

UNIT IV CRITICAL READING AND WRITING 12

Listening- Watching videos/ documentaries and responding to questions based on them; **Speaking** Informal and formal conversation; **Reading** –Critical reading (prediction & inference);**Writing**–Essay writing (compare & contrast/ analytical) – Interpretation of visual materials; **Grammar** – Tenses (future time reference);**Vocabulary** – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V LETTER WRITING AND SENDING E-MAILS 12

Listening- Listening to programmes/broadcast/ telecast/ podcast; **Speaking** – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation; **Reading** –Extensive reading; **Writing**- Poster making – Letter writing (Formal and E-mail) ;**Grammar** – Direct and Indirect speech – Combining sentences using connectives; **Vocabulary** –Collocation;

TEACHING METHODS:

Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.

EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL:60 PERIODS

OUTCOMES:

- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXT BOOK:

1. Richards, Jack.C with Jonathan Hull and Susan Proctor **New Interchange : English for International Communication. (level2, Student's Book)** Cambridge University Press,New Delhi: 2010.

REFERENCES:

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Morgan, David and Nicholas Regan. **Take-Off: Technical English for Engineering**. London: Garnet Publishing Limited, 2008.
3. Redston, Chris & Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skills for Business English.** Cambridge University Press, Cambridge: Reprint 2011.

MA7151	MATHEMATICS – I	L	T	P	C
	(Common to all branches of B.E. / B.Tech. Programmes in I Semester)	4	0	0	4

OBJECTIVES:

- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit funns – 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 III 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 IV 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.

UNIT V DIFFERENTIAL EQUATIONS 12

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

TOTAL: 60 PERIODS

OUTCOMES:

- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXT BOOKS:

1. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, New Delhi, 2008.
2. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2014.
4. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH7151 **ENGINEERING PHYSICS** **L T P C**

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

OBJECTIVE:

- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics
- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals

UNIT I PROPERTIES OF MATTER 9

Elasticity – Poisson's ratio and relationship between moduli (qualitative) - stress-strain diagram for ductile and brittle materials, uses - factors affecting elastic modulus and tensile strength - bending of beams - cantilever - bending moment - Young's modulus determination - theory and experiment - uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - calculation of reverberation time for different types of buildings – sound absorbing materials - factors affecting acoustics of buildings : focussing, interference, echo, echelon effect, resonance - noise and their remedies. Ultrasonics: production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating – ultrasonic interferometer - industrial applications – Non-destructive testing - ultrasonic method: scan modes and practice.

UNIT III THERMAL AND MODERN PHYSICS 9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media - Forbe's and Lee's disc method: theory and experiment- Black body radiation – Planck's theory (derivation) – Compton effect – wave model of radiation and matter – Schrödinger's wave equation – time dependent and independent equations – Physical significance of wave function – particle in a one dimensional box.

UNIT IV APPLIED OPTICS 9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its applications - Lasers – principle and applications – Einstein's coefficients – CO_2 and Nd:YAG laser - semiconductor lasers: homo junction and hetro junction - construction and working – applications. Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

OUTCOME:

- The students will understand different moduli of elasticity, their determination and applications.
- The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics
- The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
- The students will gain knowledge on interferometers, lasers and fiber optics
- The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.

TEXT BOOKS:

1. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publications (2013)
2. Palanisamy P.K., "Engineering Physics", Scitech Publications (P) Ltd. (2006).
3. Arumugam M., "Engineering Physics", Anuradha Publications (2000)

REFERENCES:

1. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co. (2010).
2. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics". W.H.Freeman, (2007).
3. Markert J.T.,Ohanian, H. and Ohanian, M. "Physics for Engineers and Scientists". W.W.Norton & Co. (2007).

CY7151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES

- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

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.

UNIT II SURFACE CHEMISTRYAND CATALYSIS 9

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions-Types of isotherms–Frendlich adsorption isotherm, Langmuir adsorption isotherm. Industrial applications of adsorption. Catalysis: Characteristics and types of catalysts-homogeneous and heterogeneous, auto catalysis. Enzyme catalysis -factors affecting enzyme catalysis, Michaelis- Menton equation. Industrial applications of catalysts.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry-Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes-internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV CHEMICAL THERMODYNAMICS 9

Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van't Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANOCHEMISTRY 9

Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Preparation of nanoparticles – sol-gel and solvothermal. Preparation of carbon nanotube by chemical vapour deposition and laser ablation. Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning. Properties and uses of nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

TOTAL: 45 PERIODS

OUTCOMES

- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXT BOOKS

1. Jain P. C. & Monica Jain., "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd, New Delhi, 2014.
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014

REFERENCES

1. Pahari A., Chauhan B., "Engineering Chemistry", Firewall Media, New Delhi, 2012.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. AshimaSrivastava. Janhavi N N, Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
4. Vairam S., Kalyani P., Suba Ramesh., "Engineering Chemistry", Wiley India Pvt Ltd., New Delhi., 2011.

GE7152 ENGINEERING GRAPHICS L T P C
3 2 0 4

OBJECTIVES

• To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

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 eccentricity method – 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 14

Orthographic projection- principles-Principal 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 14

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 14

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 15

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.

L=45+T=30, TOTAL: 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, planes and solids
- Obtain development of surfaces.
- Prepare isometric and perspective views of simple solids.

TEXT BOOK:

1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.

REFERENCES:

1. K.R.Gopalakrishna., "Engineering Drawing" (Vol I&II combined) SubhasStores, Bangalore, 2007
2. Luzzader, Warren.J., and Duff,John M.,'' Fundamentals of Engineering Drawingwith an introduction to Interactive Computer Graphics for Design and Production",Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P)Limited ,2008.
5. K. V.Natarajan, "A text book of Engineering Graphics", 28th Edition, Dhanalakshmi Publishers, Chennai, 2015.
6. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. N.S Parthasarathy and Vela Murali, " Engineering Drawing", Oxford University Press, 2015

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out ofdrawing 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. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

BS7161	**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)

OBJECTIVE:

- 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, band gap determination and viscosity of liquids.

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. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille‟s flow

OUTCOME:

- 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)

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 poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 60 PERIODS

TEXT BOOKS

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

GE7162	ENGINEERING PRACTICES LABORATORY (Common to all Branches of B.E. / B.Tech. Programmes)	L	T	P	C
		0	0	4	2

OBJECTIVES

To provide exposure to the students with hands-on experience on various Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES **15**

PLUMBING

Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

• Laying pipe connection to the suction side of a pump.
• Laying pipe connection to the delivery side of a pump.
• Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK

Sawing, planing and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

STUDY

• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICES **15**

• Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
• Stair case light wiring
• Tube – light wiring
• Preparation of wiring diagrams for a given situation.
• Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS) **15**

3. MECHANICAL ENGINEERING PRACTICES

WELDING

• Arc welding of Butt Joints, Lap Joints, and Tee Joints
• Gas welding Practice.
• Basic Machining - Simple turning, drilling and tapping operations..
• Study and assembling of the following:

Centrifugal pump

a. Mixie
b. Air Conditioner.
c. DEMONSTRATION ON FOUNDRY OPERATIONS.

4. ELECTRONIC ENGINEERING PRACTICES **15**

• Soldering simple electronic circuits and checking continuity.
• Assembling electronic components on a small PCB and Testing.
• Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS

OUTCOMES

- Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
- Ability to use welding equipments to join the structures
- Ability to do wiring for electrical connections and to fabricate electronics circuits.

HS7251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES

- To enable students acquire proficiency in technical communication.
- To enhance their reading and writing skills in a technical context.
- To teach various language learning strategies needed in a professional environment.

CONTENTS

UNIT I ANALYTICAL READING 12

Listening- Listening to informal and formal conversations; **Speaking** – Conversation Skills (opening, turn taking, closing)- explaining how something works-describing technical functions and applications; **Reading** –Analytical reading, Deductive and inductive reasoning; **Writing**- vision statement–structuring paragraphs.

UNIT II SUMMARISING 12

Listening- Listening to lectures/ talks on Science & Technology; **Speaking** –Summarizing/ Oral Reporting, **Reading** – Reading Scientific and Technical articles; **Writing**- Extended definition –Lab Reports – Summary writing.

UNIT III DESCRIBING VISUAL MATERIAL 12

Listening- Listening to a panel discussion; **Speaking** – Speaking at formal situations; **Reading** – Reading journal articles - Speed reading; **Writing**-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques

UNIT IV WRITING/ E-MAILING THE JOB APPLICATION 12

Listening- Listening to/ Viewing model interviews; **Speaking** –Speaking at different types of interviews – Role play practice (mock interview); **Reading** – Reading job advertisements and profile of the company concerned; **Writing**- job application – cover letter –Résumé preparation.

UNIT V REPORT WRITING 12

Listening- Viewing a model group discussion; **Speaking** –Participating in a discussion - Presentation; **Reading** – Case study - analyse -evaluate – arrive at a solution; **Writing**– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

TEACHING METHODS:

Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

EVALUATION PATTERN:

Internals – 50%
End Semester – 50%

TOTAL:60 PERIODS

OUTCOMES

- Students will learn the structure and organization of various forms of technical communication.
- Students will be able to listen and respond to technical content.
- Students will be able to use different forms of communication in their respective fields.

TEXT BOOK:

1. Craig, Thaine**. Cambridge Academic English: An integrated skills course for EAP(Student's Book)Level: Intermediate** Cambridge University Press, New Delhi: 2012

REFERENCES:

1. Laws, Anne. **Presentations.** Hyderabad: Orient Blackswan, 2011.
2. Ibbotson, Mark. **Cambridge English for Engineering**. Cambridge University Press, Cambridge,New Delhi: 2008
3. Naterop, Jean B. and Rod Revell. **Telephoning in English**. Cambridge: Cambridge University Press, 2004.
4. Rutherford, Andrea J. **Basic Communication Skills for Technology**. New Delhi: Pearson Education, 2001.
5. Bailey, Stephen. **Academic Writing A practical Guide for Students**. Routledge, London: 2004
6. Hewings, Martin**. Cambridge Academic English: An integrated skills course for EAP(Student's Book)Level: Intermediate** Cambridge University Press, New Delhi: 2012.

MA7251	MATHEMATICS - II	L	T	P	C
	(Common to all branches of B.E. / B.Tech. Programmes in II Semester)	**4**	**0**	**0**	**4**

OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of the electric current.
- To make the student 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 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 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, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION 12

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

UNIT IV 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 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

OUTCOMES:

- Upon successful completion of the course, students should be able to:
- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems
- Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
- Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2014.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:

1. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2010.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
4. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
5. Peter V. O'Neil , "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

GE7151 COMPUTING TECHNIQUES L T P C
(Common to all branches of Engineering and Technology) 3 0 0 3

OBJECTIVE

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures - Unions

TOTAL : 45 PERIODS

OUTCOMES

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

- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort**.**
- Use programming language to solve problems.

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Byron S Gottfried, “Programming with C”, Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007

PH7251	MATERIALS SCIENCE (Common to Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering)	L T P C 3 0 0 3

OBJECTIVE:

- To impart knowledge on the basics of binary phase diagrams and their applications
- To learn the phase diagram, effect of alloying elements and various transformations in the Fe-C system, and also the heat treatment of steels.
- To introduce various strengthening methods of materials, and also various mechanical properties and their measurement
- To instill the types, properties and applications of magnetic, dielectric and superconducting materials.
- To introduce the preparation, properties and applications of various new materials.

UNIT I PHASE DIAGRAMS 9

Solid solutions - Hume Rothery's rules - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II FERROUS ALLOYS AND HEAT TREATMENT 9

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructue of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, baintic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

UNIT III MECHANICAL PROPERTIES 9

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS 9

Ferromagnetism – Domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites - dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials, properties, types and applications.

UNIT V NEW MATERIALS 9

Ceramics – types and applications – Composites: classification, role of matrix and reinforcement – processing of fiber reinforced plastics – Metallic glasses – types , glass forming ability of alloys – Inoue criteria – melt spinning process – applications - Shape memory alloys – phases, shape memory effect, pseudoelastic effect – NiTi alloy – applications- Nanomaterials – preparation: ball milling and chemical vapour deposition - properties and applications – carbon nanotubes - Biomaterials

TOTAL: 45 PERIODS

OUTCOME:

Upon completion of this course, the students will

- gain knowledge on the basics of binary phase diagrams and the use of lever rule
- learn about the Fe-C phase diagram, effect of alloying elements, TTT in the Fe-C system, and also the heat treatment of steels.
- understand the significance of dislocations, strengthening mechanisms, and tensile, creep, hardness and fracture behavior of materials
- acquire knowledge on the types, properties and applications of magnetic, dielectric and superconducting materials.
- get adequate understanding on the preparation, properties and applications of ceramics, composites, metallic glasses, shape-memory alloys and nanomaterials.

TEXT BOOKS:

1. Raghavan, V. “Physical Metallurgy: Principles and Practice”, Phi Learning (2009).
2. Balasubramaniam, R. “Callister's Materials Science and Engineering”, Wiley India Pvt. Ltd. (2014).
3. Palanisamy P.K., “Materials Science” , Scitech (2013).

REFERENCES:

1. Raghavan, V. “Materials Science and Engineering”, Printice Hall of India (2007).
2. Shackelford, J.F. “Introduction to Materials Science for Engineers”. Pearson India (2006).
3. Donald Askeland. “Materials Science and Engineering”, Brooks/Cole (2010).
4. Smith, W.F., Hashemi, J. and R.Prakash. “Materials Science and Engineering”,Tata Mcgraw Hill Education Private Limited (2014).

GE7153	ENGINEERING MECHANICS	L	T	P	C
		4	0	0	4

OBJECTIVE :

- The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I STATICS OF PARTICLES **12**

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.

UNIT II EQUILIBRIUM OF RIGID BODIES **12**

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 16

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center 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 8

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

UNIT V DYNAMICS OF PARTICLES 12

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.

L – 45 + T – 15 TOTAL: 60 PERIODS

OUTCOME:

- Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw-Hill Education (India) Pvt. Ltd. 10th Edition, 2013.

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
2. J.L. Meriam & L.G. Karige, Engineering Mechanics: Statics (Volume I) and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
3. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
4. Irving H. Shames, G. Krishna Mohana Rao, Engineering Mechanics - Statics and Dynamics, Fourth Edition – PHI / Pearson Education Asia Pvt. Ltd., 2006.
5. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

PR7251	PRODUCTION PROCESSES (Common to Aero/Auto/Rubber and Plastics)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the knowledge about the various production processes available
- To expose the student on the principle and applications of the processes
- To make a decision on a relevant process based on the merits and demerits.

UNIT I CASTING PROCESSES 10

Methods of production processes – comparison – sand casting – mould, pattern, die – pattern allowances – materials – types – 2 and 3 box moulding process – steps involved – core function and core making – runner, riser, gate-purpose – construction, principle, merits, demerits and applications of die casting, shell moulding, investment casting, centrifugal casting, continuous casting squeeze casting.

UNIT II METAL FORMING PROCESSES 8

Definition and companion of hot and cold forming – Principle, construction, types, merits, demerits and application of forging, rolling, extrusion, spinning processes – sheet metal operations – Types of dies used – Principle of powder metallurgy – steps involved – merits, demerits and applications.

UNIT III MACHINING PROCESSES 9

Machine and machine tool – construction, types operations in the following machines with block diagrams – Lathe, Milling, Drilling and Grinding – Concept of NC/CNC machines – Comparison of CNC with conventional machines – sample manual part programming for CNC Lathe and milling.

UNIT IV WELDING PROCESSES 9

Types of joining – soldering, brazing, welding, Chemical and mechanical – Fusion welding process – Gas welding – flame types – applications = Arc welding – types of joint – electrode – power supply – edge preparation – weld symbol – filler material – flux/ shielding gases – arc theory – Construction and applications of types of arc welding – Manual, GTAW, GMAW, SAW, ESW – Thermit welding, Pressure welding – resistance welding – spot, seam, projection and flash butt welding – stud welding – friction stir welding – diffusion bonding.

UNIT V UNCONVENTIONAL MACHINING PROCESSES 9

Need for unconventional – Construction, working principle merits, demerits and applications with block diagram only for AJM, AWJM, USM, CHM, ECM, EDM, EBM, LBM, PAM and IBM.

TOTAL: 45 PERIODS

OUTCOMES:

- Has enough knowledge on the various process available to make a part.
- Confident to select the process to based on cost of time and quantities.
- Can determine processes for new materials.

TEXT BOOKS

1. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology - Anna University, 4/e, Pearson Education, 2014
2. P.C. Sharma, “A Text Book of Production Technology”, S.Chand and Co. Ltd., New Delhi, 2010.

REFERENCES:

1. B.H.Amstead, “Manufacturing Processes”, Phillip F.Ostwald, L.Begemon, John Wiley and Sons, 8th Edition, 1998.
2. De Garmo, “Materials and Processes in Manufacturing”, Prentice Hall of India, 8th Edition, 2008.
3. P.N.Rao, “Manufacturing Technology – I and II”, Tata McGraw Hill Publishing Co., New Delhi – 2013.
4. Amitabha Ghosh, Asok Kumar Mallik, Manufacturing Science, EWP Pvt. Ltd, 2007

GE7161	COMPUTER PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To understand the basic programming constructs and articulate how they are used to develop a program with a desired runtime execution flow.
- To articulate where computer programs fit in the provision of computer-based solutions to real world problems.
- To learn to use user defined data structures.

LIST OF EXPERIMENTS

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

OUTCOMES

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

- Write and compile programs using C programs.
- Write program with the concept of Structured Programming
- Identify suitable data structure for solving a problem
- Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS

30 Systems with C compiler

PR7261	PRODUCTION PROCESSESS LABORATORY (Common to Aero/Auto/Rubber and Plastics)	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To get hands on experience in the machines for production
- To prepare the process planning sheets for all the operations and then follow the sequence during the machining processes.

LIST OF EXPERIMENTS:

1. Study of all the machining tools- identification of parts/mechanisms and position of tool and work piece.
2. Facing, plain turning/step turning operations in Lathe.
3. Taper Turning/Threading and knurling operations in Lathe.
4. Multi-start Threading/Burnishing operations in Lathe.
5. Machining to make a cube using shaper
6. Machining to make a V-block using shaper.
7. Counter sinking, counter Boring and Tapping operations in a drilling machine.
8. Surfacing/pocket milling in a vertical milling machine.
9. Polygonal shape milling in a horizontal milling machine

10. Flat surface grinding and cylindrical grinding operations
11. Machining an internal spline in slotting machine.
12. To machine the given part drawing using Lathe and milling machines.

TOTAL: 60 PERIODS

OUTCOME:

- Enough experience to operate machines and processes commonly used in production of components.
- Enable interpretation of process plan sheets to be followed for he machining of products.

AE7352 MECHANICS OF SOLIDS L T P C
3 0 0 3

OBJECTIVES

- The objective of this course is to make the students to understand the concepts of stress and strain and their relationships by analysis of solids and structures, to analyze determinate and indeterminate axial members, torsional members, and beams, in order to determine axial forces, torque, shear forces, bending moments, stresses and deflections.

UNIT I STRESS-STRAIN – AXIAL LOADING 9

Definition of stress and strain- Stress-Strain relation- Relation between material constants.-Bar under axial loading- Statically determinate and indeterminate cases – Thermal stress-Impact Loading

UNIT II STRESSES IN BEAMS 9

Types of beams and loadings – Relation between shear force and bending moment - Shear force and bending moment diagrams – Euler beam theory - Bending stress in beams – Shear stress in beam – Composite beam.

UNIT III DEFLECTION OF BEAM 9

Various methods for statically determinate beams - Double integration method – Macaulay's method – Moment area method – Conjucate Beam method – Method of superposition

UNIT IV TORSION AND SPRINGS 9

Shear stress and twist relation for circular section – Comparison of hollow shaft and solid shaft – Compound shaft – Power transmission by circular shafts – Springs – Deflection expression for close coiled helical spring – Stress in springs.

UNIT V BIAXIAL STRESS 9

Thin walled cylinder under internal pressure – Principal stresses for general biaxial stress field – Mohr's circle - Stresses in combined loading

TOTAL : 45 PERIODS

OUTCOMES

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

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

TEXT BOOKS:

1. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, 3rd edition, 2004.
2. William A. Nash, Merle C. Potter, "Schaum's Outline of Strength of Materials", 6th Edition, McGraw Hill Education, 2014

REFERENCES:

1. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer publishers, 2013
2. R.K.Rajput, 'Strength of Materials', S Chand; 4th Rev. Edition 2007.
3. Timothy A. Philpot, "Mechanics of Materials: An Integrated Learning System," 3rd Edition, Wiley, 2012.
4. Ferdinand P. Beer, E. Russell Johnston Jr., John T. Dewolf and David Mazurek, "Mechanics of Materials," seventh edition, McGraw-Hill, 2014
5. Russell C. Hibbeler, "Mechanics of Materials", Ninth Edition, Pearson education, 2013
6. Roy R Craig, "Mechanics of Materials", Third Edition, John Wiley & Sons, 2011
7. James M Gere, Barry J Goodno, "Mechanics of Materials", Eighth Edition, Cengage Learning, 2012

AU7301 AUTOMOTIVE PETROL ENGINES L T P C
3 0 0 3

OBJECTIVE

- To impart basic knowledge on IC engines and its types and to develop the knowledge on various additional systems which are helps to improve the engine characteristics. Also to give through knowledge on complete construction and working details of petrol engine and its different accessories.

UNIT I ENGINE CONSTRUCTION AND WORKING 9

Engine classifications, 4 stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air & Actual cycles. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials for engine components.

UNIT II FUEL AND IGNITION SYSTEM 9

Carburetor – requirements, working principle, types, different circuits – Compensation & Maximum power devices – Petrol injection in SI engines, Magneto coil and battery coil spark ignition system. Advance mechanism. Electronic ignition System – CDI.

UNIT III COOLING AND LUBRICATION SYSTEM 9

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system, Evaporative cooling system – Need for Lubrication system. Mist lubrication system, wet & dry sump lubrication, Properties of lubricants, properties of coolant – Recent Technologies.

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion in SI engine – Stages of combustion – Flame propagation – Rate of pressure rise – Abnormal combustion – pre ignition and knock in SI engines – effect of engine variables on knock – Different combustion chambers for SI engine –Factors controlling combustion chamber design.

UNIT V TWO STROKE ENGINES 9

Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging processes. Merits and demerits, scavenging efficiency, Scavenging pumps, Rotary valve engine.

TOTAL : 45 PERIODS

OUTCOMES

Student can able to,

CO1: Understand various components of petrol engines and its sub systems.

CO2: Understand and analyse actual engine working principle and its related components

CO3: Design critical systems like ignition and injection systems

CO4: Design other systems like cooling and lubrication systems

CO5: Understand advanced knowledge on petrol combustion and its related parameters

TEXT BOOKS

1. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai, 2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York,1994.

REFERENCES

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books:Co., Scranton, Pennsylvania, 1988.
3. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.
4. Ellinger, H.E., Automotive Engines, Prentice Hall Publishers, 1992.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	1	1	2	1	1	3		2	3	3
2	3	3	3	3	1	1	2	1	1	2		2	3	3
3	3	3	3	3	1	1	1	1	1	2		2	3	3
4	3	3	3	3	1	1	1	1	1	2		2	3	3
5	3	3	3	3	1	1	1	1	1	2		2	3	3
AVG	3	3	3	3	1	1	1.4	1	1	2.2		2	3	3

AU7302 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
4 0 0 4

OBJECTIVE:

- The objective of this course is to introduce the basic principles of thermodynamics and thermal engineering via real world engineering examples, to show students how thermodynamics is applied in engineering practice.

UNIT I BASIC THERMODYNAMICS 14

Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth low, First law. 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

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. 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

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 10

Principles of refrigeration, Vapor compression – Vapor 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 – 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: 60 PERIODS

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

OUTCOMES:

CO1: Demonstrate a basic understanding of the nature of the thermodynamics process for pure substances

CO2: Interpret First law of Thermodynamics and its application to systems and control volumes.

CO3: Solve any problem in an engineering approach based on basic concepts and logic sequences

CO4: compare and contrast refrigeration cycles and the air conditioning systems

CO5: evaluate basics of heat transfer and its necessary applications

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. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
6. Mathur& Sharma Steam Tables, Jain Publishers, New Delhi.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	3	1	1	1	2	1	1	3		2	3	3
2	2	3	2	1	1	1	2	1	1	2		2	3	3
3	2	2	2	1	1	1	1	1	1	2		2	2	3
4	2	2	2	1	1	1	1	1	1	2		2	3	2
5	2	2	2	1	1	1	1	1	1	2		2	3	3
AVG	2.2	2.2	2.2	1	1	1	1.4	1	1	2.2		2	2.8	2.8

EI7306 ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES

- Gain knowledge on network theorems.
- Understand the basics of AC circuits and the terms related to AC circuits.
- Gain knowledge on construction and working principle of AC and DC machines.
- Get exposed to basic electronic devices and their applications.
- Gain knowledge on logic gates and their applications in digital electronics.

UNIT I BASIC CONCEPTS AND D.C. CIRCUIT ANALYSIS 9

Ohm's law - Ideal voltage and current sources-Independent sources -dependent sources-circuit elements - Kirchhoff's law - voltage and current division in series and parallel circuits-Node and Mesh analysis - Star/Delta transformations- Thevenin's , Norton's and Super position theorem.

UNIT II A.C. CIRCUITS 9

Sinusoidal voltage and current-RMS and average value of periodic waves - Form factor - Phase and Phase difference – Simple RC.RL and RLC circuits - series and parallel resonance - power and power factor – introduction to three phase systems – power measurement in 3 phase system.

UNIT III ELECTRICAL MACHINES 9

DC Generators: Construction-Principle of Operation-EMF Equation and Applications- DC Motors: Back EMF-Voltage and torque equation- Principle of transformer- EMF Equation - Tests on transformer - AC motors: Construction and basic Principle of Operation-Starting and Running torques.

UNIT IV ANALOG ELECTRONICS 9

Semiconductors - Characteristics of PN Junction Diode and Zener Diode– Half wave and Full wave Rectifiers. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics-Class A, B and C amplifiers (quantitative treatment).

UNIT V DIGITAL ELECTRONICS 9

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms

of Boolean expression-Combinational circuits- Design of adder, subtractor, encoders, decoders, multiplexers and demultiplexers-Flip flops.

TOTAL : 45 PERIODS

OUTCOMES

- Able to analyze and solve problems for all types of electrical networks by applying various theorems.
- Able to understand and solve problems for basic AC circuits.
- Will be in a position to suggest suitable AC/DC machines for a given application.
- Able to analyze the characteristics of electronic devices such as PN junction and other diodes.

REFERENCES

1. Charles K. Alexander and Matthew N. Q. Sadiku, "*Fundamentals of Electric Circuits*", Third Edition, Mc Graw-Hill International Edition, 2007.
2. Theraja, B.L., " A Text Books of Electrical Technology ", S.S.Chand and Co., New Delhi, 1998.
3. Sudhakar.A and Shyam Mohan.S.P, "C*ircuits and Networks Analysis and Synthesis"*, Fourth edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.
4. Boylestad & Nashelsky, "*Electronic Devices & Circuit Theory"*, Eighth edition, Prentice Hall Of India (P) Ltd., 2003.
5. Thomas L. Floyd, *"Electronic Devices",* Pearson Education, 9th Edition, 2011.
6. M. Morris Mano and Michael D. Ciletti, Digital Design, Pearson Education, 2013.

GE7251 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

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 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 production 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

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

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)

MA7354 NUMERICAL METHODS L T P C
4 0 0 4

OBJECTIVES:

- To provide the mathematical foundations of numerical techniques for solving linear system, eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

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

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

OUTCOMES:

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.

- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyze and evaluate the accuracy of common numerical methods.

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Sankara Rao . K, " Numerical Methods for Scientists and Engineers" PHI Learning Pvt Ltd. New Delhi, 2007.

REFERENCES:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.
4. S. R. K. Iyengar, R. K. Jain, Mahinder Kumar Jain, "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New Age International Publishers, New Delhi, 2012.

AU7311 MECHANICAL TESTING AND IC ENGINES LABORATORY L T P C
0 0 4 2

OBJECTIVE:

To give on hand training to the students in testing and quantifying the various mechanical properties of Engineering Materials and to find various performance characteristics of Internal combustion engine.

LIST OF EXPERIMENTS

- Tension Test
- Torsion Test
- Testing of springs
- Impact test i) Izod, ii) Charpy
- Hardness test i) Vickers, ii) Brinell, iii) Rockwell, iv) Shore
- Deflection of Beams
- Dye Penetrant Test
- Tensile testing of polymers.
- Relaxation Fatigue test for Elastomers.
- Injection molding machine operation.
- Performance test on a 4 stroke diesel engine
- Performance test on a 4 stroke petrol engine
- Moment of inertia of connecting rod
- Determination of Effectiveness of a parallel and counter flow heat exchangers.
- Valve timing of a 4 stroke engine
- Port timing of a 2 stroke engine.

TOTAL : 60 PERIODS

OUTCOMES:

Student can able to

- Understand various physical characterization and mechanical properties of materials
- Examine various testing methods of mechanical properties
- Evaluate the basics of internal combustion engine and its performance characteristics
- Evaluate fuel properties and related emission in engines.
- Know the type of materials used for automotive application.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	3	3	3	3	1	3	3	2	3	3	3
2	3	3	2	3	3	3	3	1	3	3	2	3	3	3
3	3	3	2	3	3	3	3	1	3	3	2	3	3	3
4	3	3	2	3	3	3	3	1	3	3	2	3	3	3
5	3	3	2	3	3	3	3	1	3	3	2	3	3	3
AVG	3	3	2	3	3	3	3	1	3	3	2	3	3	3

EE7261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L T P C
0 0 4 2

OBJECTIVE:

- To train the students in performing various tests on electrical drives, sensors and circuits.

LIST OF EXPERIMENTS:

1. Load test on separately excited DC shunt generator
2. Load test on DC shunt moor
3. Load test on S Transformer
4. Load test on Induction motor
5. Regulation of 3 Alternator
6. Study of CRO
7. Logic gates
8. Operational amplifiers
9. Time constant of RC circuit
10. Characteristics of LVDT
11. Calibration of Rotometer
12. RTD and Thermistor
13. Flapper Nozzle system

TOTAL: 60 PERIODS

OUTCOMES:

- Ability to perform speed characteristic of different electrical machine
- Ability to use of diodes, transistors for rectifiers
- Ability to use of operational amplifiers

AE7351 ENGINEERING FLUID MECHANICS AND MACHINERY L T P C
3 0 0 3

OBJECTIVE:

- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy. The applications of the conservation laws to flow though pipes and hydraulics machines are studied.

UNIT I INTRODUCTION 8

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

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor loses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 8

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV TURBINES 10

Impact of jets - Euler's equation - Theory of roto-dynamic machines-Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner –. Specific speed - unit quantities – performance curves for turbines .

UNIT V PUMPS 10

Various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

TOTAL: 45 PERIODS

OUTCOME:

CO1: Students will be familiar with all basic concepts of fluids statics
CO2: Summarize the concepts of flow governing equations
CO3: Generate solutions to complex pipe flow problems
CO4: Interpret the results of dimensional analysis
CO5: Expose to the applications of fluid machinery in vehicles

TEXT BOOKS:

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, Ninth edition,2015.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:

1. Ramamurtham. S, Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Co Pvt., Ltd, 9th edition, 2012.
2. Kumar. K.L. Engineering Fluid Mechanics (VII Ed.) S Chand publishers Reprint Edition 2006 edition (1 December 2010)
3. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	3	2	1	2	1	2	1		3	3	3
2	3	3	2	3	2	1	2	1	2	1		3	3	3
3	3	3	2	3	2	1	2	1	2	1		3	3	3
4	3	3	2	3	2	1	2	1	2	1		3	3	3
5	3	3	2	3	2	1	2	1	2	1		3	3	3
AVG	3	3	2	3	2	1	2	1	2	1		3	3	3

AU7401 AUTOMOTIVE CHASSIS L T P C
3 0 0 3

OBJECTIVES:

- The student shall gain appreciation and understanding function of front axle, types of stub axle, types of steering gear box, Shall be able to understand need of suspension and its types, types of tyre, tyre specification, tyre rotation, Student shall gain knowledge of design consideration braking system, suspension system and for chassis

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 9

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, Types of Front Axles and Stub Axles, Front Wheel Geometry. Condition for True Rolling Motion. Ackerman's and Davi's Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power Steering.

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Final drive, different types of final drive, Worm and Worm wheel, straight bevel gear, spiral bevel gear and hypoid gear final drive. Differential principle. Constructional details of differential unit, Differential housings, Non–Slip differential, Differential locks.

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9

Construction of rear axles, Types of Loads acting on rear axles, Full –Floating, Three–Quarter Floating and Semi–Floating Axles, Twist beam rear axle, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details. tubeless, cross ply radial type, tyre sizes and designation

UNIT IV SUSPENSION SYSTEM 9

Requirement of Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf spring, Coil and Torsion bar Springs, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details of Leaf and Coil Springs, Sprung and unsprung mass, torsion bar springs.

UNIT V BRAKE SYSTEMS **9**

Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes, Braking Torque, drum brake and disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders – antilock braking systems(ABS).

TOTAL : 45 PERIODS

OUTCOMES

CO1: Identify the different types of frame and chassis used in Automotive
CO2: Relate different types of drive lines and drives used in Automotive
CO3: Acquire knowledge about different types of front axle and rear axles used in motor vehicles
CO4: Examine the working principle of conventional and independent suspension systems
CO5: Apply knowledge on working principles of brake and its subsystems

TEXT BOOKS

1. Newton Steeds and Garret, “Motor Vehicles” 13th Edition, Butterworth, London, 2005.
2. Heinz Hazler, “Modern Vehicle Technology”, Butterworth, London, 2005.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.

REFERENCES

1.Heldt P.M., “Automotive Chassis” Chilton Co., New York, 1990.
2.Giri. N.K., “Automotive Mechanics” Khanna Publishers, New Delhi, 2005.
3.“Motor Vehicles”, Newton, Steed and Garrot, 13th Edition, Butterworth London.
4.“Vehicle and Engine Technology”, Heisler, Second Edition SAE International Publication.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
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2	3	3	3	3	3	2	1	1	2	2	1	3	3	3
3	3	3	3	3	3	2	1	1	2	2	1	3	3	3
4	3	3	3	3	3	2	1	1	2	2	1	3	3	3
5	3	3	3	3	3	2	1	1	2	2	1	3	3	3
AVG	3	3	3	3	3	2	1	1	2	2	1	3	3	3

AU7402 AUTOMOTIVE DIESEL ENGINES **L T P C**
3 0 0 3

OBJECTIVES

- To impart knowledge on basic concepts of automotive diesel engines, combustion process involved in diesel engines and the various subsystems used along with their functions in detail.

UNIT I BASICS OF DIESEL ENGINES 9

Diesel engine classification, construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel - air and actual cycle analysis problems. Diesel fuel properties. Ignition quality of diesel. Cetane number and cetane Index. Laboratory tests for diesel fuel. Standards and specifications.

UNIT II FUEL INJECTION IN DIESEL ENGINES 9

Requirements – solid injection. Function of components – conventional fuel injection system, common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Types of injection nozzle, Nozzle tests. Electronic fuel injection. Spray characteristics. Injection timing. Pump calibration. Split and Multiple injection. Mechanical and pneumatic governors.

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 9

Air intake systems – Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting combustion. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – M-Combustion chamber. Combustion chambers for HCCI engines.

UNIT IV SUPERCHARGING AND TURBOCHARGING 9

Necessity and limitation of supercharging. Thermodynamic cycle with super charging. Types of supercharging and turbocharging – Relative merits. Intercooler. Matching of turbocharger. Modification of an engine for supercharging. Effect of supercharging on engine performance. Variable geometry and variable nozzle turbocharger. E-Turbocharger. Problems.

UNIT V ENGINE TESTING AND RECENT DEVELOPMENTS 9

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Heat balance – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, HCCI and RCCI engines. Problems.

TOTAL : 45 PERIODS

OUTCOMES

CO1: Understand engine glossaries, identify various components of diesel engines and its sub-systems.

CO2: Design fuel injection systems

CO3: Attain the advanced knowledge on air motion and CI engine combustion and its related parameters

CO4: Design and analyse intake air boosting systems

CO5: Attain knowledge on recent Developments of engine developments.

TEXT BOOKS

1. V. Ganesan, Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.
2. M.L. Mathur and R.P.Sharma, Internal Combustion Engine, Dhanpath Rai Publications (P) Ltd, New Delhi 110002

REFERENCES

1. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
2. Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
3. Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co.,Scranton, Pennsylvania, 1988.
4. Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
5. Heinz Hesiler, Advanced engine technology. Butterworth Heinmann publications

CO - PO and PSO Mapping

COs	POs												PSOs	
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4	3	3	3	3	1	2	2	1	2	2		3	3	3
5	3	3	3	3	1	2	2	1	2	2		3	3	3
AVG	3	3	3	3	1	2	2	1	2	2		3	3	3

AU7403 METROLOGY AND MEASUREMENT SYSTEM L T P C
3 0 0 3

OBJECTIVE:

- To understand the different degree of accuracy obtained from different types of instruments and the process of reducing uncertainties in measurements

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 – systematic and random errors – common types of 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)

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, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement – Mc leod gage, 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 – hydraulic, electric cradle and eddy current dynamometers.

UNIT V MEASUREMENT OF TEMPERATURE AND FLOW 10

Measurement of temperature – liquid in glass thermometer –partial and total immersion thermometers – resistance thermometers – thermistor – thermo electric thermometers – laws of thermocouples – industrial thermocouples and their ranges – pyrometers – optical total radiation and photo electric

Measurement of flow – need for flow metering – orifice plate, venture meter, flow nozzles, pitot tube rotameter – theory and constructional details – magnetic flow meters – hotwire anemometers-turbine flow meter - flouted tube flow meter-ultrasonic flow meter

TOTAL: 45 PERIODS

OUTCOMES:

The Students will

CO1: Be able to demonstrate their knowledge about different measurement method and devices used in industries.

CO2: Have the ability to handle and interpret measurement data, to estimate measurement uncertainties.

CO3: Design measuring equipment's for the measurement of Pressure Force, temperature and flow.

CO4: To understand about pressure, force and torque measurement equipment's

CO5: To understand about measurement of temperature and flow

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. I.C Gupta, "Engineering Metrology", Danpat Rai Publications, 2004.
2. Beckwith Thomas G, "Mechanical Measurements", Pearson Education, 2008.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	1	3	2	1	1	2	2		3	2	2
2	3	3	3	1	3	2	1	1	2	2		3	2	2
3	3	3	3	1	3	2	1	1	2	2		3	2	2
4	3	3	3	1	3	2	1	1	2	2		3	2	2
5	3	3	3	1	3	2	1	1	2	2		3	2	2
AVG	3	3	3	1	3	2	1	1	2	2		3	2	2

AU7404 THEORY OF FUELS AND LUBRICANTS L T P C
3 0 0 3

OBJECTIVE

- To understand the basic of manufacturing of fuels and lubricants along with properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I MANUFACTURE 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.

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, petrol fuel additives and diesel fuel additives – specifications of fuels. ASTM and SAE standards.

TOTAL : 45 PERIODS

OUTCOMES

Student would have basic understanding of

CO1: Can able to compare Various refinery processes

CO2: Can able to explain Theory of lubricants

CO3: Can infer the different types of Properties and testing of fuels

CO4: Can discuss about Fuel ratings

CO5: Can analysis the Additive mechanisms

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma “A course in internal combustion engines”, Dhanpatrai publication, 2003.

REFERENCES

1. Arthur J Caines “Automotive lubricants Reference book”, SAE International, Second edition 2004
2. Keith Owen and Trevor Coley “Automotive fuels reference book” SAE International, second edition 1995
3. Francis, W – Fuels and Fuel Technology, Vol. I & II
4. Hobson, G.D. & Pohl.W- Modern Petroleum Technology
5. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press 1982.
6. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.
7. A R Lansdown “Lubrication and selection A practical guide” Third Edition,2014, Wiley

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	3	3	3	2	2	2		3	3	3
2	3	3	2	2	3	3	3	2	2	2		3	3	3
3	3	3	2	2	3	3	3	2	2	2		3	3	3
4	3	3	2	2	3	3	3	2	2	2		3	3	3
5	3	3	2	2	3	3	3	2	2	2		3	3	3
AVG	3	3	2	2	3	3	3	2	2	2		3	3	3

PR7451 KINEMATICS AND DYNAMICS OF MACHINES L T P C
4 0 0 4

OBJECTIVE:

- To understand the basic concepts of mechanisms and machinery.

UNIT I MECHANISMS 12

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 12

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 12

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 12

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 multirotor systems – geared shafts – critical speed of shafts.

UNIT V BALANCING 12

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:60 PERIODS

OUTCOME:

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.

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

CO - PO and PSO Mapping

COs	POs												PSOs	
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1	3	3	3	3	3	2	1	1	2	2		3	3	3
2	3	3	3	3	3	2	1	1	2	2		3	3	3
3	3	3	3	3	3	2	1	1	2	2		3	3	3
4	3	3	3	3	3	2	1	1	2	2		3	3	3
5	3	3	3	3	3	2	1	1	2	2		3	3	3
AVG	3	3	3	3	3	2	1	1	2	2		3	3	3

AU7411 AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LABORATORY **L T P C 0 0 4 2**

OBJECTIVES:

- To familiarize and train the students on the constructional arrangements of different engine system.
- Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts.
- To familiarize and train the students on the constructional arrangements of different engine system.

LIST OF EXPERIMENT FOR AUTOMOTIVE ENGINE

1. Study the layout of chassis system
2. Study the layout of steering systems with different Steering gearboxes
3. Dismantling, study and Assembling of Transfer case

4. Dismantling, study and Assembling of Constant Velocity Joint(Front Axles)
5. Dismantling, study and Assembling of Clutch.
6. Dismantling, study and Assembling of sliding mesh gear box
7. Dismantling, study and Assembling of Constant mesh gear box
8. Dismantling, study and Assembling of Syncro mesh gear box
9. Dismantling, study and Assembling of Differential.
10. Study the Layout of Rear Axle.
11. Study the Layout of Braking system.
12. Study of different types of suspension system.
13. Study the Automatic transmission system.

STUDY OF THE FOLLOWING ENGINES AND ITS COMPONENTS:

1. Single Cylinder Four Stroke Diesel Engine
2. Two wheeler Two stroke Petrol engines
3. Two wheeler Four Stroke Petrol Engine
4. Three wheeler Engine
5. Multi cylinder inline diesel engine
6. Multi cylinder inline Petrol engine
7. Multi cylinder V type diesel Engine
8. MPFI engine
9. CRDI engine

TOTAL: 60 PERIODS

OUTCOMES

- Dismantle and Assemble the automobile chassis and Engine components
- Identify & differentiate components of SI & CI engines
- Understand working of braking, steering, clutch, transmission, Suspension systems.
- Differentiate various subsystems of two, three & Four wheeler vehicles

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	2	1	2	3	3	1	3	3	3
2	3	3	3	3	3	2	1	2	3	3	1	3	3	3
3	3	3	3	3	3	2	1	2	3	3	1	3	3	3
4	3	3	3	3	3	2	1	2	3	3	1	3	3	3
AVG	3	3	3	3	3	2	1	2	3	3	1	3	3	3

AU7412 FUELS AND LUBRICANTS LABORATORY L T P C
0 0 4 2

OBJECTIVE

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

LIST OF EXPERIMENTS:

1. Temperature dependence of viscosity of lubrication oil by Redwood Viscometer.
2. Viscosity Index of lubricating oil by Saybolt Viscometer

3. Flash and Fire points of fuels.
4. Flash and Fire points of lubricants.
5. Cloud and pour point of fuels.
6. ASME distillation test of fuels (gasoline / diesel).
7. Carbon residue test of lubrication oil.
8. Calorific value of liquid fuel.
9. Ash content test of fuel.
10. Penetration test on grease.
11. Copper strip corrosion test
12. Density test on different fuels

TOTAL : 60 PERIODS

OUTCOMES

CO1: Student would have basic understanding of various testing methods adopted to assess quality of fuels and lubricants like viscosity

CO2: Student would have basic understanding of various testing methods adopted to assess quality of fuels and lubricants like flash, fire point

CO3: Student would have basic understanding of various testing methods adopted to assess quality of fuels and lubricants like Cloud and pour point

CO4: Student would have basic understanding of various testing methods adopted to assess quality of fuels and lubricants like Calorific value

CO5: Student would have basic understanding of various testing methods adopted to assess quality of fuels and lubricants like Density

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	2	1	2	3	3	1	3	3	3
2	3	3	3	3	3	2	1	2	3	3	1	3	3	3
3	3	3	3	3	3	2	1	2	3	3	1	3	3	3
4	3	3	3	3	3	2	1	2	3	3	1	3	3	3
5	3	3	3	3	3	2	1	2	3	3	1	3	3	3
AVG	3	3	3	3	3	2	1	2	3	3	1	3	3	3

AU7501 AUTOMOTIVE COMPONENTS DESIGN L T P C
3 0 0 3

OBJECTIVE:

To familiarize the various steps involved in the design process and understand the principles involved in design.

UNIT I INTRODUCTION 9

Classification of design -Principle of Design optimization – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials –Determination of endurance limit for ductile materials – Notch sensitivity –Future trends – CAD Euler's formula – Rankine's formula – Tetmajer's formula – Johnson formula – Reduction of stress Concentration

UNIT II DESIGN OF SHAFTS AND SPRINGS 9

Introduction – Material-Types-Standard size –Stresses in shaft –Design of shafts subjected to bending moment only, twisting moment only, and combined loading –Design of rear axle. Spring material- Types –Design of closed coiled helical springs and leaf springs.

UNIT III DESIGN OF FLYWHEELS 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.

UNIT IV DESIGN OF BEARINGS 9

Types of bearings – Sliding contact bearings –Rolling contact bearings .Bearing life –Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise. Design of journal bearings - Ball and Roller bearings

UNIT V GEAR DESIGN 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

OUTCOMES:

The students will be able

CO1: To identify the design requirements for any specific components.

CO2: Acquire knowledge on design of shafts and springs.

CO3: To design the flywheel based upon input parameters.

CO4: To design bearings for specified automotive applications.

CO5: To design and select the gear based on the load perspective.

TEXT BOOK

1. Jain,R.K., Machine Design, Khanna Publishers, 1992.
2. Sundararaja Murthy,T.V., Machine Design, Khanna Publishers, New Delhi, 1991.
3. Bhandari,V.B., Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

REFERENCES

1. Hall Allen,S. & Others, Machine Design, Schaum Publisher Co., 1982.
2. Sigley, Machine Design, McGraw Hill, 1981.
3. Design Data Book, PSG College of Technology, Coimbatore, 1992.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	2	2	1	1	1		3	3	3
2	3	3	3	3	3	2	2	1	1	1		3	3	3
3	3	3	3	3	3	2	2	1	1	1		3	3	3
4	3	3	3	3	3	2	2	1	1	1		3	3	3
5	3	3	3	3	3	2	2	1	1	1		3	3	3
AVG	3	3	3	3	3	2	2	1	1	1		3	3	3

AU7502	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS	L T P C 3 0 0 3

OBJECTIVES

- Knowledge in vehicle electrical and electronics components for engine operation.
- Enhancing the knowledge of revsor and microprocessor applications in vehicle control systems.
- Gaining information's on modern safety system in vehicle braking.

UNIT I BATTERIES AND STARTING SYSTEM 10

Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.

UNIT I CHARGING SYSTEM LIGHTING AND ACCESSORIES 9

DC Generators and Alternators their characteristics. Control unit – cut out, electronic regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design. Dashboard instruments. Horn, trafficator.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM 9

Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems.

UNIT IV SENSORS AND MICROPROCESSORS IN AUTOMOBILES 9

Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

UNIT V SAFETY SYSTEMS 8

Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

CO1: Define the glossary related to vehicle electrical and electronic system -
CO2: Understand the need for starter batteries, starter motor and alternator in the vehicle.
CO3: Differentiate the conventional and modern vehicle architecture and the data transfer among the different electronic control unit using different communication protocols
CO4: List common types of sensor and actuators used in vehicles.
CO5: Understand networking in vehicles.

REFERENCES:

1. Judge. A.W., modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992
2. Young.A.P., & Griffiths.L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990
3. Spreadbury. F.G., Electrical Ignition Equipment, Constable & Co Ltd., London, 1962
4. Robert N Brady Automotive computers and Digital Instrumentation. A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	2	1	1	1	2	2		3	3	3
2	3	3	3	3	2	1	1	1	2	2		3	3	3
3	3	3	3	3	2	1	1	1	2	2		3	3	3
4	3	3	3	3	2	1	1	1	2	2		3	3	3
5	3	3	3	3	2	1	1	1	2	2		3	3	3
AVG	3	3	3	3	2	1	1	1	2	2		3	3	3

AU7503 AUTOMOTIVE TRANSMISSION L T P C
3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices, automatic transmission system and electric drive used in road vehicles. At the end of course the students will have command over both mechanical transmission system, automatic transmission systems and their applications.

UNIT I CLUTCH 9

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

UNIT II GEAR BOX 9

Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box 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 AUTOMATIC TRANSMISSION 9

Introduction to epicycle gear trains, 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.

UNIT V HYDROSTATIC DRIVE AND ELECTRIC DRIVE 9

Hydrostatic drive; various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drive-types- Principle of early and modified Ward Leonard Control system-Advantages & limitations.

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of the course, students will

CO1: Acquire knowledge in the construction and working principle of different types of mechanical transmission system,

CO2: Design the mechanical transmission system (Gearboxes)

CO3: Identify the function of hydrodynamic Transmission.

CO4: compare the working of various transmission systems in modern vehicles

CO5: Justify the need of in Electric drive

TEXT BOOKS:

1. Heldt,P.M., Torque converters, Chilton Book Co., 1962.
2. Newton and Steeds, Motor vehicles, Illiffe Publishers, 1985.

REFERENCES:

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

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	2	1	1	1	2	2		3	3	3
2	3	3	3	3	2	1	1	1	2	2		3	3	3
3	3	3	3	3	2	1	1	1	2	2		3	3	3
4	3	3	3	3	2	1	1	1	2	2		3	3	3
5	3	3	3	3	2	1	1	1	2	2		3	3	3
AVG	3	3	3	3	2	1	1	1	2	2		3	3	3

AU7504 ELECTRONIC ENGINE MANAGEMENT SYSTEMS L T P C
3 0 0 3

OBJECTIVE

- The objective of the course is to make the student to understand the need, role, components, control strategies used in an engine management system. The student will be familiarized in the fundamentals, operation, function of various sensors and actuators in an engine. The student will gain knowledge on various systems related to ignition and injection system, and 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 – Onboard diagnosis system.

TOTAL : 45 PERIODS

OUTCOMES

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

CO1: Define the function, construction and operation of various sensors and actuators.

CO2: Describe basic electronic engine management theory

CO3: Demonstrate the principles and application of computerized engine control devices and electronic fuel and ignition management systems in the modern automobile.

CO4: Ability to recognize which electronic system best for vehicle and also for safety consideration.

CO5: Control algorithm for different operating modes of engine.

TEXT BOOKS:

1. William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.
2. Allan W. M. Bonnick, "Automotive Computer Controlled Systems", Butterworth-Heinemann, 2001.
3. Bosch, "Automotive Sensors", Robert Bosch GmbH, 2001.
4. Eric Chowanietz, “Automobile Electronics,” SAE, 1995.

REFERENCES:

1. Tom Denton, “Advanced Automotive Fault Diagnosis,” Second edition, Elsevier Butterworth-Heinemann, 2006
2. Diesel Engine Management by Robert Bosch, SAE Publications, 3rd Edition, 2004.
3. Gasoline Engine Management by Robert Bosch, SAE Publications, 2nd Edition, 2004.
4. Forbes Aird, "Bosch Fuel Injection Systems", HP Books, 2001.
5. Bosch, "Gasoline Fuel Injection System", Robert Bosch GmbH, 1995.

CO - PO and PSO Mapping

COs	POs												PSOs	
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1	3	3	3	3	2	1	2	1	1	1		3	3	3
2	3	3	3	3	2	1	2	1	1	1		3	3	3
3	3	3	3	3	2	1	2	1	1	1		3	3	3
4	3	3	3	3	2	1	2	1	1	1		3	3	3
5	3	3	3	3	2	1	2	1	1	1		3	3	3
AVG	3	3	3	3	2	1	2	1	1	1		3	3	3

AU7511 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY **L T P C 0 0 4 2**

OBJECTIVE:

The main objective of this course is to impart practical knowledge in various automobile electrical and electronic components by testing, checking and programming.

LIST OF EXPERIMENTS:

1. Testing and checking of battery
2. Testing and checking of starting systems
3. Testing and checking of charging systems
4. Testing and checking of ignition systems
5. Study of automotive lighting system
6. Adjustment of head lights beam
7. Testing and checking of body controller systems
8. Logic gates, Adders, Flip flops
9. SCR and IC Timers
10. Interface circuit like amplifier, filter, Multiplexer and De Multiplexer
11. Interfacing seven segment displays
12. Basic microprocessor and microcontroller programming like arithmetic and Logic operation, code conversion, waveform generation, look up table etc
13. Interfacing ADC and DAC for Data Acquisition and Control Application
14. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
15. Display, Keyboard, Stepper Motor and DC Motor interface using microcontroller.
16. EPROM Programming
17. Study of Virtual Instrumentation

TOTAL : 60 PERIODS

OUTCOMES:

CO1: Understand the working principle of Electrical circuits in automobile.
CO2: Evaluate the working principle of Battery, and starter motor.
CO3: Understand the working principle of auxiliary systems used in automobiles.
CO4: Understand the use of sensors in an automobile.
CO5: Develop a programing knowledge on Microprocessor

CO - PO and PSO Mapping

COs	POs												PSOs	
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3	3	3	3	3	3	1	1	1	3	3		3	3	3
4	3	3	3	3	3	1	1	1	3	3		3	3	3
5	3	3	3	3	3	1	1	1	3	3		3	3	3
AVG	3	3	3	3	3	1	1	1	3	3		3	3	3

AU7512 SIMULATION OF ENGINE AND CHASSIS COMPONENTS LABORATORY **L T P C**
0 0 4 2

OBJECTIVE:

- To import the knowledge in the area of design and analysis of automotive engine components and Chassis Components.

LIST OF EXPERIMENTS:

Design, model and analysis of the following components

1. Engine Cylinder
2. Piston
3. Connecting rod Assembly
4. Valve train
5. Crank shaft
6. Cam shaft
7. Clutch components
8. Gear Box
9. Front Axle
10. Propeller Shaft
11. Rear Axle
12. Final Drive

TOTAL: 60 PERIODS

OUTCOME:

CO1: Visualize The Automotive Components With The Help Of Modelling Software.
CO2: Make The Modifications Instantly If Required At The Initial Stage Itself.
CO3: Demonstrate The Knowledge On Designing Components To Withstand The Loads And Deformations.
CO4: Synthesize, Analyze And Document The Design Of The Various Components.
CO5: Demonstrate The Ability To Use Engineering Techniques For Developing Vehicle Components With Industry Standards.

REFERENCES:

1. Dean Averns, " Automobile Chassis Design ", Illiffe Books Ltd, 1992.
2. Bosch, “Automotive HandBook” 6th edition, SAE, 2004.
3. Heldt.P.M., " Automotive Chassis ", Chilton Co., New York, 1992.
4. Steeds.W., " Mechanics of Road vehicles ", Illiffe Books Ltd., London, 1990.
5. Giles.J.G., Steering, " Suspension and tyres ", Illiffe Books Ltd., London, 1988.
6. T. Kenneth Garrett, Kenneth Newton and William Steeds, “The Motor Vehicle” 13th Edition, Butterworth-Heinemann Limited, London, 2005.
7. Heldt.P.M., " Torque converter ", Chilton Book Co., New York, 1982.
8. Dr. N. K. Giri, “Automobile Mechanics”, Seventh reprint, Khanna Publishers, Delhi, 2005.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	1	1	3	3	3	1	3	3	3
2	3	3	3	3	3	1	1	3	3	3	1	3	3	3
3	3	3	3	3	3	1	1	3	3	3	1	3	3	3
4	3	3	3	3	3	1	1	3	3	3	1	3	3	3
5	3	3	3	3	3	1	1	3	3	3	1	3	3	3
AVG	3	3	3	3	3	1	1	3	3	3	1	3	3	3

AU7601 AUTOMOTIVE POLLUTION AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in automotive pollution control.
- The detailed concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

UNIT I INTRODUCTION 6

Introduction to SI Engine Combustion, CI Engine Combustion. Pollutants – sources – formation – effects of pollution on environment, human. Transient operational effects on pollution – Regulated – Unregulated emissions - Emission Standards. Introduction to noise pollution.

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL 10

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 10

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 9

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 10

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 analyzers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TOTAL : 45 PERIODS

OUTCOMES:

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

CO1: Differentiate the various emissions formed in IC engines
CO2: Analyze the effects of pollution on human health and environment
CO3: Design the control techniques for minimizing emissions
CO4: Categorize the emission norms
CO5: Identify suitable methods to reduce the noise emissions.

TEXT BOOKS:

1. Springer and Patterson, Engine Emission, Plenum Press, 1990.
2. B.P.Pundir, " IC Engines Combustion and Emissions" Narosa Publishers, 2010

REFERENCES:

1. Ramalingam. K.K., Internal Combustion Engines, Scitech Publications, Chennai, 2003.
2. Ganesan,V., Internal Combustion Engines, Tata McGraw Hill Co., 1994.
3. SAE Transactions, Vehicle emission, 1982 (3 volumes).
4. Taylor,C.F., Internal Combustion Engines, MIT Press, 1972.
5. Heywood,J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
6. Automobiles and Pollution SAE Transaction, 1995.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	3	3	2	1	1		3	3	3
2	3	3	3	3	3	3	3	2	1	1		3	3	3
3	3	3	3	3	3	3	3	2	1	1		3	3	3
4	3	3	3	3	3	3	3	2	1	1		3	3	3
5	3	3	3	3	3	3	3	2	1	1		3	3	3
AVG	3	3	3	3	3	3	3	2	1	1		3	3	3

AU7602 HYBRID AND ELECTRIC VEHICLES L T P C
3 0 0 3

OBJECTIVE :

- To understand the basic concept of Hybrid, Electric Vehicles , energy Storage devices and controls.

UNIT I INTRODUCTION TO NEED FOR ALTERNATIVE SYSTEM 9

History of electric and hybrid vehicles. Need of electric and hybrid vehicles – comparative study of diesel, petrol, electric and hybrid vehicles. Limitations of electric vehicles. Specification of different electric and hybrid vehicles.

UNIT II ENERGY STORAGE DEVICES AND FUELL CELLS 9

Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency and ultra-capacitors.

Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III ELECTRIC VEHICLES 9

Electric vehicle layout, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system, safety and challenges in electric vehicles.

UNIT IV HYBRID VEHICLES 9

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, hybrid electric drive train design, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles.

UNIT V PROPULSION MOTORS AND CONTROLLERS 9

Types of electric motors – working principle of AC and DC motors. Characteristic of shunt, series and compound type of DC motors- permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

TOTAL : 45 PERIODS

OUTCOMES

End of the course student would have deep knowledge on

CO1: Understand the need for Electric and hybrid vehicles

CO2: Evaluate different Energy requirement for vehicles

CO3: Distinguish different operating modes and performance parameters of the Electric vehicles.

CO4: Design the hybrid and electric vehicles subsystems

CO5: Know about different electric propulsion motors.

TEXT BOOKS:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained “ John Wiley & Sons,2003
2. Iqbal Husain, “ Electric and Hybrid Vehicles-Design Fundamentals”, CRC Press,2003
3. Mehrdad Ehsani, “ Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press,2005

REFERENCES:

1. Ron HodKinson, “ light Weight Electric/ Hybrid Vehicle Design”, Butterworth Heinemann Publication,2005
2. Lino Guzzella, “ Vehicle Propulsion System” Springer Publications,2005

CO - PO and PSO Mapping

COs	POs												PSOs	
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4	3	3	3	3	3	3	3	1	1	1		3	3	3
5	3	3	3	3	3	3	3	1	1	1		3	3	3
AVG	3	3	3	3	3	3	3	1	1	1		3	3	3

AU7603	VEHICLE BODY ENGINEERING	L T P C 3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamics, paneling of passenger car and commercial vehicle body design. At the end of the course the student will be well versed in the design and construction of external body of all types of vehicles such as car, light commercial vehicles and heavy commercial vehicles.

UNIT I CAR BODY DETAILS 10

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – 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.

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

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

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, students will

CO1: Different aspects of car body

CO2: Bus body and commercial vehicle bodies.

CO3: Role of various aerodynamic forces and moments, measuring instruments in vehicle body design.

CO4: Material used in body building,

CO5: Tools used in body repairs and command over vehicle body engineering applications.

TEXT BOOKS:

1. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.
2. James E Duffy, Body Repair Technology for 4-Wheelers,Cengage Learning,2009.

REFERENCES:

1. Giles, G.J., Body construction and design, Illiffe Books Butterworth & Co., 1991.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1992.
3. Braithwaite, J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1997.
4. Dieler Anselm., The passenger car body, SAE International, 2000

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	1	2	1	1	1		3	3	3
2	3	3	3	3	3	1	2	1	1	1		3	3	3
3	3	3	3	3	3	1	2	1	1	1		3	3	3
4	3	3	3	3	3	1	2	1	1	1		3	3	3
5	3	3	3	3	3	1	2	1	1	1		3	3	3
AVG	3	3	3	3	3	1	2	1	1	1		3	3	3

AU7604 VEHICLE CONTROL SYSTEM L T P C
3 0 0 3

OBJECTIVE:

- The main objective of this course is to impart knowledge in the selection of various control related variables in automobile sub systems, review of various control schemes, control oriented modeling and dynamic response of automotive system.

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- modeling 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 traveler 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:

Students will gain understanding on automotive-control problem considering the physics and

CO1: Understand the basics of control system used in automobiles
CO2: Recognize the electronically controlled system used in driving mechanics
CO3: Understand the working principle of driver modelling and power train control systems
CO4: Identify the control system used in hybrid and electrical vehicles.
CO5: Illustrate the need of automated transport systems.

TEXT BOOKS:

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

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	1	1	1	1	1		3	3	3
2	3	3	3	3	3	1	1	1	1	1		3	3	3
3	3	3	3	3	3	1	1	1	1	1		3	3	3
4	3	3	3	3	3	1	1	1	1	1		3	3	3
5	3	3	3	3	3	1	1	1	1	1		3	3	3
AVG	3	3	3	3	3	1	1	1	1	1		3	3	3

AU7611 CREATIVE AND INNOVATIVE PROJECT L T P C
0 0 4 2

The goal of this course is to help students to identify innovative projects that promotes and inhibit creativity to explore the variables that affect creativity and innovation. By the end of the period, students should be familiar with current thinking in their field, and able to apply the concepts to relevant research problems or practical applications.

The goal of this course is to drive them to learn concepts, models, frameworks, and tools that engineering graduates' need in a world where creativity and innovation is fast becoming a precondition for competitive advantage.

Each student will choose a nagging workplace problem or socially relevant problems that have been difficult for them to "solve." At the end of the semester, each or group of students have to submit a report for evaluation.

TOTAL : 60 PERIODS

Course Outcome

CO1: Think creatively and innovatively towards potential research areas in the field of Engineering.

CO2: Formulate a methodology to identify the various solutions for the identified problems.

CO3: Compare and contrast the several existing solutions for the Societal identified problems.

CO4: Develop the solution as a team and interpret the results.

CO5: Report and present the findings of the work conducted.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	2	2	2	3	3	3	3	3	3	3
2	3	3	3	2	2	2	2	3	3	3	3	3	3	3
3	3	3	3	2	2	2	2	3	3	3	3	3	3	3
4	3	3	3	2	2	2	2	3	3	3	3	3	3	3
5	3	3	3	2	2	2	2	3	3	3	3	3	3	3
AVG	3	3	3	2	2	2	2	3	3	3	3	3	3	3

AU7612 ENGINE TESTING AND EMISSION MEASUREMENT LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- The main objective of this course is to impart knowledge in automotive Emission measurement and methods of testing engines. 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. The knowledge about the instruments used for measurement of pollutants, engine performance and combustion parameters are to be explained with live example. 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 NO_x analyser.
9. Measurement of HC, CO, CO_2, O_2 and NO_x using exhaust gas analyzer.
10. Diesel smoke measurement.

TOTAL : 60 PERIODS

OUTCOMES:

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

- Understand the various emission measuring instruments
- Understand the various engine testing instruments
- Understand the procedure to measure the emission
- Understand the procedure for measuring the engine performance and combustion parameters
- Understand the emission norms

TEXT BOOK:

1. Giles,J.G., Vehicle Operation and performance, Illiffe Books Ltd., London, 1989.

REFERENCES:

1. Crouse,W.H. and Anglin,D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
2. Ganesan,V., Internal Combustion engines, Tata McGraw Hill Co., 1994.
3. BIS Code Books, IS-10000 series, 1988.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	3	3	3	3	2	1	3	3	3
2	3	3	3	3	3	3	3	3	3	2	1	3	3	3
3	3	3	3	3	3	3	3	3	3	2	1	3	3	3
4	3	3	3	3	3	3	3	3	3	2	1	3	3	3
5	3	3	3	3	3	3	3	3	3	2	1	3	3	3
AVG	3	3	3	3	3	3	3	3	3	2	1	3	3	3

AU7701 HYDRAULIC AND PNEUMATICS SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To understand the hydraulic and pneumatic principles, involved and their components as well as its selection.

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

OUTCOMES:

CO1: Understand the basics of hydraulic and pneumatic systems
CO2: Examine the working of hydraulic power drives
CO3: Apply knowledge on fluid power elements
CO4: Design hydraulic and pneumatic systems.
CO5: 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

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	1	2	1	1		2	1	2	3
2	3	3	3	3	3	1	1	1	1		2	1	3	2

3	3	3	3	3	3	2	1	1	1		1	1	3	3
4	3	3	3	3	3	1	2	1	1		2	2	3	3
5	3	3	3	3	3	1	2	1	1		1	1	3	3
AVG	3	3	3	3	3	1.2	1.6	1	1		1.6	1.2	2.8	2.8

AU7702 VEHICLE DYNAMICS L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to provide fundamental knowledge of the dynamics of ground vehicles, knowledge of suspension design and function, basic concepts on concerning stability and control and to study about basic analysis of vehicle dynamics in performance, handling and ride modes.

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, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT II TYRES 9

Tyre forces and moments, Tyre structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tyres. Magic formulae tyre model, Estimation of tyre road friction. Test on Various road surfaces. Tyre vibration.

UNIT III VERTICAL DYNAMICS 9

Human response to vibration, Sources of Vibration. State Space Representation. Design and analysis of Passive, Semiactive and Active suspension using Quarter car, Bicycle Model, Half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Power limited acceleration and traction limited acceleration. 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, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering. Minuro Plot for Lateral Transient Response,

TOTAL : 45 PERIODS

OUTCOMES:

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

CO1: Develop physical and mathematical models to predict the dynamic response of vehicles
CO2: Demonstrate the importance of tyre and the forces and moments acting on it
CO3: Illustrate the various parameters that influence vehicle suspension system
CO4: Explain the importance of various subsystem that are used to control longitudinal motion of the vehicle
CO5: Illustrate the handling characteristics of a vehicle

TEXT BOOKS:

1. Singiresu S. Rao, "Mechanical Vibrations," 5th Edition, Prentice Hall, 2010
2. J. Y. Wong, "Theory of Ground Vehicles", 4th Edition, Wiley-Interscience, 2008
3. Rajesh Rajamani, "Vehicle Dynamics and Control," 2nd edition, Springer, 2012
4. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014

REFERENCES:

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

CO - PO and PSO Mapping

COs	POs												PSOs	
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3	3	3	3	3	3			1	2	1		3	3	3
4	3	3	3	3	3			1	2	1		3	3	3
5	3	3	3	3	3			1	2	1		3	3	3
AVG	3	3	3	3	3			1	2	1		3	3	3

GE7351 ENGINEERING ETHICS AND HUMAN VALUES L T P C
3 0 0 3

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES 3

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER'S RIGHTS AND RESPONSIBILITIES ON SAFETY 12

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and chernobyl as case studies.

UNIT V GLOBAL ISSUES 12

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES

CO1: Emphasise into awareness on Engineering Ethics and Human Values.

CO2: Understand social responsibility of an engineer.

CO3: Appreciate ethical dilemma while discharging duties in professional life.

CO4: Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

CO5: Study, evaluate and Overcome the Global Issues.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics –Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000
5. R.Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	1	3		3	3	3	1	1	1	3	3	3
2	2	1	1	3		3	3	3	1	1	1	3	3	3
3	2	1	1	3		3	3	3	1	1	1	3	3	3
4	2	1	1	3		3	3	3	1	1	1	3	3	3
5	2	1	1	3		3	3	3	1	1	1	3	3	3
AVG	2	1	1	3		3	3	3	1	1	1	3	3	3

AU7711 VEHICLE TESTING LABORATORY L T P C
0 0 4 2

OBJECTIVES :

- To impart the knowledge on testing of vehicle and subsystems.

LIST OF EXPERIMENTS:

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of braking system
6. Fault diagnosis and service of suspension system
7. Fault diagnosis and service of steering system
8. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system etc
9. Vehicle testing on chassis dynamometer
10. Practice the following:
    i. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
    ii. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
    iii. Wheel bearings tightening and adjustment.
    iv. Adjustment of head lights beam.
    v. Removal and fitting of tire and tube.

TOTAL : 60 PERIODS

OUTCOMES

CO1: Apply various vehicle testing methods
CO2: Operate various testing machines
CO3: Verify the procedure to test the vehicle.
CO4: Calibrate various vehicle components.
CO5: Test the vehicle after the maintenance

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	3	1	1	3	1		3	3	3
2	3	3	3	3	3	3	1	1	3	1		3	3	3
3	3	3	3	3	3	3	1	1	3	1		3	3	3
4	3	3	3	3	3	3	1	1	3	1		3	3	3
5	3	3	3	3	3	3	1	1	3	1		3	3	3
AVG	3	3	3	3	3	3	1	1	3	1		3	3	3

AU7712 INDUSTRIAL TRAINING AND SEMINAR L T P C
0 0 4 2

OBJECTIVE:

- To give students a first-hand experience on industrial environment and to implement the theoretical knowledge in solving existing problems at industry. This course will also give students a thirst on entrepreneurship.

1. The students have to undergo practical industrial training for four weeks in recognized industrial establishments during their vacation periods.
2. At the end of the training they have to submit a report with following information:
    a. Profile of the industry
    b. Product specification
    c. Organizational chart
    d. Plant layout
    e. Processes/Machines/Equipment/Devices
    f. Personnel & social welfare schemes
    g. Details of the training undergone
    h. Projects undertaken during the training, if any
    i. Inference from training
3. The assessments will be based equally on the report in the prescribed format and viva-voce examination by a committee nominated by the Head of the Department

TOTAL: 60 PERIODS

OUTCOMES:

CO1: Aware of an industrial structure
CO2: Expose to the sequence of developing a product
CO3: Aware of the Safety standards in industries.
CO4: Understand the process layout

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	1	2	2		3	1	3	3	3
2	3	3	3	3	3	1	2	2		3	1	3	3	3
3	3	3	3	3	3	1	2	2		3	1	3	3	3
4	3	3	3	3	3	1	2	2		3	1	3	3	3
AVG	3	3	3	3	3	1	2	2		3	1	3	3	3

AU7811 **PROJECT WORK** **L T P C**
0 0 20 10

The project work may be assigned to a single student or to a group of student not exceeding 4 per group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline.

Every project work shall have a Guide who is a member of the faculty of the University. Twenty periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines.

The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

TOTAL: 300 PERIODS

OUTCOMES:

CO1: Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.

CO2: Demonstrate a strong working knowledge of ethics and professional responsibility.

CO3: Conduct project planning activities that accurately forecast project costs, timelines, and quality.

CO4: Implement processes for successful resource, communication, and risk and change management.

CO5: Demonstrate effective organizational leadership and change management skills for projects and project teams.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	2	2	2	3	3	3	3	3	3
2	3	3	3	3	3	2	2	2	3	3	3	3	3	3
3	3	3	3	3	3	2	2	2	3	3	3	3	3	3
4	3	3	3	3	3	2	2	2	3	3	3	3	3	3
5	3	3	3	3	3	2	2	2	3	3	3	3	3	3
AVG	3	3	3	3	3	2	2	2	3	3	3	3	3	3

AU7001 ADVANCED THEORY OF IC ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge in modern trends and developments in internal combustion engines. To develop knowledge in non conventional engines and their operation in detail and to acquire complete knowledge in engine modeling and combustion analysis of 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 COMBUSTION MODELLING 9

Basic concepts of engine simulation – Governing equations, Classification of engine models- Thermodynamic models for Intake and exhaust flow process – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.

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

OUTCOMES:

- Students will understand the recent developments and trends in internal combustion engines. They will be able to apply their knowledge in making changes in engine design for better engine performance.
- Students will become familiar with the non conventional engines and their importance, difficulties involved in using them for power generation
- They will also get familiarized with the equipment used for flow and combustion analysis.

TEXT BOOKS

1. John,B., Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Co., New York, 1988.
2. Ramalingam. K.K., Internal combustion engines, Scitech publications, Chennai, 2003.

REFERENCES

1. Ganesan,V., Internal combustion engines, Tata McGraw Hill Publishing Co.,1994.

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

AU7002 ADVANCED VEHICLE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

- The course should enable the students to know about the basics about the vehicle and to understand the safety aspects in the vehicle. It also enables to acquire knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle and to know about the comfort and convenience system.

UNIT I MODERN POWER PLANT AND POWER TRAIN 9

Modern Engine Technology like DTS- i, DTS – Fi, DTS – Si, VVT, Camless Engine, GDi, CRDI , Hybrid / Electric and Future Cars, Fuel Cell.

UNIT II PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM 9

Seat belt, Seat belt tightener system and importance , collapsible steering column. Air bags and its activation .Designing aspcets of automotive bumpers and materials for bumpers. Steering And mirror adjustment, central locking system, Tire pressure control system, rain sensor system, automated wiper system.

UNIT III 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.

UNIT IV VEHICLE INTEGRATION 9

Vision enhancement, road recognition system, Looking out sensors and Looking in sensors, intelligent vision system, Vehicle Integration system. Anti theft technologies, smart card system, number plate coding. Locking system- Central locking system- acoustic signaling devices.

UNIT V VEHICLE NAVIGATION SYSTEM 9

Traffic routing system - Automated highway systems - Lane warning system – Global Positioning System. Vehicle Navigation System. Road Network, Driver conditioning warning - Route Guidance and Navigation Systems- Driver Information System, driver assistance system.

TOTAL : 45 PERIODS

OUTCOMES:

The students should be able to:

CO1: Know about the recent innovation in vehicle technology

CO2: Expose to the various types of passive safety components such as air bags, seat belts. design of the bumper.

CO3: Acquainted with the various types of active safety components such as ABS,ESC,etc. and also about Driver Distraction.

CO4: Appraise about various object detection system

CO5: Recognize about various comfort, convenience system and environment information system.

TEXT BOOKS:

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”. Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., “Labview Advanced programming Techniques”,CRC Press, 2nd Edition, 2007.
3. Robert N.Brandy, “Automotive Electronics and Computer Systems”, Prentice Hall ,2001
4. Ljubo Vlacic, Michel Parent, Fumio Harashima – “Intelligent Vehicle Technologies Theory and Applications” -Butterworth-Heinemann, 2001
5. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - “Sensors for Automotive Applications “ - WILEY-VCH Verlag GmbH & Co. 2003
6. Robert Bosch GmbH - “Safety, Comfort and Convenience Systems”- Wiley; 3rd edition , 2007

REFERENCES:

1. Bosch, “Automotive HandBook”, 6th edition, SAE, 2004.
2. J.Powloski - “Vehicle Body Engineering” - Business books limited, London - 1969.
3. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.
4. ARAI Safety standards

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	2	3	2	1	1		3	3	3
2	3	3	3	3	3	2	3	2	2	1		2	3	3
3	3	3	3	3	3	2	3	1	2	1		2	3	3
4	3	3	3	3	3	2	3	2	2	1		2	3	3
5	3	3	3	3	3	2	3	1	3	1		3	3	3
AVG	3	3	3	3	3	2	3	1.6	2	1		2.4	3	3

AU7003 ALTERNATIVE FUELS AND ENERGY SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines. To develop knowledge in changing the engine system, modifying the fuel for efficient use in the internal combustion engines and to understand the challenges and difficulties in using alternative fuels in internal combustion engines

UNIT I INTRODUCTION TO ALTERNATIVE FUELS 9

Need for alternative fuels. World and Indian energy scenario on alternative fuels. Availability of different alternative fuels for SI and CI engines. 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

OUTCOMES

CO1: Acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines.

CO2: Develop knowledge in all the possible ways of using alcohols as a fuel in IC engines.

CO3: Understand the challenges and difficulties in using vegetable oil as an alternative fuel in internal combustion engines.

CO4: Identify the uses of hydrogen as fuel in IC engines as an alternative for fossil fuels.

CO5: Understand the usefulness of natural acquiring gases towards IC engines.

TEXT BOOKS

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

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. Technical papers of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
4. Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) on biofuels.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	2	2	2	2	2	1	3	3	3
2	3	3	3	3	3	2	2	2	2	2	1	3	3	3
3	3	3	3	3	3	2	2	2	2	2	1	3	3	3
4	3	3	3	3	3	2	2	2	2	2	1	3	3	3
5	3	3	3	3	3	2	2	2	2	2	1	3	3	3
AVG	3	3	3	3	3	2	2	2	2	2	1	3	3	3

AU7004 **AUTOMOTIVE AERODYNAMICS** **L T P C**
3 0 0 3

OBJECTIVE

- To learn the basics of fluid mechanics on vehicle motion and expose to the optimization techiniques followed in automotive industry in reducing aerodynamics drag, fuel consumption and improving vehicle stability. This course will also expose the students to testing techniques practiced in industry.

UNIT I BASICS OF FLUID DYNAMICS ON VEHICLE MOTION 9

Importance of study - timeline developments -basics of fluid mechanics -flow phenomenon related to vehicles - external flow problem -various resistances to vehicle motion - performance, fuel consumption and traction force diagram of a passenger car.

UNIT II DRAG FRACTIONS AND LOCAL ORIGINS IN A PASSENGER CAR 9

Car as a bluff body - generation & transportation of vortices around car -types of aerodynamic drag forces& its contribution to total drag - analysis of aerodynamic drag at local origins - shape and detail optimization techniques with case studies.

UNIT III VEHICLE HANDLING 9

The origin of forces and moments on a vehicle - lateral stability problems - methods to calculate forces and moments – vehicle dynamics under side winds - the effects of forces and moments, dirt accumulation on the vehicle, wind noise. Add-ons to improve stability of road vehicles.

UNIT IV COMMERCIAL VEHICLE AERODYNAMICS 9

Tractive resistance & fuel consumption – Drag coefficients of various commercial Vehicles – Scope for reducing drag on commercial vehicles (Trucks with trailers and buses), Advantages of commercial vehicles aerodynamics & its effects – Vehicle soiling & its effects on driving.

UNIT V WIND TUNNELS FOR ROAD VEHICLES AERODYNAMICS 9

Need of a wind tunnel, principle of wind tunnel technology, problems with reduced scale models, full scale wind tunnels examples and case studies, instrumentation& measurement techniques, Introduction to numerical analysis (CFD).

TOTAL : 45 PERIODS

OUTCOMES :

- Know the forces & moments influencing drag
- Solve simple numericals related to fuel economy & drag
- Learn the techniques of optimization practiced in industry
- Learn the relation between drag, stability & fuel economy
- Expose to fundamentals of numerical & experimental testing

TEXT BOOKS:

1. R.H.Barnard - “Road vehicle aerodynamic design, An Introduction” , Mechaero publications, Third edition
2. Hucho .W.H. – “Aerodynamic of Road Vehicles – From Fluid Mechanics to Vehicle Engineering” , Society of Automotive Engineers,U.S,Fourth edition
3. Alan Pope, Jewel B. Barlow, William H. Rae “Low speed wind tunnel testing” , John Wiley & SonsThird edition

REFERENCES :

1. “Automotive Aerodynamic”, Update SP-706 – SAE – 1987
2. “Vehicle Aerodynamics” – SP-1145-SAE-1996.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	2		3	2	1	1		3	3	3
2	3	3	3	3	3		3	2	2	1		2	3	3
3	2	2	2	2	1		3	1	2	1		2	3	3
4	1	2	3	2	1		3	2	2	1		2	3	3
5	2	3	3	2	3		3	1	3	1		3	3	3
AVG	2.2	2.6	2.6	2.2	2		3	1.6	2	1		2.4	3	3

AU7005 AUTOMOTIVE AUTOMATION L T P C
3 0 0 3

OBJECTIVE:

- To understand the various automated Automobile manufacturing activities and study the application of computer technology in the Automobile manufacturing activities.

UNIT I AUTOMATION IN AUTOMOBILE MANUFACTURING 9

Introduction: Automation-types, Introduction to CAD/CAM and CIM, evolution of CIM-Organization and information processing in manufacturing- Implementation of CIM- the future automated future .

UNIT II AUTOMATED MATERIAL HANDLING SYSTEMS 9

Automated assembly systems- Design principles and types – part feeding devices, automated material handling devices – conveyor systems- types and applications, AGVs – types and control applications ,rail guided vehicles-automated storage/retrieval systems-industrial robots- basic components-special features-applications.

UNIT III GROUP TECHNOLOGY AND FMS 9

Part families-visual-part classification and coding-production flow analysis, benefits of GT-FMS-workstations-FMS layouts configurations-computer control systems- planning the FMS- machine cell design-FMS application and benefits – automated work flow-automated flexible assembly systems.

UNIT IV AUTOMATED ASSEMBLY AND INSPECTION 9

Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

UNIT V SHOP FLOOR AND COMPUTER AIDED QUALITY CONTROL 9

Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will have a sound knowledge in the various automated manufacturing process.
- Students will be familiar in modern engineering manufacturing process and will have an update in recent scenario

TEXT BOOKS:

1. Mikel P.Groover “Automation production systems and computer integrated manufacturing“ Prentice Hall of india PVT LTD 1995.

REFERENCES:

1. N.Viswanathan and Y.Navahari “performance modelling of automated manufacturing systems” Prentice hall of India PVT LTD ,1995.
2. Mulachy .D.E “Material handling hand book” McGraw hill, New York ,1999
3. GROOVER M.P “Plant layout and automation”, John Wiley & sons Inc. New York 1994.
4. BLACK J.T “The design of factory with a future” McGraw hill inc, New York ,1991.

AU7006	AUTOMOTIVE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Knowledge on properties of engineering materials
- To select suitable materials for design
- Materials selection criteria for engine and transmission systems
- Different materials used for automotive structures.
- 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, aerospace, marine and defence 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 - Materials processing and design processes and their influence on design, Process attributes, Systematic process selection, Process selection diagrams, Process cost, 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, chasis & frames, Bumper, shock absorbers, wind screens, panels, brake shoes, Disc, wheels, differentials , damping and antifriction fluids, Tyres and tubes.

UNIT V ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS 9

Materials for electronic devices meant for engine control, ABS, Steering, Suspension, Sensors, anti-collision, Anti-fog, Head lamps.

TOTAL: 45 PERIODS

OUTCOMES

CO1: knowledge on properties of engineering materials
CO2: Select suitable materials for design
CO3: Select Materials for engine and transmission systems
CO4: Select materials used for automotive structures.
CO5: Select electronic materials for automotive applications

TEXT BOOKS

1. Gladius Lewis, "Selection of Engineering Materials", Prentice Hall Inc. New Jersey USA, 1995.
2. Charles J A and Crane. F A. A., "Selection and Use of Engineering Materials", 3rd Edition, Butterworths, London UK, 1996.

REFERENCES

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

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2		1	1	2	1	2	1		3	3	3
2	3	3	2		1	1	2	1	2	1		3	3	3
3	3	3	2		1	1	2	1	2	1		3	3	3
4	3	3	2		1	1	2	1	2	1		3	3	3
5	3	3	2		1	1	2	1	2	1		3	3	3
AVG	3	3	2		1	1	2	1	2	1		3	3	3

AU7007 AUTOMOTIVE TEST INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES

- To develop complete knowledge in using sensors, actuators and instruments in automobiles. To understand their necessities, working principles and performance characteristics in detail and to impart knowledge in modern laboratory experimental techniques for testing automobiles

UNIT I MEASUREMENT SYSTEMS 9

Introduction to Measurement systems-static and dynamic measurement –closed and open loop system - Requirements and characteristics – Analysis of experimental detail. Error analysis

UNIT II TRASDUCERS, MODIFIERS AND TERMINATING DEVICES 9

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

UNIT III MECHANICAL MEASUREMENT 9

Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES 9

I.S Code for Engine testing – Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature, Dynamic Cylinder pressure measurements.

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES 9

Laboratory tests- Study of chassis dynamometer- test tracks - Endurance Tests- crash tests- Vehicle performance test – Brake tests.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Understand the working principle of various sensors and actuators.
CO2: Develop an instrument for automobile using sensor and actuators.
CO3: Acquire knowledge about performance characteristics of a test instruments.
CO4: Analyse automobile parts using modern laboratory experimental techniques.
CO5: Apply control strategy in the various operation of automobile.

TEXT BOOKS

1. Ernest O. Doebelin*.* Measurement *s*ystems: application and design. McGraw Hill Publishing Co, 2004, ISBN 0–07–243886–X.
2. Nicos Ladommatos and Hua Zhao, Engine Combustion Instrumentation and Diagnostics. SAE International, 2001-01-30, ISBN of 978-0-7680-0665-0.

REFERENCES

1. A.W. Judge, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
3. D.Patambis, Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co, New Delhi, 1990.
4. Rangan, Sharma and Mani, Instrumentation Devices and systems, Tata McGraw Hill Publishing Co., Ltd., 1990
3. J.G. Giles, Engine and Vehicle Testing, Illiffe books Ltd., London, 1968.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	3	2		3	3	1	3	3	1	2	2
2	3	3	1	3	2		3	2	3	3	1	3	2	2
3	2	3	2	2	2		2	3	3	2	3	2	2	2
4	3	3	1	3	2		3	3	3	3	3	3	2	2
5	3	3	2	3	2		3	3	3	3	3	2	2	2
AVG	2.8	3	1.6	2.8	2		2.8	2.8	2.6	2.8	2.6	2.2	2	2

AU7008 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER L T P C
3 0 0 3

OBJECTIVES

- To make the students understand the principle of general and engine combustion.
- To understand engine heat release rate and various heat transfer models and to study the experimental methods for combustion and heat transfer in engines.

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 modeling. 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

OUTCOMES

- Upon completion the students will understand the principle of engine combustion and the various heat transfer models and measuring methods of engine heat transfer in derail
- They will understand thermodynamics of combustion, grasp the basics of normal, abnormal combustion and heat transfer in engines
- They also understand experimental techniques in investigating the combustion and heat transfer processes in IC engines

TEXT BOOK

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

REFERENCES

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

AU7009 COMPUTATIONAL FLUID MECHANICS L T P C
3 0 0 3

OBJECTIVE:

- To develop finite difference and finite volume discretized forms of the CFD equations and formulate explicit & implicit algorithms for solving the Euler Equations & Navier Strokes Equations.

UNIT I GOVERNING DIFFERENTIAL EQUATIONS AND FINITE DIFFERENCE METHOD 10

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II CONDUCTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III CONVECTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Steady One-Dimensional and Two-Dimensional Convection – diffusion, Unsteady one-dimensional convection – diffusion, Unsteady two-dimensional convection – Diffusion.

UNIT IV INCOMPRESSIBLE FLUID FLOW BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE, Computation of Boundary layer flow - Finite difference approach.

UNIT V FINITE ELEMENT METHOD AND TURBULENCE MODELS 5

Introduction to finite element method – solution of steady heat conduction by FEM. Algebraic Models – One equation model, k – ε models - Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes – Prediction of flow in a sudden pipe contraction and pipe.

TOTAL: 45 PERIODS

OUTCOMES:

The student will

- Demonstrate an ability to recognize the type of fluid flow that is occurring in a particular physical system and to use the appropriate model equations to investigate the flow.
- Gain the confidence to simplify a real fluid-flow system into a simplified model problem, and select the proper governing equations involved in the system
- Analyze and interpret data obtained from the numerical solution of fluid flow problems.
- Expose to the concept of finite volume.
- Know about various turbulence models.

TEXT BOOKS:

1. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 2003.
2. Ghoshdasdidar, P.S.,“Computer Simulation of flow and heat transfer” Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar “Numerical heat transfer fluid flow”, Hemisphere Publishing Corporation, 1980.

REFERENCES:

1. Versteeg and Malalasekera, N, “An Introduction to computational Fluid Dynamics The Finite volume Method,” Pearson Education, Ltd., 2007.
2. Taylor, C and Hughes, J.B. “Finite Element Programming of the Navier-Stokes Equation”, Pineridge Press Limited, U.K., 1981.
3. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., “Computational fluid Mechanics and Heat Transfer “ Hemisphere Publishing Corporation, New York, USA, 2012.
4. Fletcher, C.A.J. “Computational Techniques for Fluid Dynamics 1” Fundamental and General Techniques, Springer – Verlag, 1991.
5. Fletcher, C.A.J. “Computational Techniques for fluid Dynamics 2” Specific Techniques for Different Flow Categories, Springer – Verlag, 1988.
6. Bose, T.K., “Numerical Fluid Dynamics” Narosa Publishing House, 1997.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	2	2	2		3	2	1	1		3	3	3
2	3	3	3	3	3		3	2	2	1		2	3	3
3	2	2	2	2	1		3	1	2	1		2	3	3
4	1	2	3	2	1		3	2	2	1		2	3	3
5	2	3	3	2	3		3	1	3	1		3	3	3
AVG	2.2	2.6	2.6	2.2	2		3	1.6	2	1		2.4	3	3

AU7010 FINITE ELEMENT TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to make the students to understand the general steps of finite element methods, FEM formulation, be able to derive equations in finite element methods for 1D, 2D and 3D problems and its application solid mechanics and heat transfer.

UNIT I INTRODUCTION 9

Review of various approximate methods – Raleigh Ritz’s, Galerkin and finite difference methods – Steps in FEM Analysis – Governing equation and convergence criteria of finite element method.

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 in 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, Gaussian integration

UNIT V FIELD PROBLEM 9

Heat transfer problems, Steady state fin problems, Derivation of element matrices for two dimensional problems, longitudinal and lateral vibration of beams, torsion problems. Computer codes.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1: Understand and perform engineering analysis of structural members using FEM.

CO2: Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes

CO3: Develop computer codes for FEM Elements.

CO4: Derive the characteristics equation of Iso parametric elements.

CO5: Apply knowledge towards Modal analysis in a vibrating element analytically.

TEXT BOOKS:

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

REFERENCES:

1. Reddy J.N., “An Introduction to Finite Element Method”, Third edition, McGraw Hill, 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
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.
6. O.C. Zienkiewicz, R.L. Taylor, "The Finite Element Method for Solid and Structural Mechanics", Sixth edition, Elsevier Butterworth-Heinemann, 2005.
7. Roger T Fenner, "Finite Element Methods for Engineers", Imperial College Press, 1996.
8. Saeed Moaveni, "Finite Element Analysis Theory and Application with ANSYS", Third Edition, Prentice Hall , 2007

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	1	1	1	2	1	-	3	3	3
2	3	3	3	3	3	1	1	1	2	1	-	3	3	3
3	3	3	3	3	3	1	1	1	2	1	-	3	3	3
4	3	3	3	3	3	1	1	1	2	1	-	3	3	3
5	3	3	3	3	3	1	1	1	2	1	-	3	3	3
AVG	3	3	3	3	3	1	1	1	2	1	-	3	3	3

AU7011 MANUFACTURING OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

OBJECTIVE:

- To study in detail about the modern casting, forging, molding and machining processes followed in automotive components. To enhance the knowledge of the students in the field of non – ferrous materials, emerging metallic and non-metallic materials like polymers,fiber reinforced plastics (FRP), engineering ceramics, metal matrix composites (MMCs) and its manufacturing methods, selection criteria, properties and applications for automotive components.

UNIT I ENGINE COMPONENTS 9

Overview - Material selection and Manufacturing methods for the Engine Components. Engine block – Casting – Conventional and expendable pattern.Cylinder head – Casting, machining and thermal barrier coating. Crank shaft, connecting rod, camshaft – Forging, machining and heat treatment. Piston - Gravity, squeeze, die casting, machining and finishing. Gudgeon Pin - Machining and Finishing, Valve forging, friction welding, machining, thermal barrier coating, heat treatment and surface improvement. Cylinder Liners, Piston ring - Centrifugal, HPDC, LPDC, machining and finishing. Castings Processes for Oil pan and Carburetors. Push Rods, Rocker Arm, Tappets, Spark Plug – Forging, Machining, Finishing and Heat treatment.

UNIT II TRANSMISSION COMPONENTS 9

Overview - Material selection and Manufacturing methods for transmission system. Flywheel - Casting and Machining. Clutch - Friction plate, clutch housing, pressure plate conventional and fine blanking, composite friction lining. Methods of Gear manufacture – Gear hobbing and gear shaping machines - gear generation - gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching. Gearbox - Casting, precision forging, powder metallurgy, heat treatment and finishing. Propeller shaft - Continuous casting, extrusion, dies heat treatment and surface hardening. Axle-Differential – Axle Shaft – Bearing – fasteners-Forging, casting and machining. Leaf and coil spring - Forging and machining, composite leaf spring and wrap forming of coil spring.

UNIT III BODY COMPONENTS 9

Surface treatment – Plastics – Plastics in Automobile vehicles – Processing of plastics - Body Panel - Thermoforming and hydro forming, press forming, stretch forming. Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing. Welding – Resistance welding and other welding processes with the use of Robots in Body weldment. Instrument Panel - Principle of injection molding, injection molding of instrument panel. Bumpers - Molding of bumpers, reinforced reaction injection molding, tooling and tooling. Manufacture of polymer panels.

UNIT IV CHASSIS COMPONENTS 9

Material selection and manufacturing methods for Vehicle Frame Manufacturing, Wheel drum, Brake drum, Brake shoes, wheel rim and wheel housing manufacturing. Steering systems, shock absorbers, dead axle – casting, forging, machining and finishing operation. Heat treatment procedures for chassis components.

UNIT V TYRES AND ADVANCED MATERIALS MANUFACTURING 9

Tire and tube manufacturing, spray painting, powder coating, Prototype Manufacturing - RPT, 3-D Printing, chemical vapour deposition, physical vapour deposition, cryogenic grinding of powders, sealants, sound proof materials, structural adhesives, MMC liners –Selection of materials for Auto components.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the student should

CO1: Identify the methods to manufacture the vehicle components

CO2: Analyze the requirements of each component and material

CO3: Differentiate between the casting and forming process

CO4: Design the process for manufacturing vehicle components

CO5: Understand the advanced techniques used for manufacturing Automobile components

TEXT BOOKS:

1. Heldt P M, “High Speed Combustion Engines”, Oxford IBH publishing Co., Calcutta, 1996.
2. Kalpakjian, “Manufacturing Engineering and Technology”, Pearson Education, 2005.

REFERENCES:

1. John A S, “Introduction to Manufacturing Processes”, Tata McGraw-Hill, 2012.
2. Philip F O and JairoMunuz, “Manufacturing Processes and Systems”, John Wiley & Sons, New York, 1998.
3. Degarmo E P, “Materials and process in Manufacturing”, Macmillan Publishing Co, 1997.
4. Kalpakjian, “Manufacturing Processes for Engineering Materials”, Pearson Education, 2009.
5. B.P. Bhardwaj, “The Complete Book on Production of Automobile Components & Allied Products”, NIIR Project Consultancy Services, 2014.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	3	3	2	1	1	1	1	2	2	2
2	3	3	3	3	3	3	2	1	1	1	1	2	2	2
3	3	3	3	3	3	3	2	1	1	1	1	2	2	2
4	3	3	3	3	3	3	2	1	1	1	1	2	2	2
5	3	3	3	3	3	3	2	1	1	1	1	2	2	2
AVG	3	3	3	3	3	3	2	1	1	1	1	2	2	2

AU7012 NOISE, VIBRATION AND HARSHNESS L T P C

3 0 0 3

OBJECTIVE:

- To provide introduction to students the fundamentals of noise and vibration related to generation, transmission, control techniques and the effect of human sensitivity.To enable the students acquaint with principles and fundamentals in NVH instrumentation and signal analysis techniques

UNIT I FUNDAMENTALS OF NOISE, VIBRATION AND HARSHNESS 9

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 HUMANS 9

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. Noise limits in India.

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

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise—Diesel and Gasoline Engines, Tire/Road Noise, Aerodynamic Sound Sources in Vehicles, Transmission and Gearbox Noise and Vibration, Brake Noise. Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration, Noise and Vibration in Off-Road Vehicle Interiors.

UNIT IV ACOUSTICAL DESIGN OF MUFFLERS AND SILENCERS 9

Exhaust and Intake Noise in Diesel and Gasoline Engines - Electro-Acoustic Modeling, Transfer Matrix Modeling, Simple Expansion Chamber, Extended Tube Expansion Chamber, Extended Concentric Tube Resonator, Plug Muffler, Multiply Connected Muffler, Absorptive Ducts and Mufflers, Combination Mufflers, Acoustic Source Characteristics of I.C. Engines, Designing for Adequate Insertion Loss, Mufflers for High Pressure Vents and Safety Valves, Design of Muffler Shell and End Plates, Helmholtz Resonators, Active Noise Control in a Duct and Pressure Drop Considerations.

UNIT V NOISE AND VIBRATION TRANSDUCERS ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES. 9

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

OUTCOMES:

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

- Interpret the principle of noise, shock and vibration.
- Demonstrate the knowledge of physiological effect of noise and vibration on humans.
- Identify source of noise and vibration from an automobile.
- To design select the appropriate muffler for the control of tail pipe noise.
- Select different acoustic instrumentation noise control technique depending on the noise level.

TEXT BOOKS:

1. Malcolm J. Crocker “Handbook of Noise and Vibration Control”, John Wiley & Sons, Inc., 2007
2. M L Munjal “Noise and Vibration Control” IISc Lecture Notes Series, World Scientific Publishing Co. Ptv. Ltd. 2013

REFERENCES:

1. M L Munjal“Acoustics of Ducts and Mufflers”, 2nd Edition, John Wiley & Sons, Chichester, UK, February 2014.
2. David A.Bies and Colin H.Hansen “Engineering Noise Control: Theory and Practice “ Spon Press , London . 2009
3. Randall F Barron, “Industrial Noise Control and Acoustics”, Marcel Dekker, Inc. 2003
4. Gang Sheng “Vehicle Noise, Vibration and Sound Quality”, SAE International, 2012
5. C.Sujatha “Vibration and Acoustics – Measurement and Signal Analysis”, 1st Edition, McGraw Hill Education (India) Pvt Ltd, 2009
6. Allan G. Piersol ,Thomas L. Paez “Harris’ shock and vibration hand book” , McGraw-Hill , New Delhi, 2010
7. Clarence W. de Silva , “Vibration Monitoring, Testing, and Instrumentation “,CRC Press, 2007
8. Colin H Hansen “Understanding Active Noise Cancellation “ , Spon Press , London .2003
9. Matthew Harrison “Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles “, Elsevier Butterworth-Heinemann, Burlington, 2004

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2	2	2	2	2	2	2	1	1	1		3	3	3
2	2	2	2	2	2	3	3	1	1	1		3	3	3
3	3	3	3	3	2	2	2	1	1	1		3	3	3
4	3	3	3	3	3	3	2	1	1	1		3	3	3
5	3	3	3	3	3	2	3	1	1	1		3	3	3
AVG	2.6	2.6	2.6	2.6	2.4	2.4	2.4	1	1	1		3	3	3

AU7013 OFF HIGHWAY VEHICLES L T P C
3 0 0 3

OBJECTIVE:

- The main objective of this course is to introduce the concept and principle of operation ofspecial vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc. At the end of the course, the students can have a better understanding of the application of the Off Highway Vehicle in the excavation of earth.

UNIT I EARTH MOVING EQUIPMENTS 9

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders, scrappers, hydraulic shovels, Bucket conveyors etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics. Surface Miners – Highwall Miners, Off-Highway Mining Trucks.

UNIT II CONSTRUCTIONAL EQUIPMENTS 9

Layout of Constructional equipments, excavators, Jip Cranes, hoist, motor graders, Mixing machine, concrete ready mixers, drillers, ramming machines for construction of bridges and working principles, Power generators. Loader-mounted and self-propelled snow blower. Articulated Trucks, Asphalt Pavers, Vibratory Compactors, road reclaimers, Graders.

UNIT III FARM EQUIPMENTS 9

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment – Trailers and body tipping mechanism - plowing - paddy plantation machine harvesting machines. Sugarcane harvesting, power trailers.Feller Bunchers, forest machines and forwarders.

UNIT IV INDUSTRIAL APPLICATIONS 9

Constructional features, capacity and stability of jib cranes. Dragliners, Utility vehicles and man-lift chassis, Foundation and oil field drill rigs carriers, Concrete pump carriers, knuckleboom loaders, Material Handlers. forklifts, Pipelayers. Towing vehicles.fork lift trucks, alternative front end equipment (attachments) – Jib arm, shovel bucket, squeeze clamp, boom, fork extensions, barrel forks. Scissors lift trucks. Case studies.

UNIT V MILITARY AND COMBAT VEHICLES 9

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of Main Battle tankers, gun carriers and transport vehicles, bridge builders, communication vehicles.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the student will able to

- Interpret the working principle of various special vehicles like bulldozer, scrapper and backhole load.
- Acquire knowledge on the working of constructional equipments
- Categorize different form equipment based on the construction and working.
- Demonstrate the knowledge on the industrial equipment like forklift, loader, scissor lift etc.
- Understand the basic working principle of military and compact vehicle.

TEXT BOOKS:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. SAE Handbook Volume III
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.
4. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
5. Peurifoy R.L “Construction Planning, Equipment and Methods”, Tata McGraw-Hill, New Delhi, 2002.
6. Ian Graham, “Off-Road vehicles”, Heinemann Library, 2008
7. Wong J “ Terramechanics and Off-Road Vehicle Engineering”, Butterworth-Heinemann, 2009

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
4. Astokhov, Truck Cranes, MIR Publishers, Moscow.
5. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIRPublishers, 1972.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	2	2	2	2	2	1	1	1		3	3	3
2	2	2	2	2	2	3	2	1	1	1		3	3	3
3	2	2	2	2	2	3	2	1	1	1		3	3	3
4	2	2	2	2	2	3	2	1	1	1		3	3	3
5	2	2	2	2	2	3	2	1	1	1		3	3	3
AVG	2	2	2	2	2	2.8	2	1	1	1		3	3	3

AU7014 POLYMER COMPONENTS IN AUTOMOTIVE APPLICATIONS L T P C
3 0 0 3

OBJECTIVE:

- To make the students to understand the requirements related to polymers used in various automotive parts and to make the students to identify polymers for specific parts based on the usage.

UNIT I INTRODUCTION 6

Identification of plastics / rubber components in automobiles – function – selection criteria.

UNIT II STRUCTURE PROPERTY RELATIOINSHIPS IN RUBBERS 10

Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behavior in dynamic applications.

UNIT III VIBRATION AND RUBBER SPRING 10

Principles of vibration isolation – rubber mounts – spring design – comparison with metallic springs – shape factor and its effect – forced and free vibrations with damping – typical mounts, compounding and manufacture.

UNIT IV FLUID SEALINGS, FLEXIBLE COUPLINGS AND HOSES 10

Seals for static and dynamic applications – effect of heat / oil ageing – frictional behavior – fundamental of sealability.

UNIT V COMPOUND AND MANUFACTURE 9

Types of couplings – specification and selection – torque vs. deflection relationship – brake fluid / hydraulic hoses, materials and manufacture.

TOTAL : 45 PERIODS

OUTCOMES:

CO1: Apply the knowledge about the various polymers used in automotive application.
CO2: Analyze the structure and properties of polymers.
CO3: Design various mountings and parts based on vibration and damping.
CO4: Design and analyze various seals used in automotive application.
CO5: Design /identify the process used to manufacture the components..

REFERENCES

1. Freakley.P.K., and Payne A.R., Theory and Practice of Engineering with Rubber, Applied Science Publishers Ltd.
2. Hobel.E.F., Rubber Springs Design
3. Blow.C.M. and Hepburn C., Rubber Technology and Manufacture, 1982.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	1	1		1	2	1	1	1		3	3	3
2	2	1	1	1		1	2	1	1	1		3	3	3
3	2	1	1	1		1	2	1	1	1		3	3	3
4	2	1	1	1		1	2	1	1	1		3	3	3
5	2	1	1	1		1	2	1	1	1		3	3	3
AVG	2	1	1	1		1	2	1	1	1		3	3	3

AU7015 PRINCIPLES OF CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVES :

The student should be able to state, explain and illustrate a set of key concepts related to Control Systems qualitatively in the context of an engineering application

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

OUTCOMES :

- To understand the methods of representation of system and thier transfer finction models
- To provide adquate knowledge in the time response of systems and steady state error analysis
- To give basic knowledge in obtainig the open loop and closed loop frequency responses of systems
- To understand the concept of stablity of control system and methos of stablity analysis
- To study the three way of designing compensators for a control system

TEXT BOOKS:

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

AU7016 QUALITY CONTROL AND RELIABILITY L T P C
3 0 0 3

OBJECTIVE:

- Teach the essentiality of Quality Control, sampling and reliability engineering. Study on various types of control charts, six sigma and process capability to help the students understand various quality control techniques. Reliability engineering focuses on the dependability, failure mode analysis, reliability prediction and management of a system.

UNIT I STATISTICAL PROCESS CONTROL 9

Quality control – Definition – Quality Assurance Variation in process – Factors – control charts – variables XR and XÃ, - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 9

Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL and LTPD – Use of standard sampling plans – Sequential sampling plan. Acceptance sampling plan – Acceptance sampling plan for continuous production - CSP-1 plan CSP-2 Plans.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques – Pareto analysis.

UNIT IV RELIABILITY AND ITS PREDICTION 9

Life testing – Failure characteristics – MTBA MTTF – System reliability – OC curve Availability and Maintainability – Reliability Improvement techniques.

UNIT V FAILURE DATA ANALYSIS 9

Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data

requirements – Graphical evaluation.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Will be able to select an appropriate SPC and Sampling process for the Quality Control in particularly for manufacturing Automotive Components.
- Have in-depth knowledge of the Reliability and Failure Data Analysis.
- Will be able to design the experiment based on Taguchi methods

TEXT BOOKS:

1. Amita Mitra “Fundamentals of Quality Control and Improvement” Pearson Education, 2002
2. Modares, “Reliability & Risk Analysis” Marcel Decker Inc. 1993.
3. D. C. Montgomery, “Introduction to Statistical Quality Control”, John Wiley & Sons, 3rd Edition

REFERENCES:

1. Bester field D.H., “Quality Control” Prentice Hall, 7th edition 2003
2. Manohar Mahajan, “Statistical Quality Control” Dhanpal Rai & Sons, 2001
3. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publications, 2004.
4. Charles E Ebling, "An Introduction to Reliablity and Maintainability Engineering" Tata Mc Graw Hill, 2000.
5. D. C. Montgomery and G C Runger, “Applied Statistics and Probability for Engineers”, John Wiley & Sons, 4th Edition

AU7017 SIMULATION OF IC ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge in simulating IC engine processes. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. At the end of the course the students will have command over simulation of IC engine process.

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 multi zone 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

OUTCOMES

- Students will understand the classifications and applications of engine cycle simulation model and grasp the major modeling and simulation methods and the influence of model parameters on engine performance.
- Students will become familiar with the modeling of progressive combustion and gas exchange processes and ability to build up control-oriented simulation model of internal combustion engines
- They will get familiarized with the essential models of engine cycle simulation and theoretical knowledge to control the calculation accuracy and calculation efficiency of engine performance, combustion and emission.

TEXT BOOK

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

REFERENCES

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

AU7018 TWO AND THREE WHEELER TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To develop the basic knowledge of the students in constructional details of two and Three Wheelers. Dissect the skills of the students in the operating principles.

UNIT I POWER UNIT 9

Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams. Types of scavenging processes, merits and demerits – scavenging efficiency. Scavenging pumps – Rotary valve engine.

UNIT II FUEL AND IGNITION SYSTEM 9

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, and starting system - Kick starter system – Self starter system. Recent technologies.

UNIT III CHASSIS AND SUB – SYSTEMS 9

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear

controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices

UNIT IV BRAKES AND WHEELS 9

Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links lay-outs. Brake actuation mechanism. Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tyres and tubes Construction & its Types- vulcanizing methods. Steering column construction, steering geometry for two & three wheelers.

UNIT V TWO & THREE WHEELER CASE STUDY 9

Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Importance of maintenance – general maintenance schedule –Servicing of two and three wheeler – periodic checkups. Recent developments.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the working of two and four stroke engines.
- Illustrate the functioning of clutch and gear box.
- Demonstrate the wheels, tyres, suspensions and braking systems.
- Identify the latest models of two wheelers.
- Define the operations of three wheelers and latest models of three wheelers

TEXT BOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.
2. Marshal Cavandedish, 'Encyclopedia of Motor cycling', New York, 1989
3. Srinivasan.S., 'Motor cycle, Scooter, Mopeds', New century book house, 1988.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai,
3. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
4. Bryaut,R.V., Vespa Maintenance and Repair series.
5. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	2	1	1	1		1	1	1		3	3	3
2	2	1	2	1	1	1		1	1	1		3	3	3
3	2	1	2	1	1	1		1	1	1		3	3	3
4	2	1	2	1	1	1		1	1	1		3	3	3
5	2	1	2	1	1	1		1	1	1		3	3	3
AVG	2	1	2	1	1	1		1	1	1		3	3	3

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AU7019 VEHICLE AIR-CONDITIONING L T P C
3 0 0 3

OBJECTIVES :

- The objective of the course is to impart knowledge in the area of pychrometry, refrigerant and to understand the various components of vehicle air conditioning. Also the Servicing and repairing aspects of vehicle air conditioning will be covered.

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

OUTCOMES:

- Student will understand the fundamental principles and operation of the heating, cooling, ventilation and air-conditioning system.
- Student will able to solve the simple problems related to pychrometry and refrigerant
- Enable the student to understand the operation of the individual components of the A/C
- System, sensors, actuators and electronic control
- Enable the reader to understand the range of techniques that can be used in diagnosing
- faults which affect system performance
- To provide adquate 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. Mitchell Information Services, Inc., Mitchell Automatic Heating and Air Conditioning Systems, Prentice Hall Inc., 1989.
2. Paul Weisler, Automotive Air Conditioning, Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
4. Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.

AU7020	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVE :

- To impart the knowledge on basics of vehicle maintenance and maintenance of engine subsystems and drive line components.

UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS 9

Maintenance – Need, importance, classification of maintenance, basic problem diagnosis. Automotive service procedures – workshop operations – Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments.

UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE 9

General Engine service- Dismantling of Engine components- Engine repair- Service of basic engine sub systems- 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 cross and yoke 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

Maintenance and Service of steering system-Inspection, Maintenance and Service of brake system- Drum brake, Disc brake, Parking 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,

UNIT V AUTO ELECTRICAL AND AIR CONDITIOING 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

OUTCOMES

End of the course student would have deep knowledge on

CO1: Upon the completion of the course student can able to understand the importance of maintenance

CO2: Various sub systems of vehicle and its maintenance Understand Transmission

CO3: Functions of transmission and its maintenance

CO4: The importance of vehicle body structure

CO5: Basic functional principle of electrical and electronic gadgets in automobile and its maintenance

TEXT BOOKS

1. William H Crouse and Donald L Anglin “Automotive Mechanics” Tenth Edition, Mc Graw Hill Publications, 2007
2. Ed May, Automotive Mechanics Volume One , Mc Graw Hill Publications, 2003
3. Ed May, Automotive Mechanics Volume Two , Mc Graw Hill Publications, 2003

REFERENCES

1. Bosch Automotive Handbook, Sixth Edition,2004
2. Vehicle Service Manuals of manufacturers

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2	2	3	1	1	1	1	1	1	3	3	3
2	3		2	2	3	1	1	1	1	1	1	3	3	3
3	3		2	2	3	1	1	1	1	1	1	3	3	3
4	3		2	2	3	1	1	1	1	1	1	3	3	3
5	3		2	2	3	1	1	1	1	1	1	3	3	3
AVG	3		2	2	3	1	1	1	1	1	1	3	3	3

AU7021 VEHICLE MULTIPLEXING L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to impart knowledge in the areas of vehicle networking, various vehicle networking standards and multiplexing buses

UNIT I INTRODUCTION TO VEHICLE NETWORKING CONCEPTS 9

Historical Perspective- Multiplexing Paradox- Vehicle multiplexing comparison to industry- Why multiplexing – Popularity of multiplexing- SAE Classification- Intra Module Versus Intermodule communication- Examples of Vehicle Nodes – Terminology like : open architecture , Broad cast, Peer to peer, Baud rate versus Bit rate, protocol Synchronous and asynchronous protocol- On board Diagnostics- Encoding- Error Handling- Media Characteristics etc.

UNIT II VARIOUS MULTIPLEXING LEVEL 9

The vehicle Level- Topologies- Network Design issues- Development Tools- Service tools- Vehicle Level Testing- The Electronic Control Level- Integrated Control- Unexpected message delays- message synchronization- local loss of power and ground- Integrated circuit level- Partitioning – General digital tradeoffs- Digital CAN implementation- Electromagnetic compatibility

UNIT III MULTIPLEXING STANDARDS 9

ISO standards- SAE international standards- Class A protocols- Class B protocols- Class C protocols- Diagnostic Protocols- Air Bag Protocols- Wireless Protocols- Data Link Usage- Future Trends

UNIT IV CAN: FROM CONCEPT TO REALITY 9

The CAN bus: general-CAN: its protocol, its properties, its novel features-The CAN physical layer-Medium, implementation and physical layers in CAN-Components, applications and tools for CAN-Event-triggered and time-triggered aspects-TTCAN – Time-triggered communication on CAN-Towards high-speed, X-by-Wire and redundant systems

UNIT V NEW MULTIPLEXED BUS CONCEPTS 9

LIN – Local Interconnect Network-Think 'Bus', think 'Fail-safe SBC', 'Gateways' -Safe-by-Wire-Audio-video buses

TOTAL: 45 PERIODS

OUTCOMES :

- Students will acquire knowledge in multiplexing terminology and Standards relevant to vehicle
- Student can able to understand the current state of the CAN protocol, all the possible subdivisions of the physical layers and everything relating to conformity problems.
- Student can able to know the importance of various new multiplexed bus concepts

TEXT BOOKS:

1. Vehicle Multiplex Communication by Christopher Albert Lupini , SAE International ISBN 0-7680-1218-X, 2004
2. Multiplexed Networks for Embedded System by Dominique Paret, John Wiley & sons, 2007

AU7022	VIRTUAL INSTRUMENTATION IN AUTOMOBILE ENGINEERING	L T P C 3 0 0 3

OBJECTIVE :

- To learn and understand the programming,data acquistion hardware and implementing small automotive related projects in virtual instrumention.

UNIT I INTRODUCTION 9

Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation- VI programming techniques- VI, sub VI, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

UNIT II DATA ACQUISITION IN VI 9

A/D and D/A Converters, plug-in Analog input / Output cards- Digital Input and Output cards, Organization of the DAQ VI system- Opto Isolation- Performing analog input and analog output-Scanning multiple analog channels- issues involved in selection of data acquisition cards- Data acquisition modules with serial communication- Design of digital voltmeter with transducer input-Timers and Counters.

UNIT III COMMUNICATION NETWORKED MODULES 9

Introduction to PC buses-Local buses:-ISA,PCI,RS232,RS422 and RS 485- Interface buses:-USB,PCMCIA,VXI,SCXI and PXI – Instrumentation Buses:- Modbus and GPIB- Networked buses-ISO/OSI reference model, Ethernet and TCP/IP Protocols.

UNIT IV REAL TIME CONTROL IN VI 9

Design of ON/OFF controller and proportional controller for a mathematically described processes using VI software- Modeling and basic control of level and Reactor Processes- Case Studies on development of HMI, SCADA in VI.

UNIT V AUTOMOTIVE APPLICATIONS 9

PC based digital storage oscilloscope- Sensor technology and signal processing- virtual laboratory- spectrum analyzer- wave form generator- Data visualization and multiple locations:-Distributed monitoring and control-Vision and motion control. Case study related to automotive applications

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Nadovich, C., "Synthetic Instruments Concepts and Applications". Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., "Labview Advanced programming Techniques", CRC Press, 2nd Edition, 2007.
3. Gupta, S. and Gupta J. P., "PC Interfacing for Data Acquisition and Process Control", 2nd Edition, Instrument Society of America, 1994.

REFERENCES:

1. Jamal, R. and Picklik, H., "Labview-Applications and Solutions ", National Instrument Release
2. Johnson, G.," Labview Graphical programming " , McGraw-Hill, Newyork,1997.
3. Wells, L.K and Travis, J., " Labview for Everyone", Prentice Hall, New Jersey, 1997
4. Buchanan, W., "Computer Busses ", CRC Press, 2000

GE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as
- mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,
- Disaster damage assessment and management.

TEXT BOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13:978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

GE7073 FUNDAMENTALS OF NANO SCIENCE **L T P C**
3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION **8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION **9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS
PERIODS

OUTCOMES:

CO1: Able familiarize about the science of nanomaterials
CO2: Able demonstrate the preparation of nanomaterials
CO3: Able develop knowledge in characteristic nanomaterial
CO4: Able to define the characteristics of Nano materials
CO5: Apply the concepts of Nano materials in the field of automobile applications

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3	1	1	1	1	1	1		3	3	3
2	3	3	3	3	1	1	1	1	1	1		3	3	3
3	3	3	3	3	1	1	1	1	1	1		3	3	3
4	3	3	3	3	1	1	1	1	1	1		3	3	3
5	3	3	3	3	1	1	1	1	1	1		3	3	3
AVG	3	3	3	3	1	1	1	1	1	1		3	3	3

GE7074 **HUMAN RIGHTS** **L T P C**
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

CO1: Gain and apply the knowledge using computers for various manufacturing activities
CO2: Employ the most suitable material handling equipment to accomplish the given task
CO3: Employ the principles of cellular manufacturing
CO4: Gain and apply the knowledge using flexible manufacturing system
CO5: Evaluate the functions of shop floor control and associated systems.

REFERENCES:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

CO - PO and PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					3	2	2	2	1		2	2	2
2	2					3	2	2	2	1		2	2	2
3	2					3	2	2	2	1		2	2	2
4	2					3	2	2	2	1		2	2	2
5	2					3	2	2	2	1		2	2	2
AVG	2					3	2	2	2	1		2	2	2

GE7652 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand 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--The 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 bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA 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

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:
1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.

PR7452 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C
4 0 0 4

OBJECTIVE:
- To introduce the various quantitative techniques and optimization techniques and to make the students apply these techniques for modeling and solving many engineering situations in general and manufacturing situations in particular.

UNIT I LINEAR PROGRAMMING 12
Problem formulation - Graphical method – simplex method – Special cases – transportation and assignment method – applications**.**

UNIT II REPLACEMENT MODELS AND GAME THEORY 12
Basic replacement model – individual and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications of LP in game theory – applications.

UNIT III QUEUING MODELS AND SIMULATION 12
Elements of queue – queue discipline – Poisson arrival and exponential service – queue length – waiting time – steady state conditions – applications – concept of simulation – Monte Carlo method – applications.

UNIT IV FORECASTING, SEQUENCING AND LINE BALANCING 12
Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules - sequencing – methods of sequencing – Johnson's rule – Heuristic approach, line balancing – applications.

UNIT V PROJECT NETWORK ANALYSIS AND DECISION TREE ANALYSIS 12
Network – CPM/PERT – Project time estimation – critical path – crashing of network, Decision tree analysis – applications

TOTAL: 60 PERIODS

OUTCOME:
- The students shall able to select and apply techniques for typical engineering and industrial situations.

TEXT BOOKS:
1. Panneerselvam R., "Operation Research", Prentice Hall of India, 2008.
2. Hamdy A.Taha, "Operations Research – An Introduction", Prentice Hall of India, 8th edition 2008.

REFERENCES:

1. Guptha. P.K. and Man-Mohan, “Problems in Operations Research”, Sultan chand and Sons, 2014.
2. Monks. J.G, “Operations Management theory and Practice”, McGraw Hill, 2nd edition 1996.
3. Ravindran, Philips and Sojberg, “Operations Research Principles and Practice”, John Wiley and Sons, Singapore, 2nd edition,2007.
4. Sharma J.K., “Operations Research Theory and Applications”, Macmillan India Ltd., 4th edition, 2009.

GE7072	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends **- Introduction to Product Development Methodologies and Management -** Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies **-** Product Life Cycle – Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - **System Design & Modeling -** Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – **Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design -** Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program **-** Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping -** Introduction to Rapid Prototyping and Rapid Manufacturing - **System Integration, Testing, Certification and Documentation**

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance -**Maintenance and Repair – Enhancements - **Product EoL -** Obsolescence Management – Configuration Management - EoL Disposal

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials -** Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

REFERENCES:

1. Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013