

DIRECTORATE OF TECHNICAL EDUCATION,
KAHILIPARA, GUWAHATI-19



DIPLOMA PROGRAMME IN
MECHANICAL
(AUTOMOBILE)
ENGINEERING
NEW SYLLABUS

I JANUARY, 2019

3RD SEMESTER



MECHANICAL (AUTO) ENGINEERING, (NEW SYLLABUS)

3rd semester

COURSE STRUCTURE OF 3rd SEMESTER MECHANICAL (AUTOMOBILE) ENGINEERING

S l N o	Code No.	Subject	Study Scheme (Contact hours/week)			Evaluation Scheme									
						Theory					Practical			Total Marks(Theory +Practi cal)	Credit
			L	T	P	ES E	Sessional (SS)			Pass (ESE+ SS)	Practi cal Test (PT) #	Practi cal Asses sment (PA) @	Pass (PT+ PA)		
							T A	H A	Total (TA+ HA)						
1	Co-301	Computer Application & Programming	3		3	70	10	20	30	33/100	25	25	17/50	150	4
2	Hu- 302	Engineering Economics & Accountancy	3			70	10	20	30	33/100				100	3
3	El/Et- 304	Fundamental of Electrical & Electronics Engineering	3		3	70	10	20	30	33/100	25	25	17/50	150	4
4	Me/Ch 301	Environmental Education	3			70	10	20	30	33/100				100	3
5	Me- 302	Fluid Mechanics & Fluid Machines	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
6	Me- 303	Manufacturing Technology-I	3		3	70	10	20	30	33/100	25	25	17/50	150	4
7	Au- 310	Professional Practice- I	1		2						25	25	17/50	50	2
		Total	19	1	14									850	25
			34												



1. Course Title–Computer Application & Programming (All Branches)

1. **Course title: Computer Application & Programming**

2: **Course Code –Co-301**

3: **Semester- 3rd**

4: **Aim of the Course :**

- To give basic concepts related to organisation of a computer
- To give fundamental terminologies in networking
- To develop simple programs in C.

5: **Course Outcome:**

On completion of the course students will be able to:

- Explain the basics of a computer hardware and software
- Solve problems related to number systems
- Define basics of Operating System
- Familiarize with networking components
- Write simple C programs

6: **Prerequisites for the Course:** Have basic idea about a computer and its functions.

7: **Teaching Scheme (in hours):**

Teaching Scheme			
L	T	P	Total hours per week
3	0	3	6

8: **ExaminationScheme :**

	Theory (T)	Sessional (TS)	Practical (P)	Practical Sessional (PS)
Full Marks	70	30	25	25
Pass Marks	33		17	



9: Detailed Course Content:

Unit	Topic/Sub-Topics	Intended Learning Outcome	Hours
1	Computer Architecture: Brief history, Charles Babbage Machine, Von Neuman Architecture, block diagram, memory & its different types, I/O devices, Role of O.S., computer languages, translator software, editor. Data, different types of data, information and its characteristics	<ol style="list-style-type: none"> 1. Define a computer and identify its parts. 2. Define computer memory & describe its different types. 3. Define computer languages & translators. 4. Describe the characteristics of information. 	8
2	Number System and codes: Different number system- decimal, binary, octal, hexadecimal number system, their conversion, 1's and 2's Complement, subtraction using complements. Different codes- ASCII, BCD, Ex-3, Gray. Conversion from Gray to binary and vice-versa, BCD addition.	<ol style="list-style-type: none"> 5. Define decimal, binary, octal & hexadecimal number systems. 6. Convert between different number systems. 7. Define 1's & 2's complements. 8. Subtract using 1's & 2's complements. 9. Describe some different codes. 	8



Unit	Topic/Sub-Topics	Intended Learning Outcome	Hours
3	<p>Introduction to Operating System:</p> <p>Definition, single user and multi-user OS, different function performs by OS, various popular OS like DOS, Windows, UNIX/LINUX. DOS and UNIX commands.</p>	<p>10. Define operating system.</p> <p>11. Operate different commands of DOS, Windows & UNIX/LINUX.</p>	5
4	<p>Computer Network and the Internet:</p> <p>Definition, necessity of network, different types of network-LAN, MAN, WAN, network topology, transmission media, different network devices like NIC, hub, bridge, switch, gateway. Introduction to the internet, Internet services, browser, search engine.</p>	<p>12. Define network.</p> <p>13. Describe different types of network.</p> <p>14. Define network topology.</p> <p>15. Describe different network devices.</p> <p>16. Define internet & describe different internet services.</p> <p>17. Explain use of different browsers & search engines.</p>	6
5	<p>Introduction to C programming:</p> <p>Fundamentals of programming-Algorithm & Flowchart, source code and object code, Basic structure of C programs, Executing a C program, Constants, Variables, and data types. Operators and expression, Input Output function like printf, scanf, getchar, putchar, gets, puts, Decision making and branching using IF..Else, Switch, looping using for, while, and do-while, array.</p>	<p>18. Write algorithm and flow charts for simple programs</p> <p>19. Define basic terminology of C language.</p> <p>20. Write small program using C language.</p> <p>21. Write diversified solutions using C language.</p> <p>22. Differentiate between IF..Else and Switch statement.</p>	15
	Internal Assessment		3



10. Intellectual Skills:

- Logical reasoning
- Relating programming concepts in problem solving

11. Motor Skills:

- Learn to use and handle a computer and its peripherals.

List of Lab Exercises :**I. Basic commands for computer system maintenance.****II. Preparation of Documents**

Introduction to Word processing, Opening a document, preparing documents, inserting diagrams and tables, Editing document- (a) Character, word and line editing, (b) Margin Setting, Paragraph alignment, (c) Block Operations, (d) Spell Checker, (e) Saving a document, (f) Mailmerge.

III. Information Presentation through Spread Sheet

Application of Spread Sheet, Structure of spreadsheets, Preparing table for simple data and numeric operations, Using formulae and functions in excel operations, Creation of graphs, Pie charts, bar charts.

IV. Preparation of presentation

Creation of electronic slides on any topic, Practice of animation effect, presentation of slides.

V. Programming in C

Editing a C program, defining variables and assigning values to variables Arithmetic and relational operators, arithmetic expressions and their evaluation Practice on in iput/output function like getchar, putchar, gets, puts, scanf, printf etc. Programming exercise on simple if statement, If..else statement, switch statement Programming exercise on looping with do-while, while, for loop and array.



10: Distribution of Marks:

Unit	Topic	Type of Question			Total Marks
		Objective	Short	Descriptive	
1	Computer Architecture	6	5	5	16
2	Number System and codes	4	2	8	14
3	Introduction to Operating System	4	2	4	10
4	Computer Network and the Internet	5	3	6	14
5	Introduction to C programming	6	3	7	16
		25	15	30	70

11: Table of specification:

Unit	Topics (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Computer Architecture	8	19	✓			
2	Number Systems & Codes	8	19	✓		✓	
3	Introduction to Operating Systems	5	12	✓			
4	Computer Network & the Internet	6	15	✓		✓	
5	Introduction to C Programming	15	35	✓		✓	
	Total	Σ b=42	100				

K = Knowledge C = Comprehension

A =Application HA = Higher Than

Application (Analysis, Synthesis, Evaluation)

$$c = \frac{b}{\Sigma b} * 100$$

Detailed Table Of Specifications

Unit	Topics	Objective				Short					Descriptive				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Computer Architecture	7			7	5				5	4				4
2	Number Systems & Codes	4			4	2				2	4		4		8
3	Introduction to Operating Systems	4			4	2				2	4				4
4	Computer Network & the Internet	5			5	3				3	3		4		7

5	Introduction to C Programming	5		5	3			3	3		4		7
	Total	25		25	15			15	18		12		30

K = Knowledge C = Comprehension A = Application HA = Higher Than Application T = Total

12: Suggested Implementation Strategies:

- 1: As the subject is taught to the students of all branches, basic knowledge required to understand the computer hardware and software needs to be emphasized.
- 2: Too much of hardware details could be avoided.
- 3: Programming section theory could be taught side by side in the lab.

13: Suggested Learning Resources :

1. Fundamentals of Computer, Rajaraman, PHI
2. It Tools and Applications, DOEACC "O" Level, Firewall Media
3. Let us C by Y. Kanetkar, BPB
4. Programming in ANSI C / E. Balagurusamy / Tata McGraw-Hill



2. Course Title– Engineering Economics and Accountancy (All Branches)

1. Course Title : **ENGINEERING ECONOMICS AND ACCOUNTANCY**
2. Course Code: **Hu – 302**
3. Semester: 3rd

4. Aim of the Course:

1. To introduce the students to some important economic and accounting terms.
2. To acquaint the students with some economic laws and with the functions of money, bank etc.
3. To make the students capable of recording business transaction under double entry system.
4. To introduce the students about financial statements.

5. Course Outcomes:

On completion of the course on EEA, students will be able to

- CO₁ = Define some important economic and accounting terms.
- CO₂ = Explain some basic economic laws.
- CO₃ = Describe overall economic environment.
- CO₄ = Explain double entry system of book keeping.
- CO₅ = Record business transactions under double entry system of book keeping
- CO₆ = Define financial statements.

1. **Teaching Scheme (in hours)**

Lecture	Tutorial	Practical	Total
42 hrs	3 hrs	--	45 hrs

2. **Examination Scheme:**

Theory				Practical				Total Marks
Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination		Sessional		
70	30	100	33	--	--	--	--	100

3. Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
Part – A : Engineering Economics				21 hrs
1.0	Introduction to Economics :	i) Definition of Economics, its utility and scope of study ii) Definition of Engineering Economics ii) Meaning and concepts of Utility, Consumption, Value, Price, Goods and National Income, inflation iii) Wants – Definition and characteristics iv) Wealth & Welfare– Definition, meaning and types	i) explain core economic terms concepts and theories	5
2.0	Demand and Supply :	i) Meaning and types of Demand ii) The Law of Demand, its limitations iii) Preparation of Demand Schedule iv) Meaning of Supply ii) The Law of Supply, its limitations iii) Preparation of Supply Schedule	Define the Laws of Demand and Supply	4
3.0	Production :	i) Meaning and factors of production ii) Factors determining efficiency of labour iii) Savings, investment and capital formation iv) Meaning of production function	i) Define factors of production ii) Explain formation of capital	5
4.0	Money:	i) Meaning of money ii) Types of money iii) Functions of money	i) Understand meaning and functions of money	2

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
5.0	Banking Organisation :	i) Central Bank – its functions ii) Commercial banks – its functions	i) Distinguish the functions of different banks	3
6.0	Pricing	i) Objectives of pricing policy ii) price determinants iii) Price discrimination	i) explain pricing policy	2
Part – B : Accountancy				21 hrs
7.0 (A)	Introduction to Book-Keeping and Accounting:	i) Definition & objectives of Book-keeping ii) Need and advantages of Book-keeping iii) Definition of Accounting iv) Difference between Book-keeping and Accounting v) Double Entry System – main features vi) Advantages and disadvantages of Double Entry System	i) Define Double Entry System of Book Keeping ii) State its objectives, features merits and demerits	3
(B)	Introduction to Computerised Accounting System:	i) Components of Computerized Accounting Software ii) Need for Computerized Accounting iii) Difference between Manual Accounting and Computerised Accounting	i) Identify components of computerized accounting software	2



8.0	Transaction:	i) Definition ii) Meaning of Account iii) Classification of Accounts: - Traditional Approach - Modern Approach iv) Meaning of Debit and Credit v) Rules of Debit and Credit	i) State the meaning and rules of Debit and Credit	2
Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
9.0	Journal and Ledger	i) Meaning Journal ii) Recording of Transactions in Journal iii) Meaning of Ledger iv) Objectives and utility of Ledger v) Posting and balancing of Ledger vi) Distinction between Journal and Ledger vii) Names of different Books of Accounts	i) Record business transactions under double entry system in books of accounts	4
10.0	Cash Book:	i) Meaning and importance of Cash Book ii) Characteristics and advantages of Cash Book iii) Discount – Trade Discount and Cash Discount iv) Different types of Cash Book: - Single Column Cash Book - Double Column Cash Book - Triple Column Cash Book	i) Differentiate different types of Cash Book ii) Record transactions in Cash Book	4



		v) Bank Reconciliation Statement – Basic idea		
11.0	Trial Balance & Errors in Accounting:	i) Meaning and objects of Trial Balance ii) Main features and advantages of Trial Balance iii) Preparation of Trial Balance iv) Types of errors in Accounting	i) Explain meaning and features of Trial balance	3



Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
12.0	Components of Final Accounts:	i) Meaning and objectives of Trading Account ii) Contents of Trading Account iii) Meaning and objectives of Profit and Loss Account iv) Contents of Profit and Loss Account v) Meaning of depreciation, revenue expenditure and capital expenditure vi) Contents of Balance Sheet	i) Identify different components of Financial Statements	3
	Class Test			3 hrs
	Total			45 hrs

9. TABLE OF SPECIFICATIONS for Engineering Economics & Accountancy

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Comprehension	Application	HA
1	Introduction to Economics	5	12	5	3	0	0
2	Demand & Supply	4	9	2	4	0	0
3	Production	5	12	6	2	0	0
4	Money	2	5	4	0	0	0
5	Banking Organisation	3	7	3	2	0	0
6	Pricing	2	5	2	2	0	0

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Comprehension	Application	HA
7	(A) Introduction to Book-Keeping	3	7	5	0	0	0
	(B) Introduction to Computerised Accounting System	2	5	3	0	0	0
8	Transaction	2	5	2	1	0	0
9	Journal & Ledger	4	9.5	2	2	3	0
10	Cash Book	4	9.5	0	5	2	0
11	Trial Balance & Errors in Accy	3	7	5	0	0	0
12	Components of Final Accounts	3	7	2	3	0	0
Total		42hrs	100	41	24	5	0

K = Knowledge

C = Comprehension A = Application

A = Higher than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$



10. Distribution of Marks:**DETAILED TABLE OF SPECIFICATIONS FOR EEA**

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	Total
1	Introduction	3	1	0	4	2	2	0	0	4	0	0	0	0	0	8
2	Demand & Suppl	0	0	0	0	0	0	0	0	0	2	4	0	0	6	6
3	Production	1	0	0	1	2	0	0	0	2	3	2	0	0	5	8
4	Money	2	0	0	2	2	0	0	0	2	0	0	0	0	0	4
5	Banking Organis	1	0	0	1	0	0	0	0	0	2	2	0	0	4	5
6	Pricing	2	2	0	4	0	0	0	0	0	0	0	0	0	0	4
7	Introduction to B K	2	0	0	2	3	0	0	0	3	0	0	0	0	0	5
	Introd. to Computer	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3
8	Transact	2	0	0	2	0	1	0	0	1	0	0	0	0	0	3
9	Journal & Ledge	1	0	0	1	0	0	0	0	0	1	2	3	0	6	7
10	Cash Book	0	2	0	2	0	0	0	0	0	0	3	2	0	5	7
11	Trial Balance	3	0	0	3	2	0	0	0	2	0	0	0	0	0	5
12	Components F/Ac	0	0	0	0	0	0	0	0	0	2	3	0	0	5	5
	Total	20	5	0	25	11	3	0	0	14	10	16	5	0	31	70

K = Knowledge C = Comprehension A = Application

HA = Higher Than Application **Higher than Application (Analysis, Synthesis, Evaluation)**

T = Total

11 Suggested implementation Strategies: Modified syllabus may be implemented with effect from July, 2018 (Starting with the present batch (2018) of 2nd Semester students)

12 Suggested learning Resource

a. Book list

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Introductory Micro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
2	Introductory Macro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
3	Theory and Practice of Accountancy	B. B. Dam R. A. Sarda R. Barman B. Kalita	Capital Publishing Company, Guwahati – 5
4	Book-Keeping & Accountancy	Juneja, Chawla &Saksena	Kalyani Publisher, New Delhi – 110002
5	Tally. ERP 9 For Beginners	Tally Solutions Pvt. Ltd.	Sahaj Enterprises, Bangalore

- a. List of Journals
- b. Manuals
- c. Others



3 Course Title– Environmental Education

ENVIRONMENTAL EDUCATION

Subject Title	: ENVIRONMENTAL EDUCATION		
Subject Code	:	Me/Ch-301	
Hours Per Week	:	03	
Hours Per Semester	:	45	
Class Test hrs	:	03	
Total hrs	:	48	
Full marks(Theory)	:	70	
Sessional Marks	:	30	
Class hours	L	T	P
	3	0	0

Pre requisite :None

Aim of the subject :The aim of the subject is to let the students know about the environment its importance of study, different types of pollution , its effect on environment.

CO-----Course Outcome of the subject.(Outcome based Objective)

After studying the course the students will be able to

- 1) Know the need of the environmental study
- 2) Know the importance of ecology
- 3) Identify the different type of pollution and its impact on the environment
- 4) Know about the environmental sanitation process
- 5) Appreciate the resource conservation like conservation of land forest and timber, wild life, minerals
- 6) Know about the pollution control strategies

COURSE CONTENTS



1.0 General concept

- 1.1 Nature and scope of environmental problems, definition.
- 1.2 Interaction of system.
- 1.3 Environmental disturbances.
- 1.4 Public awareness and action.
- 1.6 Population and economic growth.
- 1.7 Impact of industrialization and urbanization on environment.

2.0 Elements of ecology

- 2.1 Concept of ecosystem
- 2.2 Concept of biosphere and its components.
- 2.3 Energy flow in ecosystem.
- 2.4 Food chain in ecosystem.

3.0 Environmental Pollution

- 3.1 Water pollution types, source and their effects, natural recovery of water bodies, BOD, COD, DO sag curve
- 3.2 Air pollution definition, types, sources and it's effects. Air quality standards. Acid rain, Ozone hole depletion, Green house gases and their effects, Global warming. Vehicular pollution and prevention.
- 3.3 Land pollution, it's types, sources and their effects.
- 3.4 Noise pollution, sources, measurements and it's effects.
- 3.5 Radioactive pollution, types, sources and their effects.

4.0 Environmental Sanitation

- 4.1 Epidemiology- infectious diseases, factors and transmission of diseases.
- 4.2 Sanitary protection.
- 4.3 Occupational health hazards
- 4.4 Solid waste, sources, disposal methods.

5.0 Resource Conservation

- 5.1 Conservation of land, forest and timber, wildlife, minerals
- 5.2 Environmental Management.

5.3 Pollution control strategies.

5.4 Environmental ethics.

Table Of Specification for Environmental Education																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97
1	8	General concept	2	2	2	6	2	1	3	0	6	0	2	2	2	6	18
2	9	Ecology	2	1	2	4	2	3	3	0	8	0	2	2	2	6	18
3	10	Environmental Pollution	2	3	3	8	2	2	2	2	8	2	3	2	2	9	25
4	9	Environmental Sanitation	2	2	2	6	2	2	2	0	6	0	2	2	2	6	18
5	9	Resource Conservation	1	1	3	5	1	1	2	2	6	2	2	3	2	7	18

Annexure -I Environmental Education								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total(97)
1	General concept	8	17.80	4	5	7	2	18
3)	Ecology	9	20.00	4	6	7	2	18
3	Environmental Pollution	10	22.20	6	8	8	4	25
4	Environmental Sanitation	9	20.00	4	6	6	2	18
5	Resource Conservation	9	20.00	4	4	8	4	18

REFERENCES

1. Environmental Education by Alan Reid
2. An Introduction to Environmental Education by Ezaza&Otienda Atman

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4. Course Title: Fluid Mechanics & Fluid Machines

Fluid Mechanics & Fluid Machines

Subject Title	: FLUID MECHANICS & FLUID MACHINES		
Subject Code	: Me-302		
Hours Per Week	: 03		
Hours Per Semester	: 45		
Class Test hrs	: 03		
Total hrs	: 48		
Full marks(Theory)	: 70		
Sessional Marks	: 30		
Class hours	L	T	P
	3	1	3

Pre requisite :Applied Physics, Applied Chemistry, Mathematics, Engineering Mechanics

Aim of the subject :The aim of the subject is to let the students know

- 1) about the different properties of the fluid ,
- 2) how the fluid particles behaves during statical pressure,
- 3) how the fluid particles behaves during flow,
- 4) how the different types of pump behaves with the fluid

CO-----Course Outcome of the subject.(Outcome based Objective)

After studying the course the students will be able to

1. Know the different properties of fluids
2. Calculate fluid pressure using manometer
3. Appreciate the Archimedes' Principle of a floating object
4. Apply Bernoulli's theorem for solving problems on discharge
5. Calculate the Coefficient of discharge of a Venturi-meter and a notch
6. Solve problems on head loss for both pipe flow and open channel flow
7. Identify the components of pumps and hydraulic turbines
8. Solve small problems on hydraulic turbines and pump.

1 INTRODUCTION



- 1.1 Introduction of fluid mechanics
- 1.2 Definition _solid, liquid & gas
- 1.3 Classification of Fluid: Ideal & real fluids
- 1.4 Units & dimensions

2 **PHYSICAL PROPERTIES OF FLUIDS**

- 2.1 Specific weight, mass density, specific gravity, compressibility
- 2.2 Viscosity, Newton's law of viscosity, kinematic viscosity, dimensional formula and units of viscosity
- 2.3 Surface tension, cohesion & adhesion
- 2.4 Newtonian & Non Newtonian fluid
- 2.5 Problems related to 2.1 & 2.2

3 **FLUID STATICS**

- 3.1 Pressure(atmospheric, absolute & gauge)
- 3.2 Transmission of pressure (Pascal's law & its application)
- 3.3 Hydrostatic law (Pressure, specific weight & height relationship)
- 3.4 Force & centre of pressure on a horizontal , vertical & inclined submerged surface with deduction
- 3.5 Archimedes' principle, stability of immersed & floating bodies, metacentre & determination of metacentric height (Simple problems related to 3.2,3.4 to 3.5)

4 **FLUID KINEMATICS**

- 4.1 Classifications of fluid flow (laminar & turbulent), steady & unsteady, uniform & non uniform, compressible & non compressible, rotational & irrotational
- 4.2 Flow rate & Continuity equation
- 4.3 Bernoulli's equation including its modification
- 4.4 Total Energy & Hydraulic gradient (simple problems related to 4.2 & 4.3)

5 **FLUID MEASUREMENTS**

- 5.1 Piezometer
- 5.2 Description & working principle of simple Tube manometer, differential manometer



5.3 Definition & relation of coefficient of contraction, coefficient of velocity & coefficient of discharge & vena contracta

5.4 Working principle & use – Venturimeter, Orificemeter&Pitot tube

5.5 (Simple problems on 5.2, 5.3,5.4)

6 PIPE & OPEN CHANNEL FLOW

6.1 Flow losses in pipes (at entrance,exit, contraction, expansion & bending) only empirical formula

6.2 Laws of fluid friction

6.3 Darcy's equation for head loss due to pipe friction (Simple problems on 6.2 & 6.3)

6.4 Chezy's&Manning's formula (No deductions & problems only) .

7 FLUID MACHINES : IMPACT OF JET

7.1 Direct impact of a jet on a stationary flat plate

7.2 Direct impact of a jet on an inclined fixed plate

7.3 Impact of a jet on a moving plate

7.4 Impact of a jet on a series of flat vanes mounted on the periphery of a large wheel

7.5 All related problems

8 HYDRAULIC TURBINES

8.1 Classification – Impulse & Reaction

8.2 Pelton wheel – components, working principle, velocity diagrams, work done, power,efficiency.

8.3 Francis turbine – components, working principle, velocity diagrams, work done, power, efficiency.

(PROBLEMS)

8.4 Kaplan turbine- components

8.5 Governing of an impulse turbine (Pelton wheel)

8.6 Difference between impulse & reaction turbine

9 PUMPS

9.1 Classification of pumps

9.2 Reciprocating pump – Types

9.3 Working principle (single acting & double acting), discharge, slip, pump work, power required, indicator diagram (Simple related problems)

9.4 Use of air vessels

9.5 Advantages & disadvantages of reciprocating pump over centrifugal pump

9.6 Centrifugal pump – types



9.7 Working of the pump, methods of converting the K.E of water leaving the impeller into pr. Energy, guide blades, priming

9.8 Work done by the impeller, the manometric head, the manometric efficiency. Impeller power, the mechanical efficiency., the overall efficiency.,

9.9 Multistage centrifugal pumps ,specific speed of centrifugal pumps

9.10 Problems

Table Of Specification for Fluid Mechanics & Fluid Machines																	Total	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					97	
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T		
1	1	Introduction	1	1	1	3	0	0	0	0	0	0	0	0	0	0	0	3
2	3	Physical Properties of Fluids	1	1	0	2	0	2	2	0	4	0	0	0	0	0	0	6
3	6	Fluid Statics	1	1	0	2	0	1	2	0	3	0	0	4	4	4	8	13
4	6	Fluid Kinematics	1	0	1	2	0	1	2	1	4	0	0	3	4	4	7	13
5	6	Fluid Pressure Measurement	2	0	0	2	0	0	1	2	3	0	0	4	4	4	8	13
6	6	Pipe Flow & Open Channel Flow	0	2	0	2	0	0	2	1	3	0	0	4	4	4	8	13
7	5	Fluid Machine	0	0	2	2	1	0	2	0	3	0	4	0	4	4	8	10
8	6	Hydraulic Turbines	1	1	0	2	1	2	0	0	3	0	4	4	0	0	8	13
9	6	Pumps	1	1	0	2	1	1	1	4	6	0	4	4	0	0	8	13

Annexure -I Fluid Mechanics and Fluid Machines								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total(97)
1	Introduction	1	2.22	1	1	1	0	3
2	Physical Properties of Fluids	3	3.66	1	3	2	0	6
3	Fluid Statics	6	13.33	1	2	6	4	13
4	Fluid Kinematics	6	13.33	1	1	6	5	13
5	Fluid Pressure Measurement	6	13.33	2	0	5	6	13
6	Pipe Flow & Open Channel Flow	6	13.33	0	2	6	5	13
7	Fluid Machine	5	11.11	1	0	4	4	10
8	Hydraulic Turbines	6	13.33	2	3	4	0	13
9	Pumps	6	13.33	2	2	5	4	13

Books and References:

1. Hydraulics by R H Khurmi
2. Fluid Mechanics by Jain

-----XX-----



4. Course Title: Fluid Mechanics & Fluid Machines Laboratory

Fluid Mechanics & Fluid Machine Laboratory

Weekly hrs	03
Total hrs	45
Sessional Marks	25
Viva Marks	25
Total	50

Outcome based Objectives:

After performing the experiments the students will be able to

1. Appreciate the use of Archimedes' Principle
2. Verify Bernoulli's Theorem
3. Calculate Discharge using Venturimeter
4. Calculate Discharge using Notch
5. Determine Pipe friction using Darcy's formula
6. Determine the Forces of jet on fixed and moving plate
7. Know the function of Centrifugal pump
8. Determine the type of flow in a pipe, laminar or turbulent using Reynold's Apparatus

Course content



1. Measurement of meta centric height of a floating ship model
 2. Experiment on Bernoulli's theorem
 - i) Using Bernoulli's Apparatus
 3. Determination of coefficient of discharge by using
 - i) Orifice meter
 - ii) Venturimeter
 - iii) Notch
 4. Pipe Friction
 - i) Determination of friction factor 'f' in pipe flow
 - ii) Determination of minor losses in pipe flow
 5. Force of jet
 - i) Determination of force of jet on a fixed and moving plate
 6. Centrifugal pump
 - i) Determination of pressure head
 7. Determination of Laminar flow or Turbulent flow
 - i) Reynolds' Apparatus
-



5. Course Title– Fundamental of Electrical & Electronics Engineering

1. Course Code :- EI/Et-304
2. Semester :- 3rd
3. Duration of Exam= 3 hrs
4. COURSE OUT COME (CO)

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

- Define current, voltage, insulator, conductor etc.
- Solve numerical problems using Kirchhoff's law.
- Operate motor and generator.
- Explain briefly the alternating current and transformer
- Explain the use of semiconductor and transistor.
- Guide house wiring
- Explain the fundamental concept of digital electronics correlated to microprocessor with its applications.

CO s and ILOs

<i>CO s</i>	<i>ILO s</i>
CO -1. define current, voltage, insulator, conductor etc	<ol style="list-style-type: none"> 1. Define conductor, insulator, and semiconductor with examples. 2. Define current, voltage, resistance, capacitance 3. Describe the Ohm's law 4. Solve problems related to Ohm's law
CO-2 Solve numerical problems using Kirchhoff's law	<ol style="list-style-type: none"> 1. Explain DC network. 2. Define and explain the Kirchhoff's current and voltage law 3. Solve of critical problems by using Kirchhoff's current and voltage law 4. Use of Wheatstone bridge 5. Determine of unknown resistance by Wheatstone bridge



<i>CO s</i>	<i>ILO s</i>
CO-3 operate motor and generator	<ol style="list-style-type: none"> 1. Define DC generator and motor 2. Explain the construction of DC generator and motor 3. Explain the working principle of DC generator and motor 4. Compare the DC motor and generator 5. Enumerate different types of DC motor and generator 6. Explain use of DC generator and motor
CO -4 Explain briefly the alternating current and transformer	<ol style="list-style-type: none"> 1. Define amplitude, time period, frequency, equation of alternating voltage and current, RMS, average value, instantaneous value, peak factor. 2. Explain RLC circuit 3. Explain inductance of AC circuit 4. Solve numerical problems 5. Explain construction of transformer 6. State operating principle of transformer 7. State type and uses of transformer 8. State step up and step down transformer
CO5- Explain the use of semiconductor and transistor	<ol style="list-style-type: none"> 1. Define semi conductor, energy band, intrinsic and extrinsic semi conductor 2. Doping of semi conductor 3. Explain P-type, N-type semiconductor, 4. Define PN junction diode, forward and reverse biased diode, 5. Explain diode characteristics, application of PN junction diode like Half-wave, Full-Wave rectifier. 6. Explain Transistor: Physical construction of bipolar PNP and NPN transistor. 7. biasing circuit configuration 8. Explain different mode of transistor (CE, CB, CC). 9. State the application of transistor as an amplifier. 10. State elementary ideas of display - LED, LCD, Seven segment display.



<i>CO s</i>	<i>ILO s</i>
CO-6 guide house wiring	1. Define house wiring 2. Explain different methods of house wiring 3. State the safety and precautionary measure to be taken for electrical shock.
CO-7 Microprocessor	1. Explain the various symbolic representation of logic gates, combinational logic, basic operation of flip-flops, counters and registers. 2. State the fundamental concept of microprocessor and its application in instrumentation, 8085 microprocessor and its operation.

5. Teaching Scheme (in hours/week)

Lecture	Tutorial	Practical	Total
3		3	6

6. Examination Scheme :-

Theory		Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+ Pr)	Credit
ESE	Sessional (SS)	33/100	PT	PA	17/50	150	4
	TA HA						
70	10 20		25	25			

7. Detailed Course Content

Chapter No	Chapter Title	Content	Duration (in hours)
1	Introduction	Basics of Electricity: Revision of insulators and conductors and their examples ,Definition and units of	4

Chapter No	Chapter Title	Content	Duration (in hours)
		voltage, current, resistance, inductance, capacitance, different voltage sources, Ohm's law, series & parallel combination of resistance .	
2	DC network	DC network: Kirchhoff's Law, solving network problem to find current and voltage, Wheatstone bridge and Its problem.	5
3	Generator & motor	Faradays laws of electromagnetic induction, Flemings right hand and left hand rule D.C. generator and motor: Construction, operating principle, types, uses.	4
4	AC fundamental	A. C. Fundamentals: Basic terms-cycle, amplitude, time period, frequency, equation of alternating voltage and current, RMS, average value, instantaneous value, peak factor, form factor, simple problem	5
5	AC circuit	R-L-C series circuit: AC through resistance, capacitance, inductance and their combinations, expression for impedance, reactance, current, power factor, simple problem.	4
6	Transformer	Transformer Construction, operating principle, types and uses.	4
7	Semiconductor	Semiconductor: Definition of semiconductor, energy band diagram, intrinsic and extrinsic semiconductor, doping, P-type, N-type semiconductor, PN junction diode, forward and reverse biased diode, diode characteristics, application of PN junction diode like Half-wave, Full-Wave rectifier.	5
8	Transistor	Transistor: Physical construction of bipolar PNP and NPN transistor, biasing circuit configuration	5



		(CE, CB, CC). Application of transistor as an amplifier. Elementary ideas of display - LED, LCD, Seven segment display.	
9	House wiring	9.1 Introduction to house wiring 9.2 Methods of house wiring 9.3 Safety and precautions measures against electrical hazard.	2
Chapter No	Chapter Title	Content	Duration (in hours)
10	Microprocessor	1. Symbolic representation of logic gates, combinational logic, basic operation of flip-flops, counters and registers. 2. Fundamental concept of microprocessor and its application in instrumentation, 8085 microprocessor and its operation.	5
11	Class test	Two class test	2

8. Distribution of Marks/ Table of specifications

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Introduction	4	9	3	0	0	
2	DC net work	5	11	3	0	4	
3	Generator & motor	4	9	3	0	5	
4	AC fundamental	5	11	4	3	4	
5	AC circuit	4	9	3	1	4	
6	Transformer	4	9	3	3	1	



7	Semiconductor	5	11	3	1	3	
8	Transistor	5	11	3	2	1	
9	House wiring	2	4	2	0	4	
10	Microprocessor	5	11	4	0	3	

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weight age (c)	K	C	A	HA
11	Class test	2	4				
	Total	$\Sigma b=45$	100	31	10	29	

K = Knowledge C = Comprehension A = Application

HA = Higher Than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$

10. Details Table of Specification for Theory

Sl. no	Topic	OBJECTIVE TYPE				SHORT/ DESCRIPTIVE ANSWER TYPE				
		K	C	A	T	K	C	A	HA	T
1	Introduction	1			1	2				2
2	DC net work	1		1	2	2		3		5
3	Generator & motor	1		2	3	2		3		5
4	AC fundamental	2	1	1	4	2	2	3		7



5	AC circuit	1	1	1	3	2		3		5
6	Transformer	1		1	2	2	3			5
7	Semiconductor	1	1	1	3	2		2		4
8	Transistor	1	1	1	3	2	1			3
9	House wiring	1		1	2	1		3		4
10	Microprocessor	1		1	2	3		2		5
	Total				25					45

K = Knowledge C = Comprehension A = Application HA = Higher Than Application
T = Total

N.B.:- 1. The question pattern will be as per the instruction of SCTE or as per existing rules.

2. The objective type questions may be in the form of multiple choice, fill up the blanks, true or false or very short answer type.

3. Optional question (if any) may be from the same topic in the form of either or type like below

QNo. Explain the properties of conductor

Or

Explain the properties of insulator

11. Suggested Implementation Strategies:- Teacher will use Black board, OHP, LCD Projector, Smart board, Video etc for effective teaching learning process .

12. Ref Books:

- I. A text book of Electrical Technology Vol – I, B. L. Theraja& A. K. Theraja, S. Chand.
- II. Principle of Electronics, V. K. Mehta, S. Chand.
- III. Electronic Principle, A.P. Malvino, Tata McGraw-Hill
- IV. Electronic Devices & Circuits, Millman&Halkias, Tata McGraw-Hill

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5. Course Title: - Fundamental of Electrical & Electronic Engineering (Practical)

1. Course Title: - **FUNDAMENTAL OF ELECTRICAL & ELECTRONICS ENGINEERING**

2. Course Code: - El/Et-304

3. Semester: - 3rd

INTELLECTUAL SKILLS

- a. Identify the properties of generator, ammeter, voltmeter, transformer
- b. Interpret the working principle of equipment
- c. Interpret the test results
- d. Follow the IS procedure of testing

MOTOR SKILLS

- a. Measure the quantities accurately
- a. Identify the instruments properly
- b. Handle the equipment carefully.

LIST OF PRACTICAL(Students are to perform minimum six experiments)

1. Verification of KCL and KVL
2. Study of DC shunt generator.
3. Milli ammeter as a Voltmeter.
4. Milli voltmeter as an ammeter.
5. Study of RLC series circuit.
6. Study of single phase transformer.
7. Determination of semi-conductor diode characteristic.
8. Study of transistor configuration (CE,CB,CC) (Project base)
9. Study of transistor as an amplifier. (Project base)
10. Hands on activity on house wiring (Mini project work on simple house wiring involving one light point, one fan point, one power socket, one MCB on a wooden or ply board



6. Course Title: Manufacturing Technology - I

MANUFACTURING TECHNOLOGY – I

Subject Title	:	Manufacturing Technology - I		
Subject Code	:	Me-303		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test	:	03		
Total hrs	:	48		
Full marks(Theory)	:	70		
Sessional Marks	:	30		
Class hours		L	T	P
		3	0	3

Pre requisite :None

Aim of the subject: The aim of the subject is to let the students know about the different tools used in finishing the machining processes and how the machines are used for production from raw metal to the final product. It will also help to know different mechanical manufacturing process of metals.

CO COURSE OUTCOME

After studying the course the students will be able to

1. Identify the tool angles of a single point cutting tool used in lathe machine
2. Identify the different chips in machining process
3. Know about the metal casting process, pattern making and moulding
4. Know the use of resistance and arc welding
5. Know the press operation like bending, cutting, drawing, punching
6. Appreciate the use of cutting fluids and coolants

CONTENTS:

1.0 Basic of Machine Tools

- 1.1 Introduction to machine tools.
- 1.2 Differences between machine and machine tools
- 1.3 Types of cutting tools

- 1.4 Cutting tool materials-properties and types.
 - 1.5 Single point cutting tool nomenclatures.
 - 1.6 Cutting tool life and factors effecting tool life and tool wear.
 - 1.7 Orthogonal and Oblique cutting.
 - 1.8 Cutting forces in orthogonal and oblique cutting
 - 1.9 Chip formation process, temperature zone and forces.
 - 1.10 Types of chips and factors for producing each chip.
 - 1.11 Chip breaker and its types.
- 2.0 Metal Casting Process**
- 2.1 Introduction to metal casting
 - 2.2 Casting: steps involved in casting
 - 2.3 Pattern for casting
 - 2.4 Pattern making materials
 - 2.6 Moulding- Moulding sand-Moulding process
 - 2.7 Special casting processes - Die casting, Centrifugal casting & Investment casting.
 - 2.8 Defects in casting and their remedies
- 3.0 Advanced Welding Processes**
- 3.1 Introduction.
 - 3.2 Classification of welding process
 - 3.3 Resistance welding - Spot, Seam and Projection welding
 - 3.4 Advanced Arc welding types-Shielded metal arc welding, TIG & MIG welding,Submerged arc welding, Plasma arc welding & Laser beam welding.
 - 3.5 Defects in welding and their remedies
 - 3.6 Differences between Brazing and Soldering.
- 4.0 Press Work**
- 6.1 Introduction.
 - 6.2 Presses-Types-Power press
 - 6.3 Press operations: Cutting, bending, drawing, punching, blanking & notching,
- 5.0 Powder Metallurgy**
- 7.1 Basic concepts of powder metallurgy.
 - 7.2 Methods of powder metallurgy.
 - 7.5 Applications, merits and limitations of powder metallurgy.
- 6.0 Cutting Fluids and Coolants**

- 8.1 Introduction.
- 8.2 Purpose and Properties.
- 8.3 Coolants and lubricants for different operations

Table Of Specification for Manufacturing Technology I																	Total
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					97
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
	45																13
1	6	Basic Machine Tool	2	2	1	5	0	2	1	0	3	0	2	2	2	6	14
2	10	Metal Casting Process	2	2	2	6	2	3	2	0	7	0	5	2	4	11	24
3	10	Welding Process	2	2	2	6	2	3	2	0	7	0	5	4	2	11	24
4	8	Press Work	1	2	0	3	1	2	2	0	5	0	2	0	0	2	10
5	5	Powder Metallurgy	1	2	0	3	1	2	3	0	6	0	2	0	0	2	11
6	6	Cutting Fluids and Coolants	2	0	1	3	0	2	2	0	4	0	4	0	3	7	14

Annexure -I Manufacturing Technology-I								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total(97)
1	Basic Machine Tools	6	13.33	2	6	4	2	14
2	Metal Casting Process	10	22.22	4	10	6	4	24
3	Welding Process	10	22.22	4	10	8	2	24
4	Press Work	8	17.78	2	6	2	0	10
5	Powder Metallurgy	5	11.11	2	6	3	0	11
6	Cutting Fluids and Coolants	6	13.33	2	6	3	3	14

REFERENCE BOOKS:

- 1) Workshop Technology by Hazara Chaudhary VOL - I & VOL – II.
- 2) Production Technology by Dr.P.C.Sharma., S Chand & Co
- 3) Workshop technology by B.S. Raghuvanshi
- 4) Introduction to Manufacturing Processes, P N Rao , Vol 1 &Vol II, Tata Mc Grew Hill Publications
- 5) Manufacturing Process- I & II & III- By Dr. Radhakrishna K
- 6) Production Technology by R.K.Jain.
- 7) Manufacturing Technology I &II , Dr P C Sharma , S Chand & Co
- 8) Manufacturing Technology - P P Date , Jaico Publishing House
- 9) Foundry Technology –Dr. Radhakrishna.

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6. Course Title: Manufacturing Technology Laboratory

Manufacturing Technology - I- Lab

Hours Per Week	:	03
Hours Per Semester	:	45
Total hrs	:	48
Sessional Marks	:	25
Viva Marks	:	25

Outcome Based Objectives

After performing the practical the students will be able to

1. Know the various types of cutting tools
2. Know the nomenclature of a single point cutting tool
3. Prepare a mould sand mix
4. Handle the electrode holder for laying welding beads

Course Content

1. Machining
 - 1.1 Draw the single point cutting tool and label various parts
 - 1.2 Ground the various angles according to single point cutting tool nomenclature on a rectangular work piece

2. Foundry, Moulding and casting of
 - 2.1 solid bearing
 - 2.2 flange coupling
 - 2.3 split bearing
 - 2.4 connecting rod
 - 2.5 V pulley
 - 2.6 Gear pulley
 - 2.7 Core making

3. Welding

- 3.1 Lay out of beads
- 3.2 Butt joints
- 3.3 Lap joints
- 3.4 T- joint
- 3.5 H – joints
- 3.6 Angular joints
- 3.7 Two joints

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7 Course Title: Professional Practice-I

COURSE TITLE: PROFESSIONAL PRACTICE-I

COURSE CODE : AU 310

SEMESTER : 3th Semester

Contact hours : 30

Rationale : To develop general confidence, ability to communicate and attitude, in addition to basic technological concept through industrial visit, expert lectures, seminar on technical topics and group discussion.

Course Outcome:

On completion of this course students will be able to-

1. Acquire information from various sources.
2. Prepare notes for given topic.
3. Technical presentation on given topic in a seminar.
4. Interact with peers to share thought
5. Prepare report on industrial visit, expert lecture.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
1	-	2	3

Evaluation Scheme:						Total Marks(Theory + Sessional)	Credit	
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	2
	TA	HA	ESE+SS					
	Total (TA+HA)			25	25	17/50		



Details of Contents (Activities):**1. INDUSTRIAL VISITS: 12**

Structured industrial visits be engaged and report of the same should be submitted by the individual student, to form part of the term work.

Visit any two of the following:

1. Public Water supply pumping station
2. Hydroelectric power plant
3. Engineering workshop/machine Shop(Layout, machines)
4. Dairy plants/Water treatment

2. GUEST LECTURE(S): 3

Lectures by Professional/Industrial expert/Student Seminar based on information search to be organized from any three of the following areas:

1. Computer networking and Security
2. Electric hazards, Fire Fighting/ safety Precaution and first aids.
3. Topic related to social awareness such as- Career opportunities, communication in industry, Yoga & meditation, Aids awareness and health awareness.

3. GROUP DISCUSSION: 5

The students should discuss in a group of six to eight students and write a brief report on the same as a part of team work. Two topics for groupdiscussions may be selected by the faculty member. Some of suggested topics are:

1. Sports
2. Current affairs
3. Discipline and House keeping
4. Current topic related to Engineering field.

4. STUDENT ACTIVITY: 10

The students in group of 3 to 4 perform any one of the following activities (others similar activities may be considered Activity):

1. Collect and study IS code for engineering Drawing.
2. Collect information from market: Nomenclatures and specification of engineering materials.Collect specification of machine tools.Survey of data regarding different types of pumps with specifications from

4TH SEMESTER**COURSE STRUCTURE OF 4th SEMESTER MECHANICAL (AUTOMOBILE) ENGINEERING**

Sl No	Code No.	Subject	Study Scheme (Contact)			Evaluation Scheme									Total Marks(T heory+Pr actical)	Credit
						Theory				Practical			Pass (PT+ PA)			
			L	T	P	ESE	Sessional (SS)			Pass(ES E+SS)	Practical Test (PT) #	Practical Assessm ent(PA) @				
							TA	HA	Total (TA+ HA)							
1	Au-401	Automobile Engines	3	-		70	10	20	30	33/100				100	3	
2	Au-402	Auto Workshop Practice-I	-		6						100	50	50/150	150	4	
3	Me-401	Thermodynamics	3	-	-	70	10	20	30	33/100	-	-		100	3	
4	Me-403	Manufacturing Technology-II	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
5	Me-404	Theory of Machines	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4	
6	Me-405	Strength of Materials	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5	
7	Au-410	Professional Practice- II	1		2						25	25	17/50	50	2	
		Total	16	1	17									850	25	
			34													



COURSE TITLE : AUTOMOBILE ENGINES

COURSE CODE : AU 401
SEMESTER : 4th Semester
Contact hours : 45

Rationale : Engine is the heart of an automobile. This course is developed to make the student understand the detailed construction and working of automotive engines, and the different engine systems.

Course Outcome:

On completion of this course students will be able to-

1. Define basic engine terminologies.
2. Classify different types of engines.
3. Understand the construction and working of automobile engine.
4. Compare different types of engines and engine systems.
5. Understand construction and working different engine systems i.e. fuel system, lubrication system, cooling system and ignition system.
6. Understand causes and remedies of engine troubles.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	-	3

Evaluation Scheme:							Total Marks(Theory + Sessional)	Credit
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	3
	TA	HA	ESE+SS					
			Total (TA+HA)					
70	10	20	30	33/100				

Detailed Course Content:

1.0	Introduction:	1
	History, Importance of Automobile in our daily life, types of vehicles.	
2.0	Introduction of Petrol Engine and Diesel Engine:	8
2.1	Classification of IC Engines, according to arrangement of cylinders, valve arrangement, working cycle, fuel used, speed, nature of thermodynamic cycle, arrangement of valves, method of cooling, field of application, methods of fuel ignition of petrol and diesel engines. Running in period.	
2.2	Two-stroke petrol engine and two-stroke diesel engines, their uses, advantages, disadvantages and comparison. Difference between two stroke petrol engine and two stroke diesel engine.	
2.3	Scavenging: Definition and necessity of Scavenging, cross flow, back flow, uniflow scavenging, scavenging of four-stroke engine.	
2.4	Engine liners: Dry and Wet liners, their construction and uses, advantages and disadvantages.	
2.5	Gaskets- classification of engine gaskets, gaskets material, various types of gaskets used in automobile vehicle, general gasket installation procedure.	
3.0	Diesel and Petrol engines, their parts and function:	4
3.1	Constructional details of parts, material used and functions of cylinder block, cylinder head, crankcase, crankshaft, camshaft, piston, piston rings, piston pin ,flywheel, connecting rod, bearings, valves, inlet and exhaust manifolds.	
3.2	Valve mechanism: Types of valve mechanism, function and working of each valve mechanism, valve timing, valve overlap, tappet clearance.	
4.0	Fuel system of Petrol Engine:	5
4.1	Fuel system:- line diagram of petrol engine fuel system, components, constructional details of fuel tanks, fuel lines, working principles with constructional details of mechanical and electrical fuel pumps, fuel filter:- types and necessity.	
4.2	Carburetors: - Atomization and vaporization of fuel or gasoline, carburation, simple carburetor, Working principle and constructional details, choke, venturi, float, needle valve, throttle valve, tickler, air fuel ratio, rich mixture, lean mixture, and economic ratio. Stoichiometric ratio.	
4.3	Circuits of Modern carburetor: Introduction of starting circuit, float circuit, idling and low speed circuit, high speed part load circuit, high speed full power circuit, accelerating pump circuit etc.	
4.4	Electronic fuel injection: Types of fuel injection viz. PFI, EFI, TBF, GDI, sequential fuel injection system(SFI), constructional layout, details and function of each system, fuel injectors for electronic injection system, cold start injector- constructional detail and function of injectors and their types.	
4.5	Sensors: - Types of sensors- Their functions:- variable resistor-type sensor, generating sensors, CP sensor, boost pressure sensor, MAF sensor, MAP sensor, oxygen sensor, vehicle speed sensor, knock sensor, etc., advantages and their locations.	
5.0	Ignition system:-	4
5.1	Battery or coil ignition, magneto ignition, electronic ignition system, comparison between them, circuits of the said systems, voltage necessary for ignition, ignition in single cylinder and multi cylinder engines, firing order, functions of distributors, ignition coil, condenser, spark plug, types	

of spark plugs use in various engines, ignition advance mechanism, types of advance mechanism, effects of enhancing and retarding of ignition.

- 5.2 Electronic ignition system:- Types , circuit diagrams, details of all elements of electronic ignition system , working principle ,uses ,advantages and disadvantages.
- 6.0 **Fuel system of diesel engines:** 5
- 6.1 Combustion in C.I. engines, type of injection system- air injection, solid injection, unit injection, CRDI.
- 6.2 Fuel supply system: Line diagram of fuel supply system , fuel tank, fuel feed pump, fuel filter, fuel injection pumps and its type, components, operating principles and mechanism,
- 6.3 Injections:- types and component/ parts, nozzle and its types, fuel pump, governors and control system, Types of governor- mechanical governor, pneumatic governor, functions and working principle.
- 7.0 **Intake and Exhaust system:** 3
- 7.1 Air cleaner, types and functions. Intake and exhaust manifolds, Silencer and its type, used in various vehicles.
- 8.0 **Lubrication:** 5
- 8.1 Functions of lubricants, lubricating parts of an engine. Properties of lubricant:- physical and chemical properties of lubricants, viscosity, viscosity index ,specific gravity, flash points, fire points, pour points etc. Rating of lubricant, SAE no.API .
- 8.2 Lubrication system: - Petroil system, splash system, pressure system, forced feed lubrication, dry sump, wet sump lubrication methods, oil-filters, types of filters, full flow; by pass filters, crankcase ventilation and blow-by.
Lubricating oil pumps: - types, function and their construction.
- 9.0 **Cooling system:-** 4
- 9.1 Necessity of engine cooling, overheating and under cooling.
- 9.2 Types of cooling, Air cooling- constructional details and functions, liquid cooling system: types, thermo siphon system, pump circulating cooling system or forced circulation system, constructional details of the system.Description of water pumps, radiators, thermostat valve, water jackets etc., types and functional details, coolant, antifreeze agents, rust inhibitors.
- 10.0 **Supercharging:** 2
- 10.1 Introduction, application and type of supercharging: centrifugal, vane type, blower type etc. turbo supercharger and its types and uses in various engines.
- 11.0 **Class Test:** 3

Reference Books, Journals:

1. M. L. Mathur& R. P. Sharma: Internal Combustion Engine, DhanpatRai Publications
2. C. P. Nakra: Basic Automobile Engineering, DhanpatRai Publications
3. Crouse &Anglin: Automotive Mechanics
4. Dr. KripalShing : Automobile Engineering Vol. 1
5. Journal of Society of Automotive Engineers



Annexure-I

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Introduction	1	2%	-	-	-	-
2	Introduction of Petrol Engine and Diesel Engine	7	16%	9	2	1	-
3	Diesel and Petrol engines, their parts and function	5	11%	6	2	1	-
4	Fuel system of Petrol Engine	5	11%	6	1	2	-
5	Ignition system	5	11%	6	1	1	-
6	Fuel system of diesel engines	5	11%	6	1	1	-
7	Intake and Exhaust system	3	7%	3	1	1	-
8	Lubrication	5	11%	6	1	2	-
9	Cooling system	4	9%	5	1	1	-
10	Supercharging:	2	4%	3	-	-	-
11	Class Test	3	-	-	-	-	-
Total		Σ b=45	100%	50	10	10	

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Introduction	-		-	--	-	-	-	-	-	-	-	-	-	-
2	Introduction of Petrol Engine and Diesel Engine	3	1	1	5	1	1	0	0	2	5	0	0	0	5
3	Diesel and Petrol engines, their parts and function	3	1	0	4	3	1	1	0	5	0	0	0	0	0
4	Fuel system of Petrol Engine	1	1	1	3	0	0	1	0	1	5	0	0	0	5
5	Ignition system	1	0	1	2	0	1	0	0	1	5	0	0	0	5
6	Fuel system of diesel engines	1	0	1	2	0	0	1	0	1	5	0	0	0	5
7	Intake and Exhaust system	2	1	0	3	1	1	0	0	2	0	0	0	0	0
8	Lubrication	1	1	1	3	0	0	1	0	1	5	0	0	0	5
9	Cooling system	0	1	0	1	0	0	1	0	1	5	0	0	0	5
10	Supercharging:	2	0	0	2	1	0	0	0	1	0	0	0	0	0
11	Total				25					15					30

K = Knowledge
Than Application

C = Comprehension
T = Total

A = Application
HA = Higher

COURSE TITLE: AUTO WORKSHOP PRACTICE-I

COURSE CODE : **Au 402**
SEMESTER : **4th**
Contact hours : **90**

Rationale : This course makes the student to acquire practical knowledge of construction of automobile engines and helps to develop skill to complete overhauling an engine.

Course Outcome: After completion of this course students will be able to:

1. Demonstrate the procedure of complete overhauling of automobile engine and engine systems.
2. Demonstrate the construction and working of automobile engine and engine systems.

Evaluation Scheme:						Credit
Study Scheme(Contact hours/ week)			Practical			
L	T	P	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	4
0	0	6	100	50	50/150	

DETAILS OF CONTENTS:

Safety precautions:

3

- 1.1 Safety precautions to be followed and knowledge of first aid in an automobile workshop.
- 1.2 Study of hand tools, different gauges and their use. Identification of general tools and equipment in an automobile workshop and their purpose.
- 2.0 Overhauling of a multi cylinder petrol engine: 27
 - 2.1 Procedure of Engine down from an Automobile Vehicle.
 - 2.2 Dismantling of a multi-cylinder petrol engine:-
 Note the procedure of dismantling the parts, clean the parts, listing the parts sequence wise, observing the parts for their condition, thereby make a list for defective parts, reassemble and start the engine again.
 Tune up the engine (complete overhauling of the carburetor), Setting of the CB point, spark plug, and tappet clearance.
 - 2.3 Overhauling of lubrication system, cleaning of oil gallery, servicing of oil pump, setting of oil pressure and cleaning, changing of oil filters.
 - 2.4 Complete servicing of cooling system.
 - 2.5 Study of fuel system of multi-cylinder petrol engine.
 - 2.6 Study of mechanical and electrical fuel feed pump.
 - 2.7 Study of fuel injection system of petrol engine (MPFI, GDI etc.)

2.8	Adjustment of valve timing.	
2.9	Overhauling of conventional and electronic ignition system of petrol engine.	
3.0	Overhauling of a single cylinder engine:	15
3.1	Overhauling of a single cylinder two stroke engine, setting of engine timing, spark plug gap etc.	
3.2	Servicing of the fuel system, cleaning and replacing the fuel filter.	
3.3	Tune up the engine after overhauling and start the engine again.	
4.0	Overhauling of multi cylinder diesel engine:	27
4.1	Dismantle a multi cylinder (Diesel) engine. Note the procedure of dismantling the parts, cleaning, and assemble with proper specification.	
4.2	Overhauling of fuel system.	
4.3	Servicing of injector.	
4.4	Re-assemble the parts and start the engine after rectification of the defects.	
5.0	Study&inspection of Inlet and Exhaust system. Replacing exhaust system components if required.	6
6.0	Studyof supercharger and turbo-supercharger. Locate and identify the turbo-supercharger in an engine. Maintenance of turbo-supercharger.	6
7.0	Viva.	6

TABLE OF SPECIFICATIONS FOR Practical Test

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Safety precautions	3	3%	1	0	4		5
2	Overhauling of a multi cylinder engine (petrol)	27	30%	5	5	20		30
3	Overhauling of a single cylinder engine	15	17%	2	3	10		15
4	Overhauling of multi cylinder diesel engine	27	30%	5	5	20		30
5	Study of inlet & exhaust system	6	7%	1	1	8		10
6	Study of turbo-supercharger	6	7%	1	1	8		10
7	Viva.	6	7%	10	10	30		50
Total		Σ b=90	100	25	25	100		100



Reference Book, Journal, Manuals etc.:

1. C. P. Nakra: Basic Automobile Engineering, DhanpatRai Publications
2. Crouse & Anglin: Automotive Mechanics
3. N. Malhotra : Automobile Engineering Practical, Asian Publications



1: Subject Title: Thermodynamics

Subject Title	:	Thermodynamics
Subject Code	:	Me-401
Hours Per Week	:	03
Hours Per Semester	:	45
Class Test hrs	:	03
Total hrs	:	48

Pre requisite : Applied Physics, Mathematics, Engineering Mechanics

Aim of the subject : The aim of the subject is to let the students know about the different properties of the perfect gases, different thermodynamic processes. standard cycles and its practical significance

The different properties of steam, use of steam tables, Mollier chart., vapour cycles

Outcome Based Objectives

On the completion of the course the students should be able to:

1. Solve problems on the laws of Perfect Gases
2. Analyze the thermodynamic process
3. Know the calorific values of fuel
4. Solve problems on air standard cycles
5. Solve problems of steam generation with the help of steam tables
6. Explain the principle of Rankine Cycle

7. Know the types of heat transfer

COURSE CONTENTS

1. Fundamentals and laws of Thermodynamics.

- 1.1 Definitions for system - boundary, surrounding, working fluid and state of a system.
- 1.2 Types of thermodynamic systems – closed, open and isolated systems with examples.
- 1.3 Properties of system- Intensive and Extensive properties with examples.
- 1.4 Definitions for properties like pressure (p), Volume (v), Temperature (T), Enthalpy (H), Internal energy (U) Specific heat at constant pressure(c_p), specific heat at constant volume(C_V) for a gas. and their units.
- 1.5 Definitions for quasi-static work, flow- work, specific heat.
- 1.6 Zeroth, first, second laws of thermodynamics, simple problems on conversion of Heat into Work and vice versa.
- 1.7 Steady flow energy equation (without proof),

2.0 Laws of perfect gases.

- 2.1 Brief explanation of perfect Gas Laws – Boyle's law, Charle's Law – -Gay-Lussac law-Avogadro's -Joule's law .
- 2.2 Derive characteristic gas equation - universal gas equation, universal gas constant and their relationship with molecular weight of gas.
- 2.3 Derivation for an expression showing the relationship between the two specific heats and characteristic gas constant.
- 2.4 Simple problems on gas equation.

3.0 Thermodynamic processes on gases.



- 3.1 Types of thermodynamic processes, Constant pressure, Constant volume, Isothermal, Free expansion, Isentropic, Polytrophic and throttling processes & equations representing the processes.
- 3.2 Concept of Entropy.
- 3.3 Derivation for work done, change in internal energy and Entropy for the above processes.
- 3.4 Calculation of heat supplied or rejected during the above processes.
- 3.5 Simple problems on the above processes.

4.0 Fuels and Combustion.

- 4.1 Definition of fuel. Types – solid, liquid and gaseous fuels examples and uses of different types of fuels.
- 4.2 Calorific values (Higher and lower) of fuels, Dulong's formula for calorific value. & calculation of calorific value of a fuel of given chemical composition.
- 4.3 Bomb calorimeter unit-Description

5.0 Air standard cycles.

- 5.1 Meaning of air standard cycle-its use-Reversible and irreversible process – reversible and irreversible cycles conditions for reversibility of a cycle.
- 5.2 Brief description of Carnot cycle with P.V. and T-S diagrams, Air standard Efficiency - Problems on Carnot cycle.
- 5.3 Brief explanation of Otto cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on Otto cycle.
- 5.4 Brief description of Diesel cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on Diesel cycle.

5.5 Brief description of Dual cycle with P.V. and T-S diagrams, Air standard Efficiency - Simple problems on dual cycle.

5.5 Reasons for the highest efficiency of Carnot cycle over other cycles working between same temperature limits.

6.0 Properties of steam.

6.1 Formation of steam under constant pressure, dryness, fraction and degree of superheat, specific volume.

6.2 Determination of enthalpy, internal energy, internal latent heat, entropy of wet, dry and superheated steam at a given pressure using steam tables and Mollier chart.

6.3 Simple direct problems on the above using tables and charts.

7.0 Vapour Power cycle

7.1 Rankine cycle

7.2 Modified rankine cycle

7.3 Simple problems on above

8.0 Heat Transfer

8.1 Introduction to Heat Transfer Processes.

8.2 Conduction, Convection and Radiation.

8.3 Heat Exchanger- types with diagram.

REFERENCES



1. **“Fundamental of thermodynamics”** by Richard E Snnatag, ClausBorgnakke, Gordon J Vanwylen, Wiley Student edition, 6th Ed.,
2. **“ Basic and applied thermodynamics”** by P.K.Nag ,Tata McGraw hill New delhi 2009
3. **“Heat engines(Vol-I &Vol-II)”**by Patel and Karmachandani
4. **“I.C.Engine Fundamentals”** by Hey wood
5. **“Thermal Engineering “**by R.S.Khurmi
6. **“Thermal Engineering”** by P.L.Balaney
7. **“Thermodynamics applied to heat engines”**byLewitt.
8. **“ Heat engines”** by Pandya and shah
9. **“ Thermodynamics “ Robert Ballmer ,** Jaico Publishing House

Table Of Specification for Thermodynamics													Total Marks				
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					97
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
1	5	Fundamental Of Thermodynamics	3	1	0	4	0	2	0	0	2	2	2	0	0	4	10
2	6	Laws Of Perfect Gases	2	0	0	2	0	2	0	0	2	0	6	4	0	10	14
3	8	Thermodynamic Process	2	2	0	4	0	2	2	0	4	0	6	4	0	10	18
4	4	Fuels & Combustion	2	0	0	2	0	2	0	0	2	0	4	0	0	4	8
5	8	Air Standard Cycles	2	2	0	4	0	2	2	0	4	0	4	6	0	10	18
6	8	Properties Of Steam	2	0	0	2	0	2	2	0	4	0	8	4	0	12	18
7	4	Vapour Power Cycles	0	2	0	2	0	0	2	0	2	0	2	2	0	4	8
8	2	Heat Transfer	1	2	0	3	0	0	0	0	0	0	0	0	0	3	3

Annexure -I Thermodynamics								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Fundamentals of Thermodynamics	5	11.11	5	5			10
2	Laws of Perfect Gases	6	13.30	2	8	4	0	14
3	Thermodynamic Process in Gases	8	17.78	2	10	6	0	18
4	Fuels and Combustion	4	8.89	2	6			6
5	Air Standard Cycles	8	17.78	2	8	8	0	18
6	Properties of Steam	8	17.78	2	10	6	0	18
7	Vapour Power Cycles	4	8.89	0	4	4	0	8
8	Heat Transfer	2	4.40	1	2	0	0	3



Subject Title : Manufacturing Technology-II

Subject Title	:	Manufacturing Technology-II		
Subject Code	:	Me-403		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test hrs	:	03		
Total hrs	:	48		
Full marks(Theory)	:	70		
Sessional Marks	:	30		
Class hours		L	T	P
		3	0	3

Pre requisite: Engineering Mechanics, Manufacturing Technology

Aim:The aim of the subject is to understand various operation performed in lathe machine, grinding machine, shaping machine, Planning Machine, its limitations in every machines, Importance of Jigs and fixtures, plastic processing methods, powder metallurgy, cutting fluids.

Outcome Based Objectives :

On completion of the course the students should be able to:

1. Identify the components of a lathe machine



2. Identify the components of shaping , planing, slotting and milling machine
3. Know about the surface finishing with the help of grinding machine
4. Illustrate the machining process performed in milling machine
5. Explain about the non traditional machining methods
6. Appreciate the importance of jigs and fixtures

CONTENTS

1.0 Lathe

- 1.1 Introduction to lathe.
- 1.2 Classification of lathes -specification of lathe
- 1.3 Constructional features of Engine lathe (parts)
- 1.4 Lathe attachments, accessories & work holding devices
- 1.5 Lathe operations
- 1.6 Taper turning methods.
- 1.7 Machining parameters-cutting speed, feed, depth of cut and machining time
- 1.8 Capstan and Turret lathe -Description-comparison with engine lathe

2.0 Drilling machine

- 2.1 Introduction
- 2.2 Classification of drilling machines
- 2.3 Radial drilling machine-working-drilling operations
- 2.4 Twist drill nomenclature
- 2.5 Machining parameters-cutting speed, feed, depth of cut and machining time

3.0 Shaper, Planer &Slotter



- 3.1 Introduction to Shaper & Classification
- 3.2 Specifications of Shaper
- 3.3 Principal parts of shaper.
- 3.4 Shaper Mechanisms & Shaper Operations
- 3.5 Cutting Speed, Feed, Depth of cut & Machining time.
- 3.6 Simple problems.
- 3.7 Introduction to Planer & Classification
- 3.8 Specifications of Planer
- 3.9 Principal parts of Planer
- 3.10 Planer Mechanisms & Operations
- 3.11 Differences between Planer & Shaper
- 3.12 Introduction to Slotter & Classification
- 3.13 Principal parts of Slotter
- 3.14 Specifications of Slotter
- 3.15 Slotter Mechanisms & Operations
- 3.18 Difference between Planer & Slotter.

4.0 Grinding & Surface finishing

- 4.1 Introduction to grinding & Classification
- 4.2 Plain Cylindrical grinding machines
- 4.3 Grinding wheels
- 4.4 Abrasives & classification.
- 4.5 Bond & bonding.

4.6 Grit, Grade & Structure of wheels.

4.7 Specification of wheels.

4.8 Types of grinding wheels.

4.9 Selection of grinding wheels.

4.10 Mounting of grinding wheels.

4.11 Glazing and loading of wheels.

4.12 Dressing and truing of wheels.

4.13 Balancing of wheels.

4.14 Diamond wheels.

4.15 Introduction to surface finish.

4.16 Surface finishing operations.

5.0 Milling machine

4.1 Introduction to milling and classification.

4.2 Column and knee type milling machine & copy milling machine.

4.3 Milling cutters and classification.

4.4 Fundamentals of milling processes

4.5 Milling machine operations.

4.6 Indexing methods.

4.7 Cutting speed, feed, depth of cut and machining time.

4.8 Gear hobbing

6.0 Non-Traditional machining methods



- 5.1 Introduction to modern machining.
- 5.2 Differences between conventional and non-conventional methods.
- 5.3 Classification.
- 5.4 Principle of working of - Ultrasonic machining, Electric discharge machining, Abrasive jet machining and Laser beam machining.
- 4.5 Applications, merits and demerits of above methods.

7.0 Jigs and Fixtures

- 6.1 Introduction to jigs and fixtures.
- 6.2 Definition of jig and fixtures.
- 6.3 Applications & merits of jig and fixture

Table Of Specification for Manufacturing Technology II																		Total
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					97	
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	Total (97)	
1	8	Lathe M/C	2	3	0	5	2	3	0	0	5	0	3	5	0	8	18	
2	6	Drilling M/C	1	2	0	3	2	2	0	0	4	0	2	3	0	5	12	
3	8	Shaper, Planer & Slotter	0	2	3	5	0	3	2	0	5	0	4	4	0	8	18	
4	5	Grinding and surface Finish	1	1	0	2	0	1	2	0	3	0	0	0	5	5	10	
5	8	Milling Machine	2	2	0	4	0	4	4	0	8	0	3	3	0	6	18	
6	6	Non Traditional Machining Methods	1	2	0	3	2	2	0	0	4	0	0	6	0	6	13	
7	4	Jigs & Fxtures	0	2	0	2	2	0	0	0	2	0	0	4	0	4	8	



Annexure -I Manufacturing Technology-II								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Lathe Machine	8	17.78	4	9	5	0	18
2	Drilling Machine	6	13.33	3	6	3	0	12
3	Shaper, Planer and Slotter	8	17.78	0	9	9	0	18
4	Grinding and surface finishing	5	11.11	1	2	2	5	10
5	Milling Machine	8	17.78	2	9	7	0	18
6	Non Traditional Machining Methods	6	13.33	3	4	6	0	13
7	Jigs and Fixtures	4	8.89	2	2	4	0	8

XXXXXXXXXXXXXXXXXXXXXXXXXXXX



3: Manufacturing Technology –II Lab

Outcome Based Objectives

After performing the Practical in the laboratory , the students will be able to

1. Perform turning operation on a lathe machine
2. Perform the drilling operation on a drilling machine.
3. Identify the components of shaping, planning , slotting and milling machine
4. Know the safety and precaution taken during a machining operation in a workshop
5. Know how to operate and maintenance of the machine

1. Course content

1. Machine shop(turning)
 - 1.1 Plain Turning
 - 1.2 Step Turning
 - 1.3 Taper turning
 - 1.4 Turning collars
 - 1.5 Knurling
 - 1.6 Facing
 - 1.7 Thread cutting
 - 1.8 Combination of all the operations
2. Milling and shaping
 - 2.1 Shaping practice
 - 2.2 Key way cutting
 - 2.3 Various milling operations
 - 2.4 T- slot cutting on milling machine
3. Slotter planner and drilling
 - 3.1 perform operation on a slotter and planner
 - 3.2 draw the drill and label various parts
 - 3.3 Make hole on flange using jigs
4. Servicing & maintenance

- 4.1 sub assembly of small components such as tail stock 3 jaw, 4 jaw chuck
- 4.2 measurements of wear on machine elements such as lathe beds guide ways of lathe and shaper
- 4.3 selection of appropriate recovery methods for a given machine element and performing recovery processes by using appropriate methods such as Arc gas welding, Metal spraying applying adhesives etc
- 4.4 Fault finding and repairing of machine tool and preparation of preventive maintenance schedule of work shop.

XXXXXXXXXXXXXXXXXXXXXXXXXXXX



Subject Title: Theory of Machines

Subject Title	:	Theory of Machines		
Subject Code	:	Me-404		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test hrs	:	03		
Total hrs	:	48		
Full marks(Theory)	:	70		
Sessional Marks	:	30		
Class hours		L	T	P
		3	0	3

Pre requisite: Engineering Mechanics

Aim: The aim of the subject is to know the kinematics of machine, their mechanisms, the friction involved. Methods of transmission of power, the role of cams, effect of vibration, balancing, governors.

CO-----Outcome Based Objectives

On completion of the course, the student should be able to



1. Appreciate the importance of Kinematics of Machines, their Mechanisms & Inversions
2. Explain the friction involved in bearings, clutches & brakes
3. Know different methods of transmission of power
4. Analyze different types of cams and their motions and also to draw cam profiles for various motions
5. Know different types of vibration and to understand critical speed of shaft
6. Solve problems on balancing of masses in the sameplane
7. Know the function of different types of governors

Subject Content Details

1.0 Introduction

- 1.1 Definition of Theory Of Machine(TOM)
- 1.2 Sub – divisions of TOM

2.0 Basic kinematics of Machines

- 2.1 Kinematic link or element
- 2.2 Types of links
- 2.3 Kinematic pair –types
- 2.4 Types of constrained Motions
- 2.5 Kinematic chain
- 2.6 Machine, Structure and Mechanism
- 2.7 Difference between Machine and Structure
- 2.8 Difference between Machine and Mechanism
- 2.9 Inversions
- 2.10 Types of Kinematic Chains



2.11 Four Bar Chain

2.11.1 Beam Engine

2.11.2 Coupling Rod of Locomotive

2.11.3 Watt's Indicator Mechanism

2.12 Single Slider Crank Chain

2.12.1 Pendulum Pump

2.12.2 Oscillating cylinder engine

2.12.3 Rotary I.C Engine

2.12.4 Crank and Slotted Lever Quick Return Motion Mechanism

2.12.5 Whitworth Quick Return Motion Mechanism.

2.13 Double Slider Crank Chain

2.13.1 Elliptical trammel

2.13.2 Scotch yoke mechanism

2.13.3 Oldham's coupling

3.0 Friction

3.1. Friction - Friction in Journal Bearing, Friction of Pivot and Collar Bearing, types of Pivot and Collar Bearing (No derivation requires, formulae only). Simple Problems on the above topic.

3.2. Dynamometer- Difference between brake & clutch, difference between brake and Dynamometer. Types of Dynamometer, classification of absorption type dynamometers.

4.0 Transmission of Power

4.1 Types of Belt Drives

4.2 Length of belt –open and cross belt drives

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- 4.3 Velocity Ratio, Ratio of driving Tensions, Centrifugal Tension and Initial Tension
- 4.4 Power Transmitted by belts (flat and V) and ropes
- 4.5 Maximum power transmitted by belt (without proof)
- 4.6 Problems on belt drives
- 4.7 Introduction to Gears
- 4.8 Classification of Gears
- 4.9 Spur Gear Terminology
- 4.10 Problems on gears
- 4.11 Introduction to Gear Trains
- 4.12 Types of Gear trains –Simple, Compound, Reverted and Epicycle gear trains
- 4.13 Problems on Gear Trains

5.0 Cams

- 5.1 Introduction
- 5.2 Classification of cams
- 5.3 Classification of followers
- 5.4 Terminology of Radial disc cam

6.0 Mechanical Vibrations

- 6.1 Introduction
- 6.2 Terms used in Vibrations
- 6.3 Types of Vibrations
 - 6.31 Free Vibrations



6.32 Forced Vibrations

6.33 Damped Vibrations

6.4 Types of Free Vibrations- Longitudinal ,Transverse and Torsional

6.5 Critical or Whirling speed of a shaft

7.0 Balancing

7.1 Introduction

7.2 Static and Dynamic balancing

7.3 Balancing of single rotating mass in the same plane of projection

7.4 Balancing of several masses rotating in the same plane of projection

7.5 Problems on above (Analytical and Graphical methods)

8.0 Governors

8.1 Introduction

8.2 Types of Governors

8.3 Centrifugal Governor

8.4 Terms used in governors

8.5 Watt Governor

8.6 Porter Governor

Reference Books :

1. Kinematics of Machines---J B K Das, Sapna Publication
2. Theory of machines----- R.S. Khurmi&J.K.Gupta ,S.Chand publication
- 3 . Theory of machines----- P.L.Ballaney , Khanna publication

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- 4. Theory of machines----- Thomas Bevan ,CBS publication
- 5. Theory of machines-----Malhotra& Gupta
- 6. Theory of machines-----S.S .Rattan ,Tata McGraw-Hill publication
- 7. Theory of machines-----R.K.Bansal ,Laxmi publication
- 8. Dynamics of Machines----J B K Das, Sapna Publication

Table Of Specification for Theory Of Machine																		
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total	
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T		
	45																97	
1	1	Introduction	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	2
2	8	Basic Kinematics Of Machines	2	2	0	4	0	2	2	0	4	0	3	4	3	10	18	
3	7	Friction	0	2	0	2	1	2	0	0	3	4	4	5	0	9	18	
3	8	Transmission Of Power	1	2	0	3	0	2	2	0	4	0	3	3	3	9	16	
5	6	Cams	0	2	0	2	0	2	0	0	2	0	4	4	0	8	12	
6	6	Balancing	2	0	0	2	4	0	0	0	4	0	4	4	0	8	14	
7	3	Mechanical Vibrations	0	2	0	0	0	4	0	0	4	0	0	0	0	0	6	
8	6	Governor	0	2	0	2	0	2	2	0	4	0	4	4	0	8	14	

Annexure -I Theory of Machine								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction	1	2.22	1	1	0	0	2
2	Basic Kinematics of Machines	8	17.78	2	7	6	3	18
3	Friction	7	15.56	5	8	5	0	18
4	Transmission of Power	8	17.78	1	7	5	3	16
5	Cams	6	13.33	0	8	4	0	12
6	Balancing	6	13.33	6	4	4	0	14
7	Mechanical Vibrations	3	6.67	0	6	0	0	6
8	Governors	6	13.33	0	8	6	0	14

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Theory Of Machines Lab

Outcome based Course Objectives

After performing the practical, the students will be able to

1. To determine the role of kinematics in machines
2. Calculate the Velocity ratio of components of transmission system like worm and worm wheel , rack and pinion
3. Determine the coefficient of friction of belt drive
4. Calculate the speed of a Porter governor by Instantaneous center method

Course Content:

1. Study of model and working practically on machines by various mechanisms.
 - 1.1. See the models of various mechanism in laboratory and draw the sketches labeling properly.
 - 1.2. Deduce the formula for ratio of cutting stroke to return stroke , stroke length for quick return motion mechanism. Know why it is called quick return motion mechanism?
 - 1.3. Visit the machine shop and observe the functioning of the mechanism on the machine. Know how stroke length is adjusted.
2. Transmission of Power
 - 2.1. Draw the sketches of various belt drive system.
 - 2.2. Determine the length of belts for various type of drives graphically and theoretically and observe the difference. Deduce the formula for the ratio of driving tensions.
 - 2.3. Draw the sketch of a toothed gear and label all the terminology used on it.
 - 2.4. Observe the models of various types of gears and gear trains in laboratory and draw the sketches.

- 2.5. Deduce the formula for velocity ratio for each type of gear train.
2.6. Observe the transmission of power by belt and gears practically in machine and industry.

3. Study of governors.

- 3.1. Deduce the relation between height of governor and speed for watt and porter governor.
3.2. Using universal governor apparatus determine characteristic curves for porter governor
i) Sleeve Position Vs Speed. ii) Radius of Rotation Vs Controlling force.

4. Balancing of rotating masses.

- 4.1. Explain what is balancing and why it is necessary? What is static and dynamic balancing?
4.2. Using static and dynamic balancing apparatus balance the shaft statically and dynamically and observe the effect of unbalance.

5. Mechanical Vibration

- 5.1 With the help of neat sketch explain the critical or whirling speed of shaft.
5.2. Using whirling of shaft demonstrator study the effect of whirling of shaft with
i) Both ends fixed ii) Both ends supported iii) One end fixed and one end supported

XXXXXXXXXXXXXXXXXXXX



Subject Title: Strength of Materials

Subject Title	:Strength of Materials		
Subject Code	: Me-405		
Periods /Week	: 03		
Periods/semester	: 45		
Class Test	:03		
Total class	:48		
Full marks(Theory)	:70		
Sessional Marks	:30		
Class hours	L	T	P
	3	1	3

Pre Requisite: Mathematics, Engineering Mechanics

Aim:The aim of the subject is to let the students know the physical meaning of stress and strain, the different types beams and the effect of different type of shear load on beam, Torsion , its effect on shaft and helical spring, thin cylinders , column and struts, different type of columns, effect of load on column and struts

CO -----Outcome Based Course Objectives

After studying the course, the students will be able to

1. Solve problems on simple stress and strain on materials following Hooks' Law
2. Analyze problems on cantilever beam and simply supported beam with overhanging due to point and uniformly distributed load
3. Know simple bending and and its related effect on beams



4. Calculate the bending stress on beams based on pure bending
5. Apply the principle of pure torsion on a power transmitting shaft and a helical spring
6. Design a riveted joint

Course Content

- 1.0 Simple Stresses and strains
 - 1.1 Define the strength, Mechanical properties of engineering materials, commonly used.
 - 1.2 Identify the nature and effect of tensile, compressive and shear forces.
 - 1.3 Define the terms stress, strain, modulus of elasticity, poisson's ratio.
 - 1.4 Draw typical stress Vs strain curve for a mild steel specimen under tension indicating salient points on it.
 - 1.5 Mention the significant of factor of safety.
 - 1.6 Compute stress and strain values in bodies of uniform section and of composite section under the influence of normal stresses.
 - 1.7 Calculate thermal stresses, in bodies of uniform section and composite sections.
 - 1.8 Find the relations between E, G, and K & Poisson's ratio.
 - 1.9 Compute the changes in axial, lateral and volumetric dimensions of uniform sections under the action of normal forces.
 - 1.10 Define resilience and Derive and expression for strain energy.
 - 1.11 Riveted joint. Failure, Strength, efficiency and design of Rivet.
- 2.0 Shear force and bending moments.
 - 2.1 List the type of beams and type loads.
 - 2.2 Definition of shear force and bending moments.
 - 2.3 SF and BM diagrams for various loads for simply supported, cantilever and over hanging beam and related problems
 - 2.4 Point of contraflature
- 3.0 Theory of simple bending and Deflection of beam
 - 3.1 State the theory and terms of simple bending.

- 3.2 List the assumptions in theory of simple Bending.
 - 3.3 Derive the bending equation $M/I = f/y = E/R$
 - 3.4 Calculate Bending stress, modulus of section and Moment of resistance.
 - 3.5 Calculate the safe load and safe span and dimensions of cross section.
 - 3.6 Define and explain the term deflection.
 - 3.7 Derive the deflection formula for cantilever and simply supported beams
 - 3.8 Calculate the values of deflection in the given beams.
 - 3.9 Solve problems
- 4.0 Stresses in beams
- 4.1 Neutral surface and neutral axis
 - 4.2 Bending Equation
 - 4.3 Problems of stress on different beams.
- 5.0 Torsion in circular shafts and springs
- 5.1 Function of shaft.
 - 5.2 Explain Polar moment of inertia of solid and hollow shaft.
 - 5.3 Derive the torque equation $T/J = fs/R = C\theta/L$
 - 5.4 Design of solid and hollow shafts and power transmitted by solid
And hollow shaft.
 - 5.5 Definition of spring and types of spring.
 - 5.6 Derivation of deflection equation for helical spring.
 - 5.7 Definition of stiffness of a spring.
 - 5.8 Design of helical spring.
- 6.0 Columns and Struts
- 6.1 Definition of columns and struts.



6.2 Failure of a column and a strut.

6.3 Euler,s and Rankine formula for finding critical load.

6.4 Problems on various (4)end conditions of column.

7.0 Rivets and riveted joints

7.1 Riveted joint.

7.2 Failure,

7.3 Strength,

7.4 Efficiency

7.5 design of Rivet

Class Test -3 hrs

REFERENCE BOOKS:

- 1 .Strength of Materials by Ramamrutham.
2. Strength of MaterialsBy- M. ChakrabortiS.K.Kataria& Sons
3. Strength of Materials ,A.K.UpadhyayS.K.Kataria& Sons
- 4.Strength of Materials by R. S . Khurmi

Table Of Specification for Strength of Materials																		Total
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type						
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97	
1	10	Simple Stress & Strain	2	2	2	6	0	4	2	0	6	0	2	6	4	12	24	
2	8	SF & BM	2	2	0	4	0	0	4	0	4	0	0	4	4	8	16	
3	6	Bending & Deflection of Beams	0	2	2	4	0	2	2	0	4	0	0	4	0	4	12	
4	6	Stress in Beams	1	1	0	2	0	2	0	0	2	0	4	4	0	8	12	
5	6	Transmission in shafts & Spring	1	1	0	2	1	2	0	0	3	0	4	3	0	7	12	
6	5	Columns & Struts	1	2	0	3	0	1	2	0	3	0	0	2	3	5	11	
7	4	Rivets and riveted joints	1	1	0	2	0	0	2	0	2	0	0	2	4	6	10	

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Annexure -I Strength of Materials								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Simple Stress & Strain	10	22.22	2	8	10	4	24
2	SF & BM	8	17.78	2	2	8	4	16
3	Bending & Deflection of Beams	6	13.33	0	4	8	0	12
4	Stress in Beams	6	13.33	1	7	4		12
5	Transmission in shafts & Spring	6	13.33	2	7	3		12
6	Columns & Struts	5	11.11	1	3	4	3	11
7	Rivets and riveted joints	4	8.89	1	1	4	4	10

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Strength of Materials Laboratory

Outcome Based Objective : CO

After the experiment being performed the students will be able to

1. Draw the stress strain diagram of an MS rod showing salient points
2. Perform the compression test of a brick or a timber block
3. Determine the Hardness Number of materials
4. Torsion test on mild steel-relation between torque and angle of twist –determination of shear modulus and shear stress
5. Finding the resistance of materials to impact loads by Izod test and Charpy test.

Course Contents

To understand the various material testing method.

- i) To determine stress strain relation for mild steel rod conducting test on universal testing machine.
- ii) To determine hardness of materials using Brinell and Rockwell Testing Materials.
- iii) To perform tension , bending, impact and shear test.

Exercises:

1.Test on Ductile Materials:

Finding Young's Modulus of Elasticity, Yield Points, Percentage Elongation and Percentage Reduction in Area , Stress Strain Diagram Plotting test on Mild Steel with the help of a Universal Testing machine.

2. Compression test of a brick or a timber block on a Compression Testing Machine

3.Hardness Test:

Determination of Brinell's Hardness Number for metal specimen

4.Torsion Test:

Torsion test on mild steel-relation between torque and angle of twist –
Determination of shear modulus and shear stress.

5.Impact Test:



Finding the resistance of materials to impact loads by Izod test and charpytest..

6. Impact Test: Finding the resistance of materials to impact loads by Izod test and charpy test.

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COURSE TITLE: PROFESSIONAL PRACTICE-II

COURSE CODE : AU 410
SEMESTER : 4th Semester
Contact hours : 15

Rationale : To develop general confidence, ability to communicate and attitude, in addition to basic technological concept through industrial visit, expert lectures, seminar on technical topics and group discussion.

Course Outcome:

Oncompletion of this course students will be able to-

1. Acquire information from various sources.
2. Prepare notes for given topic.
3. Technical presentation on given topic in a seminar.
4. Interact with peers to share thought
5. Prepare report on industrial visit, expert lecture.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
1	-	2	3

Evaluation Scheme:							Total Marks(Theory + Sessional)	Credit
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	2
	TA	HA	ESE+SS					
			Total (TA+HA)	25	25	17/50		

Details of Contents (Activities):**1. INDUSTRIAL VISITS:**

Structured industrial visits be engaged and report of the same should be submitted by the individual student, to form part of the term work.

Visit any one of the following:



1. Manufacturing organisations for observing various manufacturing processes including heat treatment.
2. Auto workshop/garage.
3. Plastic material processing unit.
4. Industries relevant to course.

2. GUEST LECTURE(S):

Lectures by Professional/Industrial expert/Student Seminar based on information search to be organized from any one of the following areas:

4. Use of Plastics in automobiles.
5. Nonferrous metals and alloys for engineering application
6. Composite materials.
7. Refractory and Ceramics.
8. Industrial hygiene.
9. Safety engineering and waste disposal.

3. INDIVIDUAL ASSIGNMENTS:

Any two from the list suggested-

1. Process sequence of any two machine components.
2. Write material specifications for any two composite job.
3. Collection of samples of different or cutting tools with properties, specifications and applications.
4. Select materials with desirable properties for at least 10 different machine components.
5. Select 5 different carbon steels and alloy steels used in mechanical engineering applications and specify heat treatment processes with brief description.
6. List the various properties and application of following materials: Fiber, reinforcement plastics, Thermo plastics, thermosetting plastics & Rubbers.

OR

Conduct any one of the following activities through active participation of students and write report.

- a. Rally for energy conservation/ tree plantation.
- b. Survey for local social problems such as mal nutrition, cleanliness, unemployment, illiteracy.
- c. Conduct aptitude, general knowledge, IQ test.
- d. Arrange any one training in the following areas-
 - i. Yoga,
 - ii. Use of firefighting equipment and first aid,
 - iii. Maintenance of domestic appliances.

4. MODULAR COURSE(OPTIONAL)

A course module should be designed in the following areas for max. 12hrs. Batch size – minimum 15 students.

Course may be organized internally or with the help of external organisations.

- a. Forging Technology.
 - b. CAD –CAM related software.
 - c. Welding techniques.
 - d. Personality development.
 - e. Entrepreneurship development.
5. 2-D/3-D DESIGN USING SOFTWARE

Computer screen, coordinate system and planes, definition of HP,VP, reference planes, how to create them in 2nd/3rd environment. Selection of drawing site and scale. Commands for creation of line, coordinate points, axis, poly lines, square, rectangle, polygon, sp. Line, circles, ellipse, text, move, copy, offset, Mirror, Rotate, Trison, Extend, Break, Chamfer, Fillet, Curves, constraint fit agency, perpendicular, dimensioning line convention, material conventions and lettering.

Students should draw- different orthographic views(including sections), auxiliary views according to 1st/3rd angle projection. Minimum two sheets, each containing problems after learning the contents as above.

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5TH SEMESTER**COURSE STRUCTURE OF 5th SEMESTER MECHANICAL (AUTOMOBILE) ENGINEERING**

Sl No	Code No.	Subject	Study Scheme (Contact hours/week)			Evaluation Scheme									
						Theory					Practical			Total Marks (Theory+Practical)	Credit
			L	T	P	ESE	Sessional (SS)			Pass (ESE+SS)	Practical Test (PT) #	Practical Assessment (PA)@	Pass (PT+PA)		
1	Au-501	Automobile Chassis and Transmission	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
2	Au-502	Garage Practice & Management	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
3	Au-503	Auto Workshop Practice-II	-		6	-	-	-	-	-	100	50	50/150	150	4
4	Au-504	Machine Drawing & CAD	3		3	-	-	-	-	-	100	50	50/150	150	5
5	Au-505	Heat Power Engineering	3	1	-	70	10	20	30	33/100	-	-	-	100	3
	Au-510	Professional Practice- III	1		2						25	25	17/50	50	2
Elective (Any One)															
6	Me-502	Industrial Engineering	3		-	70	10	20	30	33/100	-	-	-	100	3
7	Au-506	Refrigeration and Air Conditioning	3		-	70	10	20	30	33/100	-	-	-	100	3
8	EL/ME/AU/IPE-505	Non-Conventional Energy	3		-	70	10	20	30	33/100	-	-	-	100	3
		Total	16	1	17									850	25
			34												



COURSE TITLE: AUTOMOBILE CHASSIS AND TRANSMISSION

COURSE CODE : AU 501
SEMESTER : 5th Semester
Contact hours : 45

Rationale : This is a core technology course of Mechanical(Automobile) engineering provides fundamental knowledge of vehicle control system, their parts and power transmission system. Conceptual knowledge of this course is very much essential for vehicle maintenance and improving of performance of automobile control systems and transmission.

Course Outcome: On completion of this course students will be able to:

1. Define different types of chassis frames.
2. State various components of chassis and draw chassis layout.
3. Understand the construction and working of various control systems employed in a vehicle such as suspension system, steering system, braking system, transmission system.
4. Understand the causes and remedies of various troubles associate with these control systems.
5. Understand construction of axles and wheels used in automobiles.
6. Understand the importance of chassis lubrication.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	3	6

Evaluation Scheme:							Total Marks(Theory + Sessional)	Credit	
Theory				Practical					
ESE	Sessional			Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	50/ 150	4
	TA	HA	Total (TA+HA)	ESE+SS					
70	10	20	30	33/100	25	25	17/50		

Detailed Course Content:**1.0 Vehicle layout, chassis and Chassis frame:****3**

- 1.1 Introduction, Definition of chassis, Classification and specifications of chassis- 2-wheeler, Passenger car, Commercial vehicle
- 1.2 Vehicle lay out and its types- 2 wheel drive, 4-wheel drive, front engine front wheel drive, rear engine rear wheel drive, front engine rear wheel drive
- 1.3 Major components of chassis- their locations and functions.

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- 1.4 Various loads acting on chassis frame.
- 1.5 Types of frames, frame constructions and materials
- 1.6 Automobile body- Types and construction- integral and built up car body (salon, station wagon, traveler's car) bus body and truck body, requirements of Automobile body, body parts and materials.
- 2.0 Suspension system:- 5**
- 2.1 Function of suspension system, types of suspension system, advantages and disadvantages of different suspension system, engine mountings, front end suspension system, rear end suspension system, rigid axel front wheel system, independent front wheel suspension system.
- 2.2 Different types of springs used in suspension system, torsion bar, stabilizer
Shock absorbers- its working principle, types of Shock absorbers, frictional and hydraulic shock absorber, gas filled shock absorber.
- 3.0 Steering: 4**
- 3.1 Functions of Steering, requirements of Steering, different types of Steering, different Steering gear mechanism, Fifth wheel steering ,Steering gear ratio, Steering mechanism:- Davis steering gear mechanism, Ackermann steering gear mechanism.
- 3.2 Factors affecting wheel alignment, castor angle, king-pin inclination, combined angle, toe-in, toe-out etc. cornering force, slip angle, under Steering, over- Steering, common defects and remedies.
- 3.3 Power Steering: - functions, types, working and application.
- 4.0 Brake system: 5**
- 4.1 Necessity and requirement of brakes, types of brake system with details, brake shoe, brake lining, brake drum etc.
- 4.2 Hydraulic brake system, master cylinder, tandem-master cylinder, wheel cylinder, brakes lines, bleeding of brake system.
- 4.3 Power brake, vacuum- assist power brakes, air or pneumatic brake, parking brake, braking efficiency: common defects and remedies.
- 4.4 Antilock braking system- functions, types of ABS, components and working principles, EBD.
- 5.0 Clutch: 5**
- 5.1 Functions of clutch, requirements of clutch, clutch plate material, types of clutch-single, multi-plate clutch, centrifugal clutch, hydraulic clutch etc. Main parts of clutch and their description with operating principles, clutch adjustments. Common defects and remedies of clutch, uses of different types of clutch in various vehicle.
- 5.2 Function and description of cone clutch, centrifugal clutch, semi-centrifugal clutch, hydraulic clutch, diaphragm clutch, vacuum clutch.
- 5.3 Fluid flywheel and its constructional details and principles, advantages and disadvantages of fluid flywheel.
- 6.0 Gear Box: 5**
- 6.1 Functions of gear box, requirements of gear box, types of gear box, sliding mesh, synchromesh, constant-mesh gear box, difference between them, gear actuating mechanism, different types of gear boxes used in various vehicles. Common defects and remedies in the gear boxes.
- 6.2 Torque converter and its construction and working principle, advantages and disadvantages of torque converter.

- 6.3** Automatic Manual Transmission (AMT), continuously variable transmission (CVT), Direct Shift Gear Box (DSG).
- 7.0 Propeller shafts and universal joints:** **2**
- 7.1** Functions of propeller shafts, universal joints, slip joint. Propeller shafts of front wheel and rear wheel drive vehicles. Trouble shooting of propeller shaft.
- 7.2** Universal joints: Types of universal joints and its constructional details and their uses.
- 8.0 Final drive and Differential :-** **3**
- 8.1** Final drive- Straight bevel gear, Spiral bevel gear hypoid gears, single reduction final drive system, double reduction final drive system, worm and wheel arrangement.
- 8.2** Types of drive- Hotchkiss drive, Torque tube drive.
- 8.3** Functions of differential, principles of differential, description, differential lock. Troubleshooting of differential.
- 9.0 Rear Axle:** **2**
- 9.1** Types of Rear axle:- types, Full floating, three quarter floating, semi floating axles, functions of rear axles, constructional details and different load on the axles, four wheel drive mechanisms.
- 10.0 Front Axle:** **2**
- 10.1** Necessity of front axle, types of front axles, stub axles and types, front wheel drive axle, front wheel assembly, live axle, dead axle, various defects in axles and its remedies.
- 11.0 Wheels and Tyres:** **2**
- 11.1** Functions of wheels, types of wheel assembly, wheel dimensions etc. Alloy wheel, advantages and disadvantages.
- 11.2** Tyre:- Types of tyres-Tube tyre, tubeless tyre, high-pressure tyre, low pressure tyre. Carcass or skeleton of tyres-cross-ply type, radial ply type, belted bias type-their advantages. Tyre materials, constructions of tyre. Factors affecting tyre life, Specification of Tyres.
- 12.0** Power transmission system of two wheelers like scooter, motor cycle. **2**
- 13.0 Chassis lubrication:** **2**
- Importance, lubricants used for chassis-lubrication, lubricating points for chassis lubrication. Lubricants used for suspension system, steering system, gearbox, differential, front and rear axle, distributor etc., lubricating charts.
- 14.0** Class Test. **3**

Reference Book, Journal, Manuals etc.:

4. C. P. Nakra: Basic Automobile Engineering, DhanpatRai Publications
5. Crouse & Anglin: Automotive Mechanics



6. G. B. S. Narang: Automobile Engineering, Khanna Publisher
7. Dr. KripalShing: Automobile Engineering Vol-II

Table of specification

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Vehicle layout chassis and Chassis frame	3	7%	1	0	2	
2	Suspension System	5	12%	5	1	1	
3	Steering	4	10%	5	0	0	
4	Brake System	5	12%	8	1	1	
5	Clutch	5	12%	8	1	1	
6	Gear Box	5	12%	8	1	1	
7	Propeller Shaft and Universal Joints	2	5%	2	2	0	
8	Final Drive and Differential	3	7%	4	0	1	
9	Rear Axle	2	5%	2	0	1	
10	Front Axle	2	5%	2	1	0	
11	Wheels and Tyres	3	7%	3	2	0	
12	Power Transmission of Two wheelers	2	5%	1	1	1	
13	Chassis lubrication	1	2%	1	0	1	
14	Class Test	3					
Total		$\Sigma b=45$	100%	50	10	10	

K = Knowledge C = Comprehension A = Application HA = Higher Than Application (Analysis, Synthesis, Evaluation)

$$c = \frac{b}{\Sigma b} \times 100$$



DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Vehicle layout chassis and Chassis frame	1	0	1	2	0	0	1	0	1	0	0	0	0	0
2	Suspension System	1	1	0	2	0	0	1	0	1	4	0	0	0	4
3	Steering	1	0	0	1	0	0	0	0	0	4	0	0	0	4
4	Brake System	2	1	0	3	0	0	1	0	1	6	0	0	0	6
5	Clutch	1	1	1	3	1	0	0	0	1	6	0	0	0	6
6	Gear Box	1	1	1	3	1	0	0	0	1	6	0	0	0	6
7	Propeller Shaft and Universal Joints	1	1	0	2	1	1	0	0	2	0	0	0	0	0
8	Final Drive and Differential	0	0	0	0	0	0	1	0	1	4	0	0	0	4
9	Rear Axle	1	0	1	2	1	0	0	0	1	0	0	0	0	0
10	Front Axle	1	0	0	1	1	1	0	0	2	0	0	0	0	0
11	Wheels and Tyres	2	1	0	3	1	1	0	0	2	0	0	0	0	0
12	Power Transmission of Two wheelers	1	0	1	2	0	1	0	0	1	0	0	0	0	0
13	Chassis lubrication	1	0	0	1	0	0	1	0	1	0	0	0	0	0
	Total				25					15					30



Automobile Chassis and Transmission(Lab)

TOTAL hours: 60

Evaluation Scheme:						Credit
Study Scheme(Contact hours/ week)			Practical			
L	T	P	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	
0	0	3	25	25	17/50	

1. Cleaning of engines parts: various cleaning procedures (chemical, thermal and abrasive cleaning) of different parts of petrol/diesel engines.
2. Overhauling of clutch assembly in 2 wheelers:
 - 2.1 Dismantling, installing and aligning a clutch disc in a two wheelers,
 - 2.2 Clutch free pedal play adjustments, clutch troubles.
3. Gearbox Troubleshooting -
 - 3.1 Servicing and adjustment of gear selector mechanism.
 - 3.2 Troubleshooting of gearboxes like slipping out of gears, difficult shifting of gears, noise in gears or transmission noise etc.
 - 3.3 Determination of gear ratios of different types of gear box.
4. Troubleshooting of propeller shaft, differential & final drive
 - 4.1 Angular alignment of propeller shaft and changing of cross and bearing from universal joints.
 - 4.2 Measuring and adjusting backlash and side bearing preload on a final drive assembly with a shim pack and adjusting nuts.
 - 4.3 Diagnosing differential noises, causes and remedies.
5. Study of rear axles-
 - 4.1 Semi floating, three quarter floating and full floating axles according to load and construction.
 - 4.2 Replacing procedure of axle bearing and oil seal.
6. Study of power brakes-
 - 6.1 Types of power brakes- Air brake, servo assisted brakes etc.
 - 6.2 Overhauling of power brake system.
7. Study of steering geometry-
 - 7.1 Adjustment of steering geometry:-camber, caster, toe-in and toe-out (wheel alignment).
8. Study of wheels-
 - 8.1 Conventional & alloy rims
 - 8.2 Tube& tubeless type, Cross ply & radial ply type.
 - 8.3 Specification of tyres



8.4 Vulcanizing of tube tyre, repair and replace of tubeless tyre, tyre rotation procedure.

9. Study of power steering system -

9.1 Hydraulically and electronically assisted.

9.2 Overhauling of power steering pump.

10. Study of suspension system

10.1 Rigid axle suspension & independent suspension system,



11. Hotchkiss drive & torque tube drive. Types of springs. shock absorber- hydraulic & gas type. Leakage of shock absorber.
12. Vivavoce/Seminar



COURSE TITLE: GARAGE PRACTICE AND MANAGEMENT

COURSE CODE : AU 502
LEVEL : 5th Semester
Contact hours : 45

Rationale : This course is important for the students of Mechanical (Automobile) Engineering to acquire the knowledge of special tools and equipment to suite modern technology and management of modern garage.

Course Outcomes:

On completion of this course student will be able to-

1. Identify and enlist garage tools, equipment and prepare garage layout for setting new garage and service station.
2. Identify different garages found in common practice.
3. Understand the various activities take place in a modern garage and service station
4. Understand schedule maintenance of automobiles.
5. Understand management of garage store, procurement of stores, sales and distribution motor vehicles.
6. Know the main features of motor vehicle act applicable for day to day life.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	3	6

Evaluation Scheme:							Total Marks(Theory + Sessional)	Credit
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	50/ 150	4
	TA	HA	ESE+SS					
			Total (TA+HA)					
70	10	20	30	33/100	25	25	17/50	

Detailed Course Content:

1.0 Introduction:

5



- 1.1** Garage, service station, factors to be considered while locating garage and service station. Types of garage. Layout of service station and garage.
- 1.2** Equipment for service station, washing and cleaning equipment, hydraulic ram, air compressor, blower, water pump, lubricating equipment-grease gun and nipples, hand and compressed air operated lubrication equipment, lubrication charts, servicing procedure.
- 2.0** Equipment for Service Station: 4
- 2.1** Garage tools and equipment- different types of garage tools, special tool, flaring tools, cutters, pullers, stud extractors, torque wrench, piston ring expander and compressor, piston ring groove cleaner, valve lifter etc.
- 2.2** Reconditioning equipment- degreasing plant, de-carbonizing, cylinder re-boring and honing, valve re-facer, grinding of crank shaft main journal bearings, crank pin, connecting rod aligner, brake drum lathe, brake shoe riveting, rivet gun (pneumatic type, hand operated type), valve spring tester, injector test bench, injection pump and calibrating machine.
- 3.0** Engine Testing and Tuning: 3
- 3.1** Engine testing procedure, engine testing equipments, engine analyzer or computer/carscanner, compression gauge, vacuum gauge, voltmeter, ohm meter, ammeter, tachometer, oscilloscope, timing light, multi meter etc.
- 3.2** Engine timing- Tune-up procedure, major and minor tune up.
- 4.0** Material Handling: 4
- 4.1** Objectives and functions of material handling, Material handling equipment- Lift and hoist and their types, chain pulley block, cranes, trolley, fork lift truck, jacks, recovery van, car lift,towing equipment, Ramp.
- 5.0** Body repairing, reconditioning and painting. 4
- 5.1** General background of body repairing, accident repair, repairing dents, welding, metal shrinkage, soldering etc.
- 5.2** Painting:- Definition, objective of paintings, elements of paints, primer, paint coat- undercoat paint, primer surface, second coat paint, sealer, top coat paint. Surface preparation or treatment- details application of sanding putty, abrasive paper and their uses with number.
- 6.0** Garage work procedure and records: 4
- 6.1** Inspection, test report, estimation and quotation for repair work, work order, job control system, billing and costing.
- 7.0** Garage stores: 4
- 7.1** Stores and material control, requirements of material control system, store management, functions of store department, duties of store keeper, location and layout of stores, receipt and issue of materials, store records, bin card, stores ledger, indent on store, types of stores, storage and handling equipments. Inspection, prevention of spoilage of stores, storage of inflammables, stores, petrol, diesel, oil, rubber components, tubes and tyres, plastics etc.

- 7.2** Inventory control, various levels of stock such as ordering level, maximum level, Economic Order Quantity, buffer stock, interchangeability of spares etc. Centralized and decentralized stores. ABC analysis.
- 7.3** Purchase organization, importance, objectives, functions, duties, methods of purchasing, purchasing procedure, tenders, tender notice, purchase order, etc.
- 8.0** Sales and distribution of motor vehicles: 3
- 8.1** Marketing organization, salesmanship, canvassing, publicity, display, dealership and agency system, sales and purchase procedure, documents for new and second hand vehicles, service after sales, customer record and follow-up.
- 9.0** Industrial law and road transportation: 5
- 9.1** Motor vehicle act, driving license, permits, registration, insurance, fitness certificate, pollution under control certificate, MACT, motor vehicle act 1939, motor vehicle act 1989 and amendments thereafter. Traffic signals and their types.
- 10.0** Maintenance: 5
- 10.1** Elements of maintenance management, preventive maintenance- items and procedure of preventive maintenance, running maintenance, daily and periodic maintenance for prevention of break down. Brake down maintenance- procedure and preparation, scheduled maintenance.
- 11.0** Important features of automobiles : 1
- Log book (operational records) of vehicles such as movement, servicing, oil change, changing filter elements, repairing records etc.
- 12.0** **Class Test:** 3

Reference/ Text Books:

1. Crouse and Anglin: Automotive Mechanics
2. G.B.S. Narang: Automobile Engineering,
3. James E. Duffy : Body Repair Technology for 4-Wheelers
4. T.R Banga & S.C. Sharma: Industrial Organisation and Engineering Economics, Khanna Publishers



TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Introduction	6	14%	8	1	1		10
2	Equipment for Repairing Shop	5	12%	6	1	1		8
3	Engine Testing and Tuning	3	7%	3	1	1		5
4	Material handling	2	5%	2	0	1		3
5	Body repairing, reconditioning and Painting	4	10%	5	1	1		7
6	Garage work procedure and records	4	10%	5	1	1		7
7	Garage Store	5	12%	6	1	1		8
8	Sales and distribution of motor vehicle	3	7%	4	1	0		5
9	Industrial law and road transportation	5	12%	6	1	1		8
10	Maintenance	4	10%	6	0	1		7
11	Important features of automobiles	1	2%	1	0	1		2
12	Class Test	3			-			Act
	Total	45	100	52	8	10		70

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Introduction	1	1	0	2	2	0	1	0	3	5	0	0	0	5
2	Equipment for Service Station	2	1	0	3	0	0	1	0	1	4	0	0	0	4
3	Engine Testing and Tuning	1	1	1	3	2	0	0	0	2	0	0	0	0	0
4	Material handling	1	0	1	2	1	0	0	0	1	0	0	0	0	0
5	Body repairing, reconditioning and Painting	0	0	1	1	0	1	0	0	1	5	0	0	0	5
6	Garage work procedure and records	0	1	0	1	0	0	1	0	1	5	0	0	0	5
7	Garage Store	2	0	1	3	1	1	0	0	2	4	0	0	0	4
8	Sales and distribution of motor vehicle	2	0	0	2	2	1	0	0	3	0	0	0	0	0
9	Industrial law and road transportation	2	1	1	4	1	0	0	0	1	3	0	0	0	3
10	Maintenance	2	0	0	2	0	0	0	0	0	4	0	0	0	4
11	Important features of automobiles	1	0	1	2	0	0	0	0	0	0	0	0	0	0
	Total				25					15					30

GARAGE PRACTICE AND MANAGEMENT (LAB)

CODE NO: Au 502

COURSE OUTCOMES: On completion of this course students will be able to-

1. Identification of different Garage tools, Equipment and their uses.
2. Demonstrate the testing of engine.
3. Perform reconditioning of engine system.
4. Demonstrate washing, cleaning and servicing procedure of an automobile vehicle and vehicle maintenance.
5. Perform driving practice and vehicle maintenance.

Details of Contents:

- | | |
|--|----|
| 1. Identify Garage tools, Equipment and their uses. | 3 |
| 2. Engine Testing and tuning: | 15 |
| 2.1 Study of various spark plugs. Spark plug testing and cleaning, gap measuring and adjusting. | |
| 2.2 Testing and adjustment of ignition timing with ignition timing tester in an engine. | |
| 2.3 Study cam/Dowell angle of S.I. engine. Measure the Dowell angle with the help of filler gauge and Dowell meter when the contact-breaker points are replaced. | |
| 2.4 On board diagnosing of an engine with car scanner | |
| 2.5 Measurement of fuel consumption, emissions and vehicle performance by road simulation | |
| 2.2 Calibration of Fuel Injection Pump of a diesel engine. | |
| 3. Engine reconditioning: | 15 |
| 3.1 Study engine gaskets, gasket materials and various types of gaskets used in Automobile vehicle, general gasket installation procedure. | |
| 3.2 Checking Cylinder Bore for taper and ovality / out of roundness, Cylinder Boring and honing & compression test in an engine. | |
| 3.3 To measure and align bend, twist and off-set of connecting rod with the connecting rod aligner. | |
| 3.4 Checking of crankshaft and main journal pin for taper and ovality. According to manufacturer's specification grind the Crankshaft pins with crankshaft grinding machine, if necessary. | |
| 3.5 Valve re-facing, Grinding and seat cutting. | |
| 4. Vehicle Maintenance: | 9 |
| 4.1 Surface preparation, Removing dents and vehicle painting. | |
| 4.2 Washing, cleaning and servicing procedure of a vehicle (According to maintenance schedule). | |
| 4.3 Periodic and breakdown maintenance of automobiles. | |

- 5 Driving practice 15
- 5.1 Study of traffic signals and identify all types of traffic signals and indicators.
 - 5.2 Driving practice in a 4 wheeler vehicle: First hand checking of vehicle before driving, use of clutch, gear, accelerator,brake, signal lights, study of dash boardinstruments, safety precautions,
- 6 Viva-voce



COURSE TITLE: Automobile Workshop Practice II

COURSE CODE : AU 503
SEMESTER : 5th
Contact hours : 90

Rationale : This course makes the student to apply theoretical knowledge to develop skill for repairing and maintenance of different mechanical systems of automobiles.

Course Outcome: After completion of this course students will be able to

3. Demonstrate the procedure of complete overhauling of transmission system and control system of automobiles.
4. Demonstrate the construction and working of transmission system and control system of automobiles.

Evaluation Scheme:						Credit
Study Scheme(Contact hours/ week)			Practical			
L	T	P	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	4
0	0	6	100	50	50/150	

Details of Contents:**1.0 Chassis and Frame:-**

Study layout of different types of frame and Chassis of car, truck and buses.

2.0 Clutch:-

2.1 Procedure of demount the complete clutch assembly from an automobile vehicle.

2.2 Dismantling a clutch unit, note down the different parts, clean, inspect & rectify the possible defects / troubles. Refit the clutch assembly after necessary adjustments.

3.0 Gear box:-

Procedure of demount the Gear box from a given automobile vehicle

Dismantle the gear box, cleaning, inspection and check for defects, change the parts if required. Reassemble the parts, check for back lash. Refit the selector mechanism and check for proper shifting of gears. Mount the gear box on the vehicle.

3.0 Universal Joints and Propeller Shaft: -

Dismantle the Universal Joints and Propeller Shaft, cleaning, inspection and check for possible defects, change the parts if required. Reassemble the parts and refit the whole unit.



4.0 Differential: -

Dismantle the Differential gears, cleaning, inspection and check for possible defects, change the parts if required. Reassemble the parts, check for back lash and refit the whole assembly.

5.0 Rear Axles & Front Axle: -

Dismantle the rear axle assemblies, specify/identify the specific type of rear axle, cleaning, inspection and check for possible defects, change the parts if required. Reassemble the parts and refit the whole assembly. Servicing of front axle assemblies.

6.0 Steering System: -

Study of steering system, servicing of steering gear box and steering linkages, adjustments, refitting the steering gear box, adjustment of steering play if any. Road test.

7.0 Wheels and Tyres:- Static and dynamic balancing of wheels and wheel alignment**8.0 Brake system:-**

Study of brake system, servicing of master cylinder, wheel cylinder- and refitting the brake system. . Bleeding of brake system.

9.0 Servicing of vehicle:-

Practice on servicing of vehicle, procedure of servicing, servicing tools/equipment and its uses.

10.0 VIVA**Reference Book, Journal, Manuals etc.:**

8. C. P. Nakra: Basic Automobile Engineering, Dhanpat Rai Publications
9. Crouse & Anglin: Automotive Mechanics
10. N. Malhotra : Automobile Engineering Practical, Asian Publication.



TABLE OF SPECIFICATIONS FOR Practical Test

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	H A	T
1	Chassis and Frame	9	10%	1	2	5		8
2	Clutch	9	10%	1	3	8		12
3	Gear Box	9	10%	1	3	8		12
4	Universal Joints & Propeller Shaft	6	7%	1	2	5		8
5	Differential	9	10%	1	1	7		9
6	Rear axles and Front axles	6	7%	1	1	6		8
7	Steering System	9	10%	1	2	6		9
8	Wheels and Tyres	9	10%	1	2	6		9
9	Brake system	9	10%	1	2	7		10
10	Servicing of vehicle	9	10%	1	2	7		10
11	Viva/SEMINAR	4	4%	5	0	0		5
	Total	$\Sigma b= 90$	100%	1 5	2 0	65		100

K = Knowledge C = Comprehension A = Application HA = Higher Than Application

$$c = \frac{b}{\Sigma b} \times 100 \quad T = \text{Total}$$



COURSE TITLE: Machine Drawing and CAD

COURSE CODE : Me -504
SEMESTER : 5th Semester
Contact hours : 90

Rationale : This course helps the students in understanding of drawing, which includes clear visualization of objects and the proficiency in reading and interpreting a wide variety of machine elements and assembly drawings. This course also reinforces and enhances the knowledge and skill acquired in the earlier lower semester course.

Course Outcome: After completion of this course students will be to:

1. Draw true shape of solid sections, surface development of solid sections.
2. Read and interpret machine elements and assembly drawings
3. Draw different machine elements and engine parts.
4. Draw 2D and 3D machine element using software.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	3	6

Evaluation Scheme:							Total Marks(Theory + Sessional)	Credit	
Theory				Practical					
ESE	Sessional			Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	50/ 150	5
	TA	HA	Total (TA+HA)	ESE+SS					
					100	50	50/150		

Detailed Course Content:

- 1.0 Section of Solids: 18
- 1.1 Cutting geometric solids with plans, true shape of the sections, development of surface of geometric solids and interpenetration. Parallel and radial line development.

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2.0	Pipe drawing:	6
2.1	Pipe joints, Pipe fittings.	
2.2	Piping drawings.	
3.0	Keys and cotters.	6
3.1	Keys and spline.	
3.2	Cutter joints.	
3.3	Knuckle joints.	
4.0	Welded joints:	3
4.1	Lap joints, Butt joints, single and double butt.	
5.0	Shaft coupling:	9
5.1	Rigid coupling (anyone).	
5.2	Non rigid or flexible coupling: such as pin coupling, floor coupling etc. (anyone)	
6.0	Bearings and Brackets:	6
6.1	foot step bearing, bush bearing, wall bracket (anyone).	
6.2	Plummer block.	
7.0	Pulleys:	9
7.1	Fast and loose pulley, cone pulley.	
8.0	valves:	9
8.1	Stop valve, feed check valve.	
9.0	Engine parts:	9
9.1	Steam engine piston and rings, piston rod assembly staffing box, cross head eccentric.	
9.2	IC engine piston with rings and gudgeon, pin connecting rod.	
10.	C.A.D	9
10.1	Drawing of figure using absolute coordinates, polar coordinates and relative Co-ordinates	
10.2	Drawing of figure using the line and Circle and Arc commands and dimensioning of figure.	
10.3	Use of Snap, Copy, offset, fillet, Mirror and Array Command.	
10.4	Showing of front, side, top view of an object and hatching the views.	
10.5	Construction of composite solid of an object by using solprof command to generate front side, and top profiles.	
10.6	Drawing of figure by using 3D command.	
11.0	Class Test	6

Reference/Text Books:

1. R.B. Gupta : Machine Drawing



2. V.M. Panchal& N.D. Bhatt: Engineering Drawing
3. N.D. Bhatt : Machine Drawing, Charotar Publishing House.



TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Section of Solids	20	26%	30	5	5	-	40
2	Pipe Drawing	6	8%	3	1	1	-	5
3	Keys and Cotters	6	8%	5	0	0	-	5
4	Welded Joints	3	4%	3	1	1	-	5
5	Shafts Coupling	9	12%	8	1	1	-	10
6	Bearing and Brackets	9	12%	7	1	2	-	10
7	Pulleys	9	12%	8	1	1	-	10
8	Valves	6	8%	5	1	0	-	6
9	Engine Parts	9	12%	6	2	1	-	9
10	CAD	7	-	0	-	-	-	-
11	Class Test	6	-	0	-	-	-	-
	Total	90	100%	75	13	12	-	100

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Section of Solids	3	2	2	7	6	3	3	-	12	21	-	-	-	21
2	Pipe Drawing	0	1	1	2	3	0	0	-	3	0	-	-	-	0
3	Keys and Cotters	0	0	0	0	0	0	0	-	0	5	-	-	-	5
4	Welded Joints	0	1	1	2	3	0	0	-	3	0	-	-	-	0
5	Shafts Coupling	1	0	1	2	0	1	0	-	1	7	-	-	-	7
6	Bearing and Brackets	2	1	0	3	0	1	1	-	2	5	-	-	-	5
7	Pulleys	1	1	1	3	0	0	0	-	0	7	-	-	-	7
8	Valves	1	1	0	2	4	0	0	-	4	0	-	-	-	0
9	Engine Parts	2	1	1	4	4	0	1	-	5	0	-	-	-	0
10	CAD	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Class Test	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total				25					30					45



COURSE TITLE: HEAT POWER ENGINEERING**COURSE CODE : Au-505****SEMESTER : 5th Semester****Contact Hours : 45****Course Outcomes:** On the completion of the course the students should be able to:

1. Understand Working, construction, mountings and accessories of Steam generators
2. Illustrate the principle and working of steam nozzles
3. Explain the principle and operations of different types of steam turbines
4. Summaries the principle and operations of Steam condensers and Cooling towers
5. Understand the working principle of Nuclear power plant.
6. State the different laws of heat transfer.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	1		4

Evaluation Scheme:							Total Marks (Theory + Sessional)	Credit	
Theory				Practical					
ESE	Sessional			Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	3
	TA	HA	Total (TA+HA)	ESE+SS					
70	10	20	30	33/100					

COURSE CONTENTS**1.0 Steam generators****10**

- 1.1 Steam boiler- function of boiler -classification of boilers
- 1.2 Low pressure boilers- Sketch and working of Cochran and Babcock and Wilcox boiler
- 1.3 High pressure boilers- Sketch and working of Lamont and Benson boiler
- 1.4 Comparison of water tube and fire tube boilers.
- 1.5 Boiler mountings-Pressure gauge, water level indicator, fusible plug, blow off valve, stop valve, safety valve
- 1.6 Boiler accessories - feed pump, economizer, super heater and air pre-heater
- 1.7 Boiler fuels, burning equipment and ash handling
- 1.8 Chimney draught and measurement
- 1.9 Feed water treatment
- 1.10 Boiler performance, Boiler acts, dry inspection and hydraulic test

2.0	Steam nozzles	05
2.1	Introduction -Types of stem nozzles	
2.2	Flow of steam through nozzle	
2.3	Friction in a nozzle	
2.3	Discharge of steam through nozzles	
2.5	Condition for maximum discharge	
2.6	Critical pressure ratio-Physical significance	
2.7	Effect of friction in nozzles	
2.8	Supersaturated flow through nozzle	
2.9	Simple problems of nozzles	
3.0	Steam turbine	10
3.1	Classification of steam turbines with examples and their working	
3.2	Turbine components	
3.3	Working principle with line diagram of a simple De-Laval turbine - velocity diagram of impulse turbine	
3.4	Expression for work done, axial thrust, diagram efficiency, stage efficiency, nozzle efficiency.	
3.5	Methods of reducing rotor speed by compounding (velocity compounding, pressure compounding & pressure - velocity compounding)	
3.6	Working principle with line diagram of a Parson's Reaction turbine - velocity diagram of reaction turbine	
3.7	Losses in steam turbine	
3.8	Governing of turbine	
3.9	Simple problems on single stage impulse turbines (without blade friction) and reaction turbines	
4.0	Steam condensers and Cooling towers	07
4.1	Function of condenser	
4.2	Elements of steam condensing plant	
4.3	Types of Condenser-Jet Condenser and Surface Condenser	
4.4	Vacuum in condenser and its measurement	
4.5	Cooling tower	
5.0	Nuclear power plant	05
5.1	Elements of nuclear power plant	
5.2	Nuclear reactor, fuels, moderators, coolants and control	
5.3	Classification of nuclear power station	
5.4	Cost of nuclear power	
6.0	Heat transfer	03
6.1	Fourier's law of heat conduction	
6.2	Newton law of cooling- Stefan-Boltzmann law of radiation	
6.3	Heat transfer by conduction through slab and composite wall	
6.4	Radial heat transfer by conduction through a thick cylinder	
6.5	Simple problems on above (conduction only)	

7.0 Class Test

03

REFERENCES

1. **“Fundamental of thermodynamics”** by Richard E Sntag, Claus Borgnakke, Gordon J Vanwylen, Wiley Student edition, 6th Ed.,
2. **“ Basic and applied thermodynamics”** by P.K.Nag ,Tata McGraw hill, New Delhi 2009
3. **“Heat engines (Vol-I &Vol-II)”**by Patel and Karmachandani
4. **“Thermal Engineering “**by R.S.Khurmi
5. **“Thermal Engineering”** by P.L. Balaney
6. **“Thermodynamics applied to heat engines”**byLewitt.
7. **“Heat engines”** by Pandya and shah

“A course in Thermodynamics & Heat Engines” Kothandaraman, Khajuria&Arora, Dhanpat Ray & Sons

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Steam generators	10	24%	12	2	3	
2	Steam nozzles	5	12%	6	1	1	
3	Steam turbines	10	24%	12	2	3	
4	Steam condensers and Cooling towers	7	17%	8	2	2	
5	Nuclear power plant	5	12%	6	1	1	
6	Heat transfer	5	12%	6	2	0	
7	Tests	3					
8	Total	45	100%	50	10	10	

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Steam generators	4	1	2	7	2	1	1	0	4	6	0	0	0	6
2	Steam nozzles	1	0	1	2	1	1	0	0	2	4	0	0	0	4
3	Steam turbines	4	1	2	7	2	1	1	0	4	6	0	0	0	6
4	Steam condensers and Cooling towers	2	1	1	4	0	1	1	0	2	6	0	0	0	6
5	Nuclear power plant	1	1	0	2	0	0	1	0	1	5	0	0	0	5
6	Heat transfer	1	2	0	3	2	0	0	0	2	3	0	0	0	3
7	Total				25					15					30



COURSE TITLE: PROFESSIONAL PRACTICE-III

COURSE CODE : AU 510
SEMESTER : 5th Semester
Contact hours : 30

Rationale : To develop general confidence, ability to communicate and attitude, in addition to basic technological concept through industrial visit, expert lectures, seminar on technical topics and group discussion.

Course Outcome:

On completion of this course students will be able to-

1. Acquire information from various sources.
2. Prepare notes for given topic.
3. Technical presentation on given topic in a seminar.
4. Interact with peers to share thought
5. Prepare report on industrial visit, expert lecture.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
1	-	2	3

Evaluation Scheme:							Total Marks(Theory + Sessional)	Credit
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	2
	TA	HA	ESE+SS					
			Total (TA+HA)	25	25	17/50		

Contents**Activities****1. INDUSTRIAL VISITS****12**

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. The industrial visits may be arranged in the following areas / industries(one):

- i. Painting shop



- ii. State Transport workshop / Auto service station
- iii. Automobile parts and accessories manufacturing unit.
- iv. Diesel Loco Shed, Thermal power plant.

2. LECTURES BY PROFESSIONAL / INDUSTRIAL EXPERT LECTURES TO BE ORGANIZED FROM ANY ONE OF THE FOLLOWING AREAS: 3

- a) Interview Techniques.
- b) Modern Boilers - Provisions in IBR
- c) Applications of Sensors and Transducers
- d) Alternate fuels - CNG / LPG, Biodiesel, Ethanol, hydrogen
- e) Piping technology.
- f) Heat transfer.

3. INFORMATION SEARCH: 5

Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report **any one** topic.

Following topics are suggested:

- a) Power steering
- b) Automatic transmission
- c) Diesel Locomotive
- d) Heat Exchangers
- e) Power brakes
- f) Maintenance procedure for solar equipment.
- g) New development in Automobile engineering technology.

4. SEMINAR: 10

Seminar on the report submitted of the topic mentioned above at point no.3.



Course Title: INDUSTRIAL ENGINEERING

Subject Title	:INDUSTRIAL ENGINEERING		
Subject Code	:	Me-502	
Hours Per Week	:	03	
Hours Per Semester	:	45	
Class Test hrs	:	03	
Total hours	:	48	
Full marks(Theory)	:	70	
Sessional Marks	:	30	
Class hours	L	T	P
	3	0	0

Pre Requisites: None

Aim of the Subject: The aim of the subject is to know the method of work study and its related techniques, to understand job evaluation , wage system, inspection procedure & quality Control , network analysis and various maintenance systems in Industry.

CO ____OUTCOME BASED OBJECTIVES

After studying the course the students will be able to

1. Explain the principle of work study(Method and Time study)
2. Illustrate the job evaluation and merit rating
3. Know the wage system in industry
4. Know the inspection procedure and maintenance system
5. Apply the network analysis as an effective tool of management



COURSE CONTENTS

Contribution of work study to productivity

1.0 Method Study

Meaning and purpose.

Process chart, Symbols, types.

Operation process chart ; method of Construction.

Flow process chart, its elements and Relationship.

Flow diagrams.

Other tools for method analysis.

Analysing the charts and methods by questioning process.

Decisions for improving the Methods.

Purpose, basic procedures.

Work measurement : Meaning and purpose.

Time study equipment-stop watch, study board, time study forms.

Making time study, checking the methods, breakdown of the job- recording-selection of elements- measurement of time.

Time study-rating-average rating-normal performances, factors affecting performances, rating scales, rating factors.

Allowance to be considered in determining standard time- determination of standard time.

Predetermined motion time standard, Standard data, uses of the standard data.

Work sampling , work sampling procedure- purpose-collection of data- determination of the results.

2.0 Job Evaluation & Merit Rating

Job evaluation- definition, objectives and procedure, Job analysis, job description and Job specification.

Methods of Job Evaluation- Ranking, classification, factors comparison and point rating methods.

Merit Rating- definition and objectives

Methods of merit rating- rating scale, check list and employee comparison methods, advantages and disadvantages of merit rating.

3.0 Wage Systems.

Wages- definition, types- wage differentials- reasons, Methods of wage payments, Types of incentives, standard wage plans- Halsey, Weir ,Emersons, Rowan's Gantt's task and Bonus systems- Taylor's piece rate system, Merric's piece rate system- Numerical problems on the above plans, Incentives to the supervisor and executives.

4.0 Inspection and Statistical quality control

Inspection

Introduction- meaning of the term quality, quality of design, quality conformance & quality assurance- quality & cost relationship, reliability, Inspection- definition- objectives of inspection-methods of inspection- floor or patrolling inspection & centralized inspection- merits demerits- kinds of inspection- trial run inspection- first piece inspection- pilot piece inspection- operation inspection- sample inspection, notional inspection-final inspection- working inspection.

Review of statistical terms- Quality control- measurable & non-measurable.

Variation in manufacture- assignable causes- chance causes- inspection.

Causes- variables- attributes- tally sheet frequency table histogram- frequency polygon- Normal curve- properties of normal curve.

Average and grand average- their significance determination of upper and lower control limits of \bar{X} and R using statistical tables, construction of \bar{X} and R charts for a group of samples.

Analysis of control charts- process out of control, and in control.

Thumb rules for analysis- shifts, runs, trends, erratic fluctuations.

Control charts for attributes- fraction defective- percent defective- $P, NP, 100p$ charts- significance- characteristics of \bar{X} and R charts- calculation of P from data- control limits- process 'in control' and 'out of control' –differences between P, NP and $100P$ charts.

Sampling procedure lot, Meaning of the term- lot- lot quality, lot size, sample size and acceptance number- lot sampling.

Probability of acceptance- producer's risk- consumer's risk LTPD, AOQ and AOQL.

Single sampling plan- Parameters that affect the lot size and sample size and acceptance number- effect of sample size and acceptance number on probability of acceptance (P_a)- 'OC' curves of a single sampling plan- Variables involved in double sampling plan- Calculation of P_a . A B C standard.

Problems using tables.

5.0 Network Analysis.

Definition- Network Techniques- PERT, CPM, RAMS, PEP, COPAC, MAP, RPSM, LCS, MOSS, PCS, GERT.

Terms used in Network Planning- Event, Activity, Classification of Activity, Critical Path, Duration, Total project time, EST, EFT, LFT, LST, Float or slack, Total float, Free float, Independent float.

Network diagram or Arrow diagram- Construction, critical path, calculation of project duration.

Simple problem on CP and Project duration.



REFERENCE BOOKS

1. Work Study- by I.L.O.
2. Industrial Engineering and Management Science- by T.R.Banga
3. Industrial Engineering and Management- by O.P.Khanna
4. S.O.C.- by Juran

Table Of Specification for Industrial Engineering																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
1	14	45 Work Study	2	4	2	8	3	2	4	0	6	0	6	6	5	17	34
2	6	Job Evaluation and Merit Rating	1	2	0	3	2	1	2	0	5	0	3	3	0	6	14
3	6	Wage and Incentive System	1	2	0	3	2	1	0	0	3	0	3	5	0	8	14
3	8	Inspection and Statistical Quality Control	2	1	0	3	1	1	2	0	4	0	6	4	0	10	17
5	6	Net work analysis	2	1	0	3	2	2	2	0	6	0	4	4	3	7	18

Annexure -I Industrial Engineering								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Work Study	15	31.11	5	12	12	5	34
2	Job Evaluation and Merit Rating	7	13.33	3	6	5	0	14
3	Wage and Incentive System	7	13.33	3	6	5	0	14
4	Inspection and Statistical Quality Control	8	17.78	3	8	6	0	17
5	Net work analysis	8	13.33	6	9	3	0	18

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COURSE TITLE:REFRIGERATION AND AIR CONDITIONING

COURSE CODE : Au -506

SEMESTER : 5th Semester

Contact Hours : 45

Course Objectives:After completion of this course student will be able to

- Explain the construction and working of different refrigeration and air conditioning system.
- Solve numerical problems of air refrigeration and vapour compression refrigeration system.
- Explain various applications of refrigeration and air conditioning.
- Compare different refrigeration system.
- Describe trouble shootings of refrigerator and air conditioners.
- State properties of refrigerant and its application.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	-	3

Evaluation Scheme:						Total Marks(Theory + Sessional)	Credit	
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	3
	TA	HA	ESE+SS					
			Total (TA+HA)					
70	10	20	30	33/100				

DETAIL COURSE CONTENT**1.0 INTRODUCTION**

2 PDS.

- 1.1 Terms and definition – Heat engine, refrigerator, heat pump, refrigeration, refrigerant, refrigerating effect, refrigeration capacity, COP, relative cop
- 1.2 Methods of refrigeration (names and application)

1.0 AIR REFRIGERATION SYSTEM

3 PDS.

- 2.1 Reversed Carnot cycle, determination of cop
- 2.2 Bell-Coleman cycle- open system, closed system. Determination of cop(problem)

3 VAPOUR COMPRESSION REFRIGERATION SYSTEM

6 PDS.

- 3.1 Fundamental operations and analysis with schematic T-S and p-h diagrams for simple cycle , COP
- 3.2 Advantages and disadvantages of vapour compression system over air refrigeration system
- 3.3 Actual vapour compression cycle—variation from theoretical cycle
- 3.4 Effects of sub cooling and superheating



- 3.5 Simple problems
- 4 VAPOUR ABSORPTION SYSTEM 6 PDS
- 4.1 Flow diagram and operation of NH₃- WATER cycle, components- generator, rectifier, condenser, evaporator, absorber, heat exchanger, pump
- 4.2 Flow diagram and operation of Lithium bromide – water cycle
- 4.3 Flow diagram and operation of electrolux refrigerator
- 4.4 Comparison between vapour compression and vapour absorption systems.
- 5.0 REFRIGERANTS 5 PDS
- Definition and function of refrigerant
- 5.1 Desirable properties of refrigerant
- 5.2 Classification of refrigerant
- 5.3 Important requirements, secondary requirements
- 5.4 Selection of refrigerant for required purpose
- 6.0 REFRIGERATION COMPONENTS, CONTROL AND SAFETY DEVICES 5pds
- 6.1 Brief description and field of application of reciprocating compressor, rotary compressor, centrifugal compressor.
- 6.2 Brief description and field of application of air cooled and water cooled condensers
- 6.3 Brief description and field of application of evaporators
- 6.4 Briefdescription and field of application of expansion devices-capillary tube, thermostatic expansion valve
- 6.5 Control and safety devices- low side float valve, high side float valve, solenoid valve, compressor over current and over heating protection, high and low pressure cut-outs
- 7.0 APPLICATION OF REFRIGERATION 6 PDS
- 7.1 Food preservation- spoilage agents and their control, preservation by refrigeration
- 7.2 Cold storage-construction (layout), capacity and application
- 7.3 Refrigerators and freezers
- 7.4 Ice plant- construction (layout), capacity and application
- 7.5 Ice- cream plant- construction (layout) and operational features
- 7.6 Dry ice production- construction (layout) and operation of simple system, application
- 7.7 Water cooler
-
- 8.0INTRODUCTION TO AIR CONDITIONING 1 PERIOD
- 9.0PSYCHROMETRICS5pds
- 9.1 Definition of different terms,
- 9.2Psychrometric Charts and their uses
- 10.0Cooling load Estimation 2 pds
- 10.1 A brief idea on cooling load estimation.
- 11.0 Air Conditioning System 3 PDS
- 11.1 Summer Air Conditionin
- 11.2 Winter Air Conditioning

11.3 Unit And Control System, Central ac system

11.4 Plant Layout

12.0 Application of A/C System

4 PDS

12.1 Domestic, office, Schools, Commercial Establishment

12.2 Industry & Textile etc.

Annexure -I Refrigeration and Air Conditioning								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction	1	2.22	2				2
2	Air Refrigeration system	4	8.89	4	2	2		8
3	Vapour Compression Refrigeration System	6	13.33	4	5	4		13
4	Vapour Absorption Refrigeration System	3	6.67		4	2	1	7
5	Refrigerants	5	11.11	2	4	5		11
6	Refrigeration controls and safety devices	3	6.67	2	4			6
7	Application of refrigeration	4	8.89	5	4			9
8	Air Conditioning System	1	2.22	2				2
9	Psychometric Charts	6	13.33	3	5	3	2	13
10	Cooling Load	4	8.89	3	4	2		9
11	AC System	5	11.11	2	3	5		10
12	Application of ac system	3	6.67	3	2	2		7

Table Of Specification for Refrigeration and Air Conditioning																		
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total	
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T		
1	1	Introduction	2			2											99	2
2	4	Air Refrigeration system	2			2		2			2	2					5	8
3	6	Vapour Compression Refrigeration System	2	1		3		2			3		3	4			7	13
4	3	Vapour Absorption Refrigeration System		1	1	2			1	1	2						3	7
5	5	Refrigerants	2			2		2			2		2	5			7	11
6	3	Refrigeration controls and safety devices	2			2		2			2		2				2	6
7	4	Application of refrigeration	1	1		2		1	1		2	3	2				5	9
8	1	Air Conditioning System						2			2							2
9	6	Psychometric Charts	1	1		3		2	1		3		3	2			8	13
10	4	Cooling Load	1	2		3		2	1		3		1	2			3	9
11	5	AC System	2			2			2		2		3	3			6	10
12	3	Application of ac system	1			1		2			2		2	2			4	7



Course Title: NON CONVENTIONAL ENERGY

Subject Title	: No Conventional Energy		
Subject Code	:	EI/Me/Au/IPE-505	
Hours Per Week	:	03	
Hours Per Semester	:	45	
Class test	:	03	
Total Hours	:	48	
Full marks(Theory)	:	70	
Sessional Marks	:	30	
Class hours	L	T	P
	3	0	0

Prerequisite- None

CO-----Outcome based course objectives

After studying the course the students will be able to

1. Explain the details of Non Conventional energy sources and its uses
2. Illustrate the principle of solar energy collection
3. Analyze the principle of thermal energy storage system
4. Know the principle of wind energy conversion system
5. Differentiate the principle of ocean thermal energy conversion with energy from tidal power
6. Know about the geothermal energy
7. Identify the components of a biogas Plant
8. Explain the MHD (Magneto Hydrodynamic System)
9. Know about the chemical storage system

COURSE CONTENTS



SCTE, Assam | JANUARY, 2019

1.0 Introduction to Non-Conventional Energy Sources

- 1.1 Energy consumption
- 1.2 Energy Sources & their Availability
- 1.3 Importance of Non Conventional Energy sources.

2.0 Solar Energy Engineering

- 2.1 Introduction
- 2.2 Solar Constant
- 2.3 Solar Radiation at the Earth's surface
- 2.4 Solar Radiation Measurements
- 2.5 Solar Energy Collectors
 - 2.5.1 Principles of Conversion of Solar Radiation into heat
 - 2.5.2 Flat Plate Collectors – Types, Applications & Advantages
 - 2.5.3 Concentrating Collectors – Focusing & non-focusing types
 - 2.5.4 Advantages & Disadvantages of concentrating collectors over flat plate collectors.
- 2.6 Applications of Solar Energy - Water Heating, Air Heater, Solar Cooker, Solar Pond, Solar Photovoltaic and Solar Distillation.

3.0 Wind Energy Engineering

- 3.1 Introduction
- 3.2 Basic Principles of Wind energy conversion
 - 3.2.1 The nature of wind
 - 3.2.2 The power in the wind (No derivations)
 - 3.2.3 Forces on the Blades (No derivations)
- 3.3 Site Selection considerations
- 3.4 Basic components of a wind energy conversion system (WECS)
- 3.5 Wind energy collectors (Wind mill)
 - 3.5.1 Horizontal Axis Machines
 - 3.5.2 Vertical Axis Machines
- 3.6 Advantages & Limitations of WECS.

4.0 Ocean Energy Engineering

- 4.1 Introduction

- 4.2 Ocean Thermal Energy Conversion (OTEC)
 - 4.2.1 Introduction to OTEC
 - 4.2.2 Methods of OTEC
 - 4.2.3 Site Selection for OTEC
 - 4.2.4 Prospects of OTEC in India.
- 4.3 Tidal Energy
 - 4.3.1 Introduction
 - 4.3.2 Basic Principles of Tidal Power
 - 4.3.3 Components of Tidal Power Plants
 - 4.3.4 Schematic Layout of Tidal Power house
 - 4.3.5 Operation methods of utilization of Tidal energy (single and double basin arrangement)
 - 4.3.6 Advantages & Limitations of Tidal power
 - 4.3.7 Prospects of Tidal Energy in India.

5.0 Geothermal Energy Engineering

- 5.1 Introduction
- 5.2 Nature of Geothermal fields
- 5.3 Geothermal Sources
- 5.4 Hydro thermal Sources
 - 5.4.1 Vapour dominated systems
 - 5.4.2 Liquid dominated systems
- 5.5 Prime movers for geothermal energy conversion

6.0 Bio Energy Engineering

- 6.1 Introduction
- 6.2 Biomass conversion techniques
- 6.3 Biogas Generation.
- 6.4 Factors affecting biogas Generation
- 6.5 Types of biogas plants
- 6.6 Advantages and disadvantages of types of biogas plants

7.0 Direct Energy Conversion Systems

- 7.1 Magneto Hydro Dynamic Generator

- 7.1.1 Introduction
- 7.1.2 Basic principle
- 7.1.3 MHD Systems (open cycle & closed cycle)
- 7.1.4 Advantages of MHD
- 7.2 Thermo-Electric power
 - 7.2.1 Basic Principles
 - 7.2.2 Thermo electric power generator
 - 7.2.3 Thermo Electric materials & selection of materials
- 7.3 Thermoionic Generation
 - 7.3.1 Introduction
 - 7.3.2 Thermoionic emission & work function
 - 7.3.3 Basic Thermoionic generator

8.0 Chemical Energy Sources

- 8.1 Fuel cells
 - 8.1.1 Introduction
 - 8.1.2 Fuel cells – Principles of operation, classification & Types
 - 8.1.3 Applications of fuel cells
- 8.2 Hydrogen Energy
 - 8.2.1 Introduction
 - 8.2.2 Principles of operation
 - 8.2.3 Applications

Reference:

1. Non conventional Energy sources by G.D.Rai, Khanna Publishers
2. Solar Energy by S P Sukhatme Tata McGraw Hill
3. Solar Energy Utilization G D RaiKhanna Publishers
4. Power Plant Technology by M M EI Wakil ,Tata McGraw Hill



Table Of Specification for Non Conventional Energy																		
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total	
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97	
1	2	Introduction to Non Conventional Energy sources	2	0	0	2	0	2	0	0	2	0	0	0	0	0	4	4
2	12	Solar Energy	2	3	0	5	0	2	3	0	5	0	4	4	7	15	25	25
3	6	Wind Energy	0	2	0	2	2	1	0	0	3	2	0	5	0	7	12	12
4	6	Ocean Energy	2	0	0	2	2	1	0	0	3	2	3	2	0	7	12	12
5	4	Geo thermal Energy	2	0	0	2	0	2	0	0	2	2	4	0	0	6	10	10
6	8	Energy for Bio mass	2	1	0	3	1	2	0	0	3	0	0	4	6	10	16	16
7	5	Direct Energy Conversion	2	0	0	2	0	2	1	0	3	0	2	3	0	5	10	10
8	4	Chemical Energy Storage	0	2	0	2	0	1	0	0	1	2	3	0	0	5	8	8

Annexure -I Non Conventional Energy								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction to Non Conventional Energy sources	2	4.44	2	2	0	0	4
2	Solar Energy	12	26.67	2	9	7	7	25
3	Wind Energy	6	13.33	4	3	5	0	12
4	Ocean Energy	6	13.33	6	4	2	0	12
5	Geo thermal Energy	4	8.89	4	6	0	0	10
6	Energy for Bio mass	8	17.78	3	3	4	6	16
7	Direct Energy Conversion	5	11.11	2	4	4	0	10
8	Chemical Energy Storage	4	8.89	2	6	0	0	8

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6TH SEMESTER

Course Structure of 6th Semester															
Sl No	Code No.	Subject	Study Scheme			Evaluation Scheme								Total Marks(Theory+Practical)	Credit
						Theory				Practical					
			L	T	P	ESE	Sessional (SS)			Pass(ESE+SS)	Practical Test (PT) #	Practical Assessment(PA)@	Pass (PT+PA)		
							TA	HA	Total (TA+HA)						
1	Hu-601	Industrial Management & Entrepreneurship	3			70	10	20	30	33/100				100	3
2	Au-601	Advanced Automobile Engineering	3		3	70	10	20	30	33/100	25	25	17/50	150	4
3	Au-602	Auto Electrical Equipment	3		3	70	10	20	30	33/100	25	25	17/50	150	4
4	Au-603	Design Estimating & Costing	3		3	70	10	20	30	33/100	-	-	-	100	4
5	Au-611	Project & Seminar		1	6						100	50	50/150	150	3
	Au-612	General Viva	1	1							50	-	17/50	50	2
6	Au-610	Professional Practice- IV	1		2						25	25	17/50	50	2
Elective (Any One)															
7	Me-604	Metrology	3			70	10	20	30	33/100				100	3
	Au-605	Automobile Heavy Equipment	3			70	10	20	30	33/100				100	3
		Total	17	2	17									850	25
			36												



Course Title : Industrial Management and Entrepreneurship

1. Course Code : **Hu – 601**
2. Semester : **VI**
3. **Aim of the Course:**
 1. To acquaint the students with managerial activities
 2. To provide introductory knowledge of Cost Accounting
 3. To introduce students with industrial legislation
 4. To explain the scope for self-employment
 5. To compare and contrast different forms of business organization
 6. To identify the opportunities to start a small scale industry

4. **Course Outcomes:**

On completion of the course on IME, students will be able to

- CO₁ = explain managerial activities.
- CO₂ = describe leadership qualities and decision making process.
- CO₃ = state the elements of costs.
- CO₄ = explain important industrial laws.
- CO₅ = define different forms of business organisations
- CO₆ = identify entrepreneurial abilities for self employment through small scale industries.

5. **Teaching Scheme (in hours)**

Lecture	Tutorial	Practical	Total
42 hrs	3 hrs	--	45 hrs

6. **Examination Scheme:**

Theory				Practical				Total Marks
Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination	Sessional			
70	30	100	33	--	--	--	--	100



7. Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
				42 hrs
1.0	Introduction to Management :	i) Meaning and Concept ii) Functions of Management iii) Principles of Management	i) Explain functions and principles of management	3
2.0	Leadership Decision Making & Communication :	i) Definition of Leader ii) Functions of a leader iii) Decision making – Definition iv) Decision making process v) Communication – definition, importance & types	i) Develop leadership qualities ii) Demonstrate decision making abilities	4
3.0	Introduction to Cost :	i) Definition and classification of Cost ii) Elements of Cost iii) Break Even Analysis	i) State elements of costs ii) Explain Break Even Analysis	3
4.0	Human Resource Management:	i) Meaning of manpower planning ii) Recruitment and Selection procedure iii) Payment of wages – factors determining the wage iv) Methods of payment of wages – Time rate and Piece rate v) Labour Turnover – definition, its causes, impact and remedy	i) State selection procedure of employees ii) Distinguish Time rate and Piece rate system of wage payments iii) Explain causes and impact of labour turnover	5
5.0	Industrial Legislation :	i) Need of Industrial legislation ii) Indian Factories Act – 1948 – Definition of Factory, main provisions regarding health, Safety and Welfare of Workers iii) Industrial Dispute Act – 1947 – Definition of Industrial dispute, Machineries for settlement of Industrial dispute in India	i) Identify the needs and importance of industrial laws	5
6.0	Production Management :	i) Meaning of Production ii) Production Management – definition, objectives, functions and scope	i) State the objectives and functions of Production management	3

		iii) Inventory Management, Basic idea		
7.0	Marketing Management:	i) Meaning and functions of marketing ii) e- Commerce iii) Channels of distribution iv) Wholesale and retail trade	i) state the functions of wholesalers and retailers	2
8.0	Entrepreneur and Entrepreneurship:	i) Definition of Entrepreneur and Entrepreneurship ii) Qualities required by an entrepreneur iii) Functions of an entrepreneur iv) Entrepreneurial motivation	i) State the qualities and functions of an entrepreneur	3
9.0	Forms of Business Organisation:	i) Sole Trader – meaning, main features, merits and demerits ii) Partnership – definition, features, merits and demerits iii) Joint Stock Company – Definition, types, features, merits and demerits	i) Differentiate different forms of Business organization ii) compare and contrast features, merits and demerits of different business organizations.	5
10.0	Micro and Small Enterprises:	i) Definition of Micro & Small enterprises ii) Meaning and characteristics of Micro and Small enterprise iii) Scope of SSI with reference to self-employment iv) Procedure to start SSI – idea generation, SWOT analysis v) Selection of site for factories	i) Define micro and small enterprises ii) Explain the procedure to start a small enterprise	4
11.0	Support to Entrepreneurs	a) Institutional support: i) Introduction ii) Sources of information and required application forms to set up SSIs iii) Institutional support of various National & State level organizations – DICCC, NSIC, IIE, MSME - DI, Industrial Estates	i) identify the supporting agencies to entrepreneurs ii) Explain the role of financial support organisations	5

		b) Financial support: i) Role of Commercial banks, RRB, IDBI, ICICI, SIDBI, NEDFi, and State Financial Corporations ii) Special incentives and subsidies for Entrepreneurship Development in the North East		
	Class Test			3 hrs
	Total			45 hrs

(9) TABLE OF SPECIFICATIONS for Industrial Management & Entrepreneurship

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Comprehension	Application	HA
1	Introduction to Management	3	7	2	3	0	0
2	Leadership & Decision Making	4	9.5	3	4	0	0
3	Introduction to Cost	3	7	3	2	0	0
4	Human Resource Management	5	12	6	2	0	0
5	Industrial Legislation	5	12	4	4	0	0
6	Production Management	3	7	3	2	0	0
7	Marketing Management	2	5	4	0	0	0



8	Entrepreneur & Entrepreneurship	3	7	3	2	0	0
9	Forms of Business Organisation	5	12	3	5	0	0
10	Micro & Small Enterprises	4	9.5	4	3	0	0
11	Support to Entrepreneurs	5	12	4	4	0	0
Total		42	100	39	31	0	70

K = Knowledge C = Comprehension A = Application HA = Higher Than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$

10. Distribution of Marks:

DETAILED TABLE OF SPECIFICATIONS FOR IME

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand Total
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
1	Management	1	0	0	1	1	0	0	0	1	0	3	0	0	3	5
2	Leader & Decisi	1	0	0	1	2	1	0	0	3	0	3	0	0	3	7
3	Cost	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
4	HRM	2	1	0	3	1	1	0	0	2	3	0	0	0	3	8
5	Laws	3	0	0	3	0	0	0	0	0	1	4	0	0	5	8
6	Product Manage	2	1	0	3	1	1	0	0	2	0	0	0	0	0	5



7	Market	2	0	0	2	2	0	0	0	2	0	0	0	0	0	4
8	Entrepreneurship	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
9	Forms of BO	2	1	0	3	0	0	0	0	0	1	4	0	0	5	8
10	MSME	2	0	0	2	0	0	0	0	0	2	3	0	0	5	7
11	Support to Entp.	3	0	0	3	1	0	0	0	1	0	4	0	0	4	8
	Total	20	5	0	25	12	5	0	0	17	7	21	0	0	28	70

K = Knowledge
Than Application

C = Comprehension A = Application

HA = Higher

T = Total

11. Suggested implementation Strategies: Modified syllabus may be implemented with effect from January, 2020 (Starting with the present batch (2018) of 2nd Semester students)

12. Suggested learning Resource:

a. **Book list :**

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Industrial Management	S.C. Jain H.S. Bawa	Dhanpat Rai & Co. (P) Ltd. New Delhi- 110006
2	Business Organisation and Entrepreneurship Development	S.S. Sarkar R.K. Sharma Sashi K. Gupta	Kalyani Publishers, New Delhi-110002
3	Entrepreneurial Development	S. S. Khanka	S. Chand & Co. Ltd. New Delhi-110055
4	Business Methods	R.K. Sharma Shashi K Gupta	Kalyani Publishers, New Delhi
5	Entrepreneurship Development and Management	Dr. R.K. Singhal	S.K. Kataria & Sons, New Delhi-110002
6	Business Administration & Management	Dr. S. C. Saksena	Sahitya Bhawan, Agra

7			
8			

- b. List of Journals
- c. Manuals
- d. Others



COURSE TITLE: Advanced Automobile Engineering

COURSE CODE : AU 601
SEMESTER : 6th Semester
Contact hours : 45

Rationale : This course is important for the students of Mechanical Engineering (Automobile) to acquaint with the latest trends and technologies used in automobiles.

Course Outcome: On completion of this course students will be able to-

1. Understand constructional features and working of modern automobile engines.
2. Analyse performance of I.C engines and performance curves.
3. Acquire knowledge on I.C engine fuels, its rating and combustion.
4. Understand different fuel technologies used in modern automobiles, and its prospects and limitations.
5. Understand working principles of comfort and safety devices in automobiles.
6. Acquire knowledge on automotive emission and its control.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	3	6

Evaluation Scheme:							Total Marks (Theory + Sessional)	Credit	
Theory					Practical			50/ 150	4
ESE	Sessional			Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)		
	TA	HA	Total (TA+HA)	ESE+SS					
70	10	20	30	33/100					

Details of contents:

- 1.0 Engine rating and performance:** 10
- 1.1 Engine rating, types of rating, RAC rating, derivation of the RAC horse power, use of RAC rating, limiting factors in reciprocating engines, rubbing speed, piston displacement, stroke bore relation- its effects in engine performance (power output characteristics and piston area), compression ratio, square engine, over square engines.
- 1.2 Engine performance: IHP, BHP, FHP, relation between BHP & car speed, engine efficiencies, Mech. Efficiencies, thermal efficiencies, Relative efficiency, performance curve, Otto-cycle, Atkinson cycle, Diesel cycle, mean effective pressure, heat balance sheet, Morse test., Methods of improving engine performance
- 1.3 Problems on engine performance.
- 2.0 Fuels:** 4
- 2.1 Classification of fuels, physical and chemical properties of various fuels, qualities of SI engine fuels, qualities of CI engine fuels. Fuels for CI engines, gas, petrol, kerosene, compressed natural gas (CNG) and others fuels. Fuels for CI engines- crude oil, LSD, HSD etc.
- 2.2 Corrosion effect, sulphur in fuel, additives of fuel, normal combustion of the fuel, factors effecting flame speed, abnormal combustion of the fuel, pre-ignition, detonation or knocking, fuel rating- Cetane No. , Octane No, Ignition delay, dope etc.
- 3.0 Theory of Combustion:** 3
- 3.1 Ignition limits
- 3.2 Stages of combustion in SI engines.
- 3.3 Ignition lag, effects of engine variables on flame propagation.
- 3.4 Abnormal combustion- Detonation, pre-ignition, causes and effects of detonation.
- 3.5 Control of detonation. SI engine combustion chamber
- 3.6 Stages of combustion in CI engine
- 3.7 Delay period and its control.
- 3.8 Diesel knock and its control
- 3.9 CI engine combustion chamber.
- 4.0 Valve mechanism of modern engines:** 5
- 4.1 Valves, types of valves mechanism, variable valve timing, 4 valve in a cylinder, disposition of valves, examples of valves mechanism in modern engines, operating principle of 4 valve mechanism and 3 valve mechanism in per cylinder in multi cylinder engine(VVT) , valve and camshaft placement i.e. overhead camshaft engine. Comparison between conventional and other than conventional valve system.
- 5.0 Alternative Fuel Technology(Modern Engines):** 5
- 5.1 Wankel rotary-piston engine, construction and principle, comparison of Wankel engine with the conventional engine in their construction, advantages and disadvantages, Engine with Sleeve valve, Stirling engine- working principle, Battery cum solar car. Electric vehicle, Hybrid vehicle, Fuel-cell, Hydrogen vehicle.
- 5.2 Recent development in Automobile engines and Automobile industry.
- 6.0 Gas turbines:** 4

- 6.1 Introduction to gas turbine, its use in automobile, principle of gas turbine applied in automobiles, constructional details of those engines.
- 6.2 Prospects and limitations of gas turbines in automobiles.
- 6.3 Waste heat recovery system- use of waste heat and its advantages (example from gas turbine and reciprocating I.C. engine).
- 7.0 Air conditioning: 3**
- 7.1 Introduction, Principles of Automobile Air conditioning, operating conditions, Function of Air-conditioning system components, Types of control system, Air-conditioning system in cars and buses. Advantages of Air-conditioning system. Use of refrigerant used in automobile air-conditioning system and their types. Automatic climate Control.
- 8.0 Bearings: 3**
- 8.1 Various types of bearings and their uses- Radial bearing, Thrust bearing, Radial thrust bearing; Plain bearing- Crankshaft journal and main bearing, Connecting rod bearing (Big and small end bearing), Camshaft bearing, and bushing.
ball bearing, roller bearing - its types and uses. Specific types of bearing used in Automobile vehicles & their description.
- 9.0 Automotive Emission and awareness: 5**
- 9.1 Introduction, ecology, air pollution due to Automobile emission, main pollutants from Automobiles, diesel engine combustion and smoke, types of diesel smoke, factors affecting diesel smoke, Control of Air pollution from Automobiles –Operation of an evaporative emission control system, Pre-combustion System, Positive crankcase ventilation system (P.C.V), EGR system, Spark control system, exhaust emission control system, Catalytic converter and secondary air injection system. Pollution norms, Effects of air pollution on environment and in human beings, Emission testing and monitoring devices, noises and its control.
- 10.0 Safety Devices: 4**
- 10.1 Introduction, safety measures in automobiles, necessity, interior safety and comfort in the bodywork, safety points for the driver, crumple zone.
- 10.2 Safety devices: Traction control system, Electronic Stability Programme, Hill descend control, engine immobiliser, safety belts, Air bags, child lock, rear view camera with reverse parking assist.

11. CLASS TEST

3

Reference Books, Journals:

1. M. L. Mathur & R. P. Sharma: Internal Combustion Engine, Dhanpat Rai Publications
2. S. V. Hatch: Electronic Engine Controls, Cengage Learning India Pvt. Ltd.
3. Erjavec. Arias : Alternative Fuel Technology, Yes Dee Publishing Pvt. Ltd.
4. Dr. Kripal Singh: Automobile Engineering Vol. I, Dhanpat Rai & Co.



TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Engine rating and performance	9		4	3	5		12
2	Fuels	4		2	4			6
3	Theory of combustion	4		3	5			8
4	Valve mechanism of modern engines	4		1	4			5
5	Alternative Fuel Technology(Modern Engines)	4		2	4			6
6	Gas Turbines	4		3	5			8
7	Air conditioning	4		3	5			8
8	Bearings	3		2	3			5
9	Automotive Emission and Awareness	4		4	4			8
10	Safety Measures	2		2	2			4
11	Class Test	3						-
	Total	Σ b=45	100					70

K = Knowledge

C = Comprehension

A = Application

HA = Higher

Than Application (Analysis,

Synthesis, Evaluation)

$$C = \frac{b}{\Sigma b} \times 100$$

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Engine rating and performance	2	2			2	2						6		
2	Fuels	3				2	2								
3	Theory of combustion	3				2						4			
4	Valve mechanism of modern engines	2										4			
5	Alternative Fuel Technology(Modern Engines)	2				2	2								
6	Gas Turbines	2				2						4			
7	Air conditioning	2				1						6			
8	Bearings	2				2	2								
9	Automotive Emission and Awareness	3				3	3								
10	Safety Measures	2				1	2								
11	Class Test														



K = Knowledge
Than Application

C = Comprehension A = Application

HA = Higher

T = Total



Advanced Automobile Engineering (Lab.)

CODE NO :AU 601

TOTAL hours : 45

- 1.0 Engine performance Test:
 - 1.1 Morse test of multi cylinder engine. (Minimum 4 cylinder)
 - 1.2 Fuel consumption, Specific fuel consumption, Brake thermal efficiency, Heat balance sheet of multi cylinder engine, performance curves.
- 2.0 Measurement of pollutants (Exhaust Gas analysis)
 - 2.1 Petrol engine.
 - 2.2 Diesel engines.
- 3.0 Determination of kinetic and dynamic viscosity of lubricating oil with viscometer.
- 4.0 Study of Air conditioning system: testing and servicing equipment, purity test, leak testing and refilling, service procedure.
- 5.0 Bearing:
 - 5.1 Identification and inspection of various bearings in Automobiles, bearing play and measurement of play, study of bearing failure & replacement of bearing.
- 6.0 Study of the 4 valve mechanism (VVT).
- 7.0 Study of automobile emission control system:
 - 7.1 Evaporative emission, PCV, EGR, SCR, catalytic converter.
- 8.0 Alternative fuel Technology:
 - 8.1 Study of hybrid car
 - 8.2 Electric car
 - 8.2 Solar car
- 9.0 Study of safety devices in automobiles.
- 10.0 Viva- voce.



TABLE OF SPECIFICATIONS FOR Practical Test (PT)

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Engine performance Test	9						4
2	Measurement of pollutants	6						3
3	Determination of viscosity of lubricants							
4	Study of Air conditioning system	3						1
5	Bearing	6						3
6	Study of the 4 valve mechanism (VVT).	6						2
7	Study of automobile emission control system	6						2
8	Alternative Fuel Technology	9						4
9	Study of safety devices in automobiles	6						2
		$\Sigma b=60$						25
11	Class Test							
Total								

K = Knowledge C = Comprehension A = Application HA = Higher

Than Application (Analysis, Synthesis, Evaluation) $c = \frac{b}{\Sigma b} \times 100$

Annexure-III

WEIGHTAGES TO BE ASSIGNED TO VARIOUS COMPONENTS OF EVALUATION FOR LABORATORY WORK

S.No.	Item	* Maximum Marks	Marks Awarded
1.	<u>Preparation of Drawing</u> (Process Evaluation) <ul style="list-style-type: none"> • Ability to carry out experiments following correct procedure • Handling of equipment • Ability to observe and record • Ability to follow BIS standards 	40	
2.	<u>Quality of Product</u> (Product Evaluation) <ul style="list-style-type: none"> • Quality of reporting results • Ability to interpret results 	20	
3.	<u>General Behaviour</u> <ul style="list-style-type: none"> • Care of materials and equipment • Independence • Use of working time and space 	10	



4.	<u>Viva Voce</u> <ul style="list-style-type: none">• Understanding of underlying Concepts, Principles or Theory• Critical Judgement/reasoning'• Ability to draw conclusions and generalizations	30	
5.	Total	100	

*The external evaluation can be carried out for 100 marks and then proportioned as per the total marks allotted in the study scheme



COURSE TITLE: AUTO ELECTRICAL EQUIPMENT

COURSE CODE: AU 602
SEMESTER : 6th
Contact hours : 45

Rationale : Automobiles are comprises of electrical systems consisting of various electrical and electronics equipment and accessories. This course will help the students to acquire knowledge of these electrical systems, electrical equipment and accessories.

COURSE OUTCOME:

After completion of this course students will be able to-

1. Understand the basic concepts of electricity, magnetism and automobile wiring.
2. Know the construction of lead acid battery, its characteristics, charging method and maintenance.
3. Understand the working principle and construction of a starting motor, starting switch etc.
4. Understand the ignition system of an SI engine and various spark advance mechanisms.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	3	6

Evaluation Scheme						Total Marks (Theory + Sessional)	Credit		
Theory				Practical					
ESE	Sessional			Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+ PA)		
	TA	HA	Total (TA+HA)	ESE+SS					
70	10	20	30	33/100	25	25	17/50	50/ 150	4

Details of Contents:

1.0 Introduction:

- 1.1 Necessity of electrical power in automobile, various electrical equipments.

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- 2.0** Storage Batteries: 7
- 2.1 Purpose of storage batteries, types of storage batteries and their constructional details, cell voltage, series/parallel connection of cells, battery capacity, battery ratings.
- 2.2 Charging and Discharging of batteries, electrolyte, chemical changes during charging and discharging. Slow rate and quick rate of charging, effects of temperature, charging circuits and components.
- 2.3 Battery maintenance: Battery life, cleanliness, topping, periodical checks, checking of batteries by hydrometer and cell testers. Battery troubles-self discharge, sulphation internal shorts- circuiting, deterioration of plates, cracking, corrosion of terminal and clamps, loss of water, discoloring of electrolyte- causes and treatment of these troubles, comparison of advantages and disadvantages amongst the storage batteries.
- 3.0** Starting system: 7
- 3.1 Outline of the starting circuit and functions of its various components, starting torque, factors effecting the starting of engine.
- 3.2 Cranking motor- types, principle of working, constructional details, components, testing and maintenance.
- 3.3 Starting drives- necessity, types, description and constructional details of these drives, bendix drive, over running.
- 3.4 Starting motor switches: description, details of constructional of manual switch, solenoid switch cum shift, solenoid switch with relay, ignition switch- construction,.
- 3.5 Starting system troubles and remedies.
- 4.0** Generating system: 8
- 4.1 Generator function
- 4.2 Elementary idea about flux due to electric current, Maxwell's rule for finding the direction of flux lines, Flemings right hand rule and Lentz's law, general principle, mutual induction generator constructional details.
- 4.3 D. C. Generator, Generator output control, necessity of output, control, methods-details. Generators regulators, cutout relay, current regulator, voltage regulator, necessity, construction, working principle of these relays and regulators, testing procedure for generator regulator system, setting of the regulators-procedures.
- 4.4 Generator maintenance and servicing, common generator faults, their remedies.
- 5.0** Alternator: 7
- 5.1 Principle and constructional details of alternator, alternator output control, regulator type and working description. alternator output control - electronic type
- 5.2 Comparison of performance of alternator and generator (advantages and disadvantages).
- 6.0** Electrical Wiring Systems: 4
- 6.1 Types of wiring system: Insulated and Earthed return, system, Positive & negative earth return, wiring harness, wiring colour code.
- 6.2 Electrical and Electronic Accessories



- Horns: Function and types : Wind type horn, Relay type horn & Double horn
type: their construction, electrical circuit and working
- 6.3 Indicators & warning devices: Function , construction, working and types of Fuel Gauge, Oil pressure gauge, Water temperature gauge, Speedometer, odo meter, tachometer, Oil pressure warning light ,Water temperature warning light, Brake warning light , Ignition warning light, engine immobilizer, central lock, rain sensing wiper, Windshield washer. Power window, electrically adjusted ORVM.
- 7.0 Review of the ignition system: 4
- 7.1 Battery and Coil ignition, magnetic ignition, Electronic ignition system- constructional details of coils, condenser, distributor, contact.
- 9.0 Class Test 3

Reference Books, Journals:

5. Automotive Electrical Equipment, Tata MCGraw Hills International Publication
6. B. D. Arora: Automotive Electrical Equipment, R. B. Publications
7. P.L. kohli: Automotive Electrical Equipment, tata McGraw Hill
8. A.K Sweny: Electrical and Electronic Measuring Instrument, DhanpatRai& Sons.
9. S. V. Hatch: Electronic Engine Controls, Cengage Learning India Pvt. Ltd.
10. Dr. Kripal Singh: Automobile Engineering Vol. I, DhanpatRai& Co.

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Introduction	2		1	-	1		2
2	Storage Battery	7		2	8	3		13
3	Starting System	7		1	9	3		13
4	Generating System	8		2	8	3		13
5	Alternator	7		1	9	3		13
6	Electrical Wiring System	4		1	3	1		5
7	Electrical and Electronics Accessories	4		1	4	1		6
8	Review of ignition System	3		1	4	-		5
9	Class Test	3		-	-	-		
	Total	$\Sigma b=45$	100	10	45	15		70



K = Knowledge C = Comprehension A = Application HA = Higher Than

Application (Analysis, Synthesis, Evaluation) $C = \frac{b}{\Sigma b} \times 100$

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Introduction	2													
2	Storage Battery	3				2					4	4			8
3	Starting System	3		1		2					4		4		8
4	Generating System	3		1		2					4		4		8
5	Alternator	2				2					4		4		8
6	Electrical Wiring System	2		1							4				4
7	Electrical and Electronics Accessories	2		1		2					3				3
8	Review of ignition System	3		1									3		3

K = Knowledge C = Comprehension A = Application HA = Higher Than Application T = Total



AUTO ELECTRICAL EQUIPMENT (LAB)

CODE NO : Au 602

TOTAL hours : 45

- 1.0 Study Storage Battery:
 - 1.1 Constructional details of a lead acid battery and identification of its components. electrolyte in correct ratio of acid and distilled water, charging procedure and output voltage. Determination of specific gravity of electrolyte . Battery rating.
 - 1.2 Constructional details of Nical Cadmium (NicCd) battery, Nickel –Metal Hybrid (NiMH) Batteries and their circuit diagrams. Charging and testing procedure.
- 2 Study of starting system
 - 2.1 Identification of the different components of a starting system of an Automobiles and detailed circuit diagram of the starting system.
 - 2.2 Study of starting drive- Bendix drive, Flo-through type, Pre-engaged type.
 - 2.3 Disassemble a cranking motor, test the armature and field coil (with the help of growler and test lamp), replace carbon brushes if necessary and assemble it.
 - 2.4 Testing of starting motor for proper functioning.
 - 2.5 Study of different types of starting motor switches, e.g. Manual switch, ignition switch, solenoid switch etc., their related circuit diagrams and constructional details. Test the solenoid switch.
3. Study of generating System:
 - 3.1 Disassembling and assembling of D.C. generator used in automobiles. Servicing and testing of the generator. Study of circuit diagram.
 - 3.2 Disassemble and assemble of an alternator used in automobiles. Identification of various components of an alternator. Servicing and testing of the alternator. Study of circuit diagram
4. Study of wiring system and the colour coding of wires in an automobile.
5. Study of electronic ignition system- circuit diagram, identification of different components of electronic ignition system and test the system with digital volt-ohmmeter or digital multimeter
6. Study of electrical accessories:
 - 6.1 Electric horn circuit, test and tune the horn.
 - 6.2 Wiper motor, power window, central lock, rain sensing wiper, Windshield washer. Power window, electrically adjusted ORVM, defogger.
7. Viva-Voce



COURSE TITLE : DESIGN ESTIMATING AND COSTING**COURSE CODE : AU 603****SEMESTER : 6th Semester****Contact hours : 60****Rationale : Knowledge of design drawing and estimation is very essential for engineering students. This course is to develop knowledge and skill to automotive parts design and production.****Course Objectives:** On completion of this course students will be –

1. Understand the preliminary steps for designing of automobile parts viz. shaft, bearing, flywheel etc.
2. Layout of piston, injector, pumps, springs, connecting rod, crankshaft etc.
3. Explain the important elements of estimation and costing.
4. Estimate the cost of sheet metals and fabrication.
5. Determine surface area, volume and weight of mechanical parts.
6. Estimate materials, machining time and preparation of bill of materials for jobs/parts.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	3	6

Evaluation Scheme:						Total Marks(Theory + Sessional)	Credit	
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	5
	TA	HA	Total (TA+HA)					
70	10	20	30	33/100				

DETAILS OF CONTENTS:

- | | | |
|------------|---|----|
| 1.0 | Basic Design Approach | 10 |
| 1.1 | Introduction, classification of design, design considerations. | |
| 1.2 | Types of shafts, Standard sizes, Stresses in shafts, Maximum Permissible stresses, Design of shafts subjected to Twisting and Bending Moment. | |
| 1.3 | Co-efficient of fluctuation of speed and energy, maximum fluctuation of energy and energy stored in a flywheel. | |
| 1.4 | Classification of bearings, Terms used in Hydrodynamic Journal bearing---Somerfield no., co-efficient of friction etc. | |
| 2.0 | Layout of Automobile Engine parts: | 10 |
| 2.1 | IC engine piston with rings and gudgeon pin | |

2.2	Shafts keys	
2.3	Connecting rod	
2.4	Coil spring and leaf spring.	
2.5	Fuel pumps	
2.6	Injector	
2.7	Parts of transmission system	
3.0	Bill of Materials:	2
3.1	Preparation of bill of materials for automobiles parts using standard parts and tables/chart for bill of materials	
4.0	Estimating and Costing:	4
4.1	Definitions, Difference between Estimating and Costing, Organization of estimating department, Aims of costing, errors & Standard cost, Procedure of costing.	
4.2	Elements of Estimating and Costing in details, numerical problem to find out total cost, selling price. Depreciation- Classification, methods of calculating depreciation.	
5.0	Mensuration:	8
5.1	Calculation of surface areas and figures by Simpson's rule, Trapezoidal rule, Planimeter and Guldinus rule.	
5.2	Volumes and surface areas	
6.0	Estimating of Machining Time Calculation:	8
6.1	Estimation of material and machining time for Turning (Simple turning, Knurling, Facing Chamfering, drilling, boring, Reaming Threading & Tapering) Milling, Shaping,	
6.2	Cost determination:	
7.0	Estimating and costing of sheet metal:	10
7.1	Estimating and costing of sheet metal work, edge stiffening processes, blanking.	
8.0	Estimating and Costing of fabrication:	5
8.1	Fabrication including welded parts- techniques, welding time (By gas welding and arc welding) of chassis frame, bus passenger seat, fuel tank, truck body, cost estimation.	
9.0	CLASS TEST	3

NOTE: Written examination question paper is of 4 hours duration

Reference Books:-

1. S.C Banger :Mechanical estimating and costing
2. R.S. Khurmi&J.K.Gupta: Machine Design, S.Chand& Company Ltd.
3. R.B. Gupta: Machine Drawing
4. TTTI, Madras publication :Mechanical Estimating and Costing



TABLE OF SPECIFICATIONS FOR THEORY

No	Sr. Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Basic Design Approach	10		2	10	3		15
2	Layout of Automobile Engine parts	8			7	3		10
3	Bill of Materials	2		-	-	2		2
4	Estimating and Costing	8		1	7	2		10
5	Mensuration	8		2	6	2		10
6	Estimating of Machining Time Calculation	7		2	5	1		8
7	Estimating and Costing of fabrication	7		2	5	1		8
8	Estimating and costing of sheet metal	7		1	5	1		7
9	Class Test	3		-	-	-		-
	Total	$\Sigma b=60$	100	10	45	15		70

K = Knowledge C = Comprehension A = Application HA = Higher Than Application (Analysis,

Synthesis, Evaluation) $C = \frac{b}{\Sigma b} \times 100$

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Basic Design Approach	6		1	7	2							6		
2	Design and Drawing of Automobile Engine parts	2										10			
3	Bill of Materials	1			1	2									
4	Estimating and Costing	2	2		4	2							4		
5	Mensuration	2	1		3								6		
6	Estimating of Machining Time Calculation	3			3	2							4		

7	Estimating and Costing of fabrication	3			3		2						4		
8	Estimating and costing of sheet metal	2			2								3		

K = Knowledge
T = Total

C = Comprehension

A = Application

HA = Higher Than Application



COURSE TITLE : Project& Seminar**COURSE CODE** : AU 611**SEMESTER** : 6th Semester**Contact hours** : 120**Rationale** :. Develop students to deal with engineering problems or projects individually or collectively with theacquired technical knowledge and skill.**Course Objectives:**

- Apply acquired technical knowledge and skill to solve problems involving design, manufacturing, installation, testing and maintenance of machines.
- Prepare models using the acquired technical knowledge and skill.
- Apply systematic methodology in studying engineering problems or systems..
- Analysis results with the help of charts, tables, graphs etc. .
- Prepare project report & power point presentation.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
-	1	6	7

Evaluation Scheme:							Total Marks(Theory + Sessional)	Cred it
Theory				Practical				
ESE	Sessional		Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	50/ 150	3
	TA	HA	ESE+SS					
			Total (TA+HA)	100	50	50/150		

DTAILS OF CONTENTS:

Here it is required for the concerned teacher to take the students in different Auto-workshop. Show the actual working carried out in the field. Visit to the local industries. Design of single cylinder petrol/diesel engine with complete working drawing. Transmission, Ignition systems- Design with drawing. Any project related to Automobile engineering and availability of materials.



Annexure-V
WEIGHTAGES TO BE ASSIGNED TO VARIOUS COMPONENTS OF EVALUATION FOR PROJECT WORK

S.No.	Item	* Maximum Marks	Marks Awarded
1.	<u>Nature of the Project</u> <ul style="list-style-type: none"> • Relevance • Novelty • Degree of Challenge involved 	10	
2.	<u>Quality of Product</u> <ul style="list-style-type: none"> • Dimensions • Shape • Tolerance limits • Cost effectiveness • Usability/Feasibility • Modernity • Meeting BIS standards 	40	
3.	Quality of report <ul style="list-style-type: none"> • Clarity of presentation and organization • Language and style • Quality of diagrams, drawings and graphs • Listing of cross reference/Bibliography • Suggestions for further studies 	30	
4.	Quality of Presentation/Viva Voce <ul style="list-style-type: none"> • Understanding of concepts, design, methodology, results, implications etc. • Communication skills • Ability to draw conclusions and generalization 	20	
5.	Total	100	

*The external evaluation can be carried out for 100 marks and then proportioned as per the total marks allotted in the study scheme



PROFESSIONAL PRACTICE- IV

COURSE CODE : AU 610
SEMESTER : 6th Semester
Contact hours : 15

Rational :

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

Course Outcomes: Student will be able to:

- Acquire information from different sources.
- Prepare notes for given topic.
- Present seminar in a given topic.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
1	-	2	3

Evaluation Scheme:						Total Marks(Theory + Sessional)	Credit	
Theory				Practical				
ESE	Sessional		Pass ESE+SS	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	2
	TA	HA						
				25	25	17/50		

Contents/ Activities:

1. INDUSTRIAL VISITS

8

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. (1 visits) Following are the suggested types of Industries/ Fields –

- Automobile manufacturing / auto component manufacturing units to observe the working of SPM
- Refrigeration and air conditioning manufacturing / servicing units / industries / workshops
- Automobile service stations for four wheelers
- Auto Engine Testing unit to gather details regarding the testing procedures/parameters etc.



- v. Automotive Research Association of India, Pune, Central Institute of Road Transport, Pune, Vehicle Research and Development establishment , Ahmednagar.
- vi. Engine testing, exhaust gas analysis and vehicle testing
- vii. Safety museum at Central Labour Institute, Sion, Mumbai.
- viii. Auto heavy equipment service center.

2. THE GUEST LECTURE/S**8**

From field/industry experts, professionals to be arranged (2 Hrs duration), minimum 2 nos. from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Term work

- a) Electronic fuel injection systems
- b) Exhaust gas analysis.
- c) Vehicle testing.
- d) Transducer application in automobiles.
- e) Environmental pollution & control.
- f) Vehicle aerodynamics & design.
- g) Earth moving machines.
- h) Automobile pollution, norms of pollution control.
- i) Nanotechnology
- j) Programmable logic controllers
- k) TQM
- l) Hybrid motor vehicles
- m) Packaging technology
- n) Appropriate technology
- o) Six sigma systems
- p) Alternative fuel Technology.

3. GROUP DISCUSSION:**4**

The students should discuss in group of six to eight students and write a brief report on the same, as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are (**any one**) –

- i. CNG versus LPG as a fuel
- ii. Fuel saving techniques.
- iii. Petrol versus Diesel as a fuel for cars.
- iv. Trends in automobile market.
- v. Rain water harvesting.
- vi. Trends in refrigeration Technology.
- vii. Disaster management.
- viii. Safety in day to day life.
- ix. Energy Saving in Institute.
- x. Nano technology.
- xi. Current affairs.

4. SEMINAR: (ANY 1 TOPIC)**8**

Seminar topic should be related to the subjects of 6th semester / recent advances on automobile engineering / topics from guest lectures. Students shall submit a report of at least 10 pages and deliver a seminar (Presentation time - 10 minutes for a group of 2 students)

5. STUDENT ACTIVITIES:**5**

Students in a group of 3 to 4 shall perform **any one** of the following activities (Other similar activities may be considered) and write a report as a part of term work.

ACTIVITIES:-

1. Collection of data regarding loan facilities or other facilities available through different organizations / banks to budding entrepreneurs
2. Survey and interviews of successful entrepreneurs in nearby areas.
3. Survey of opportunities available in thrust areas identified by Government or DIC.
4. Measuring Screw thread parameters on floating carriage dial micrometre and select the optimum diameter of wire.
5. Survey of farm implements used by farmers.
6. Survey of properties of fuels.

Text Books:

1. Mark Ratner and Daniel Ratner: *Nanotechnology* -Pearson Educatuion, New Delhi
2. YoramKorem:*Computer Control of Manufacturing System*- Mcgraw Hill Publication
3. Sunil Chopra, Peter Meindl:*Supply Chain Management* - Pearson Educatuion, New Delhi.



Course Title :METROLOGY

Subject Title	:	Metrology		
Subject Code	:	ME-604		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test	:	03		
Total Class	:	48		
Total Marks	:	100		
Theory	:	70		
Sessional	:	30		
Class hours		L	T	P
		3	0	0

Pre requisite: Engineering Mechanics , Manufacturing Technology, Strength of Materials, Engineering Materials

Outcome based Course Objectives

On the completion of the course the students should be able to:

1. Illustrate the principle of operation and calibration of an instrument.
2. Know different measuring device for a particular application.
3. Explain the concepts of limits, fits and tolerance
4. Explain various device and tools for angular measurements
5. Know the various comparators with their working principles and applications
6. Explain the different devices used to measure screw threads, gears
7. Explain the different devices used to measure textures and surface finish
8. Explain the different techniques and devices used to measure a groove, bores, ring and plug gauges

COURSE CONTENTS

1.0 Metrology concepts and standards



- 1.1 Definition of Metrology
- 1.2 Significance of measurement,
- 1.3 Standards of measurements-line standard, wavelength standard
- 1.4 Factors in selecting the measuring instruments
- 1.5 Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration and magnification
- 1.6 Errors in Measurements: Classification of errors, Systematic and Random error.
- 1.7 Handling and care of Measuring instruments
- 1.8 Objects of Metrology - ISO and ISI specifications

2.0 Basic Precise and Non Precise Measuring instruments

- 2.1 Introduction
- 2.2 Thread measurements: Thread gauge micrometer
- 2.3 Angle measurements: Bevel protractor, Slip gauges, Sine Bar
- 2.4 Use, Sizes, Care of slip gauges and Sine Bar
- 2.5 Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge
- 2.6 Vernier caliper, Vernier height gauge, Vernier depth gauge
- 2.7 Outside Micrometer, Inside Micrometer
- 2.8 solving small problems using slip gauges, sine bar

3.0 Limits, Fits, Tolerances and Gauges

- 3.1 Limit: Maximum limit, Minimum limit, Basic size, Nominal size
- 3.2 Fit: Types of fits -Hole basis and Shaft basis system
- 3.3 Tolerance: Basic terminology, unilateral and bilateral tolerance
- 3.4 Interchangeability and selective assembly
- 3.5 Symbols
- 3.6 Solving problems on limit, fit and tolerance

4.0 Angular Measurements

- 4.1 Concept of Angular measurements
- 4.2 Construction and working of Bevel protector, Sine Bar, Angle Gauges,
- 4.3 Clinometer-different types of Clinometer

- 4.3 Autocollimator- principle and application
- 4.4 Use of Straight Edges and Rollers
- 4.4 Solving problems on angular measurement using sine bar

5.0 Comparators

- 5.1 Principle and operation of various comparators
- 5.2 Types-Mechanical, Electrical, Optical, Pneumatic comparators
- 5.3 Relative advantages and disadvantages of various comparators
- 5.4 Characteristics of a good comparator

6.0 Screw Thread Measurement

- 6.1 Terminology of screw thread
- 6.2 Measurement of external and core diameter
 - 6.3 Testing of leads, thread angle and thread profile
 - 6.4 Use of screw thread micrometer, tool makers microscope, optical profile projector

7.0 Gear Measurement

- 7.1 Terminology of gears
- 7.2 Measurement of chordal thickness, addendum using gear tooth vernier
- 7.3 Parkinson's gear tester

8.0 Surface Finish Measurement

- 8.1 Terminology
- 8.2 Primary and secondary texture, CLA, RMS and RA value
- 8.3 Use of Straight edges and surface plates (Wedge method and Level method)
- 8.4 Principle and operation of Stylus probe instruments

9.0 Machine tool metrology

- 9.1 Testing instruments for machine tools alignment testing

- 9.2 Checking Parallelism, Straightness, flatness, squareness ,alignment testing of machine tool as per IS standard procedure.
- 9.3 Test for level of installation

10.0 MISCELLANEOUS MEASUREMENTS

- 10.1 Checking size of a groove
- 10.2 Gauging Large bores with point gauge and by four ball method
- 10.3 Gauging Small bores by two and three spheres method
- 10.4 Measuring taper ring & plug gauge

Table Of Specification for Metrology																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
			K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
	45																
1	4	Metrology Concept & Standards	1	1		2		1	1		2		2	2		4	8
2	5	Basic Precise and Non Precise Measuring Instruments		1	1	2		1	1		2		3	2	2	7	11
3	5	Limits Fits and Tolerances and Gauges		1	1	2		1		1	2		2	3	2	7	11
4	4	Angular Measurements		1	1	2		1	1		2		3	2		5	9
5	5	Comparators	1		1	2		1		1	2		2	3	2	7	11
6	4	Screw Thread Measurements		1	1	2		1			2		2	2	1	5	9
7	5	Gear Measurement		1	1	2		1			2		2		3	7	11
8	5	Surface Finish Measurement	1	1		2		1	1	1	3		2	2	2	6	11
9	4	Machine Tool Metrology	1	1		2			1	1	2		2	2		4	8
10	4	Miscellaneous Measurement		1	1	2		1	1		2		2	2		4	8



Annexure -I Metrology								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Metrology Concept & Standards	4	8.89	1	4	3		8
2	Basic Precise and Non Precise Measuring Instruments	5	11.11	0	5	4	2	11
3	Limits Fits and Tolerances and Gauges	5	11.11	0	4	4	3	11
4	Angular Measurements	4	8.89	0	5	4		9
5	Comparators	5	11.11	1	3	4	3	11
6	Screw Thread Measurements	4	8.89		4	4	1	9
7	Gear Measurement	5	11.11		4	1	3	8
8	Surface Finish Measurement	5	11.11	1	4	3	3	11
9	Machine Tool Metrology	4	8.89	1	3	3	1	8
10	Miscellaneous Measurement	4	8.89		4	4		8

REFERENCES

1. **“Metrology& Measurement”** by Anand K Bewoor, Vinaykulakarni ,Tata McGraw hill New delhi 2009
2. **“Principles of Engineering metrology”** by RegaRajendraJaico publishers-2008
3. **“Engineering Metrology”** by R.K.Jain, Khanna Publishers, 1994.
4. **“Mechanical Measurements and Instrumentation “** by R K Rajput, pub-S K Kataria& sons

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COURSE TITLE: Automobile Heavy Equipment

COURSE CODE : Au 605
SEMESTER : 6th Semester
Contact hours : 45

Rationale : This course is to make the students acquainted with and understand the construction and operation of various automobile heavy equipment used in different industries especially in infrastructure development sectors.

Objective of the course: On completion of the course students will be –

1. Understand the construction and operation of heavy equipment viz. tractors, dumpers, graders, compactors, dozers, loaders, excavators, cranes, scrapers, lift trucks, Dredgers, tanker Carriers.
2. Explain the different components of a hydraulic system utilized in a hydraulically operated heavy vehicle.
3. Understand the importance of maintenance and safety measures of heavy equipment.

Study Scheme(Contact hours/ week)			
Lecture	Tutorial	Practical	Total
3	-	-	3

Evaluation Scheme							Total Marks (Theory + Sessional)	Credit	
Theory				Practical					
ESE	Sessional			Pass	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)	33/ 100	3
	TA	HA	Total (TA+HA)	ESE+SS					
70	10	20	30	33/100					

DETAILS OF CONTENTS:

- 1.0** Tractors: 5
- 1.1** Types of tractors (wheel and crawler), purpose of tractors, tractors for earth moving, their constructional features and working operations and uses.
 - 1.2** Clutches, gear box, torque converter, differential, final drive, PTO shaft, draw bar, wheel (constructional features).
 - 1.3** Steering system of both the types of tractor and their differences

1.4	Tractor ground drive components, various power outlet units.	
1.5	Care and maintenance tractors.	
2.0	Hydraulic system:	4
2.1	hydraulic symbol and its importance,hydraulic circuit diagram (basic), introduction on hydraulic pressure measuring gauges, hydraulic transmission, hydraulic oil and its properties.	
2.2	hydraulic component, gear pump, piston pump(axial piston pump),gear motor, piston motor, pump regulator, relief valve, spool(direction control valve and flow control valve), hydraulic actuator - liner & rotary, difference between hydraulic pressure and hydraulic flow, difference between hydraulic pump and hydraulic motor	
3.0	DDump tractors and articulated hauler:	3
3.1	Descriptions, function and uses, on the road and off the road vehicles.	
3.2	Constructional features; body box, tail gate, hoist, trailers, bottom dump, side dump.	
3.3	Care and maintenance of dumpers.	
4.0	Motor Graders:	3
4.1	Descriptions, constructional features, functions and uses.	
4.2	Care and maintenance of graders.	
5.0	Compactors(Rollers):	4
5.1	Concept of soil stabilization, method/steps involved in soil stabilization	
5.2	Types, Descriptions, constructional features, functions and uses of compactors.	
5.3	Care and maintenance of compactors.	
6.0	Dozers:	5
6.1	Types, Descriptions, constructional features, working, functions and uses.	
6.2	Bull-dozers; blade, push arm, hydraulic lift, pitch arm, mechanical tilt, power tilt, constructional valve, transmission (power), steering mechanism.	
6.3	Cable controlled Bull-dozer and hydraulically controlled operating system in bulldozer	
6.4	Care and maintenance.	
7.0	Loaders:	4
7.1	Descriptions, constructional features, functions and uses.	
7.2	Tractor loader, belt loader basic shovel crawler mounted and truck mounted-slide shovel, dipper shovel, revolving shovel.	
7.3	Care and maintenance of loaders.	
8.0	Excavators:	6
8.1	Function and types: Crawlermountedand truckmounted, Hydraulic excavator; construction, working, operations etc.	
8.2	Shovels: Basicshovel operations, construction, and attachments.	
8.3	Dipper shovel, Drag shovel, Dragline, Clamshell: their basic parts, working and operations.	
9.0	Cranes:	5
9.1	Descriptions, functions and uses.	
9.2	Mobile, stationary, overhead and tower cranes, their working, basic parts, and uses	

9.3	Care, maintenance of cranes and safety precautions.	
10.0	Scrapers:	3
10.1	Constructional features, working operation and applications.	
11.0	Lift trucks:	2
11.1	Description, function and uses.	
11.2	Fork lift-both engine and battery operational, their constructional features and uses.	
11.3	Care and maintenance of lift trucks.	
12.0	Dredgers	2
12.1	Construction and operations, types- Dipper dredger, Ladder dredger, Suction dredger	
13.0	Tanker Carrier:	1
13.1	Constructional description, function, uses, repair and maintenance.	
14.0	Class Test	3

Reference Book, Journal, Manuals etc.:

11. S.C. Sharma: Construction Equipment and Management, Khanna publishers.
12. Sourabh Kumar Soni: Construction Management and Equipment, KATSON
13. Dr. V.M. Domkundawar: Automobile Engineering, DhanpatRai & Co.
14. C. P. Nakra: Basic Automobile Engineering, DhanpatRai Publications



TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA	T
1	Tractors	5	10	1	5	2		6
2	Hydraulic system	4	14	1	3	1		8
3	Dump Tractor	3	6	1	3	2		4
4	Graders	3	6	1	3	1		5
5	Rollers	4	8	1	1	2		6
6	Dozers	5	10	1	5	2		8
7	Loaders	4	4	-	4	1		4
8	Excavators	6	10	1	5	2		8
9	Cranes	5	10	1	4	1		8
10	Scrapers	3	8	1	4	-		5
11	Lift Trucks	2	6	-	4	-		3
12	Dredgers	2	4	-	4	-		3
13	Tankers	1	4	1	-	1		2
14	Class Test	3		-	-	-		-
	Total	$\Sigma b=45$	100	10	45	15		70

K = Knowledge C = Comprehension A = Application HA = Higher Than Application (Analysis,

Synthesis, Evaluation) $C = \frac{b}{\Sigma b} \times 100$

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Tractors	2			2	2						5			
2	Hydraulic system	3		1	3	2						5			
3	Dump Tractor	1			1	2					3				
4	Graders	1			1	2						5			
5	Rollers	2		1	3	2						5			
6	Dozers	2			2		2					4			
7	Loaders	1			1	2						4			

8	Excavators	3			3		2					5			
9	Cranes	3			3	2						5			
10	Scrapers	2			2	2						5			
11	Lift Trucks	1			1	2						4			
12	Dredgers	1			1	2						3			
13	Tankers	1			1	2						3			

K = Knowledge
Than Application

C = Comprehension A = Application

HA = Higher

T = Total

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