

DIRECTORATE OF TECHNICAL EDUCATION,
KAHILIPARA, GUWAHATI-19



DIPLOMA PROGRAMME IN
MECHANICAL ENGINEERING
NEW SYLLABUS

M | OCTOBER,2018

DEPARTMENT OF MECHANICAL ENGINEERING
UNDER
DIRECTORATE OF TECHNICAL EDUCATION, ASSAM

Programme Outcome(PO)

After the completion of the three-year diploma programme in Mechanical Engineering Department, the diploma holders will have:

1. The ability to apply knowledge of Applied science and engineering fundamentals to the solution of problems in engineering .
2. An ability to apply discipline - specific knowledge to solve core and / or applied engineering problems.
3. The ability to identify, formulate, and solve mechanical engineering problems through their acquired knowledge.
4. The ability to apply appropriate technologies and tools with an understanding of the limitations.
5. The ability to demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.
6. The capability to understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
7. To apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.
8. To function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.
9. An ability to communicate effectively.
10. The ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of technological changes.



Programme Specific Outcome(PSO)

After the completion of the three-year diploma programme in Mechanical Engineering, the diploma holders will:

1. Have the capability to identify, analyse, formulate, and solve different problems in Mechanical engineering.
 2. Have the ability to apply and interpret the acquired Mechanical Engineering knowledge for advancement in social, economic and environmental fields
 3. Develop professional skills, innovative ideas and ethical values for suitable employment, entrepreneur and for higher studies.
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THIRD SEMESTER

MECHANICAL ENGINEERING BRANCH



COURSE STRUCTURE OF MECHANICAL ENGINEERING (3RD SEMESTER)

S I N o	Code No.	Subject	Study Scheme (Contact hours/wee k)		Evaluation Scheme										
					Theory					Practical					
			L	T	P	E S E	Sessional (SS)		Pass(E SE+SS)	Pra ctic al Test (PT) #	Pra ctic al Ass ess men t(P A) @	Pass (PT+ PA)			Total Marks(Theory +Practi cal)
T A	H A	To tal (T A+ H A)													
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	Me/C h-301	Environmental Education	3			70	10	20	30	33/100				100	3
4	Me-302	Fluid Mechanics & Fluid Machines	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
5	Me-303	Manufacturing Technology-I	3		3	70	10	20	30	33/100	25	25	17/50	150	4
6	El/Et-304	Fundamentals of Electrical & Electronics Engg.(Cv/Me/Au Mn/Ag/FPT/Prt/ Chem/Bio/IPE)	3		3	70	10	20	30	33/100	25	25	17/50	150	4
7	Me-310	Professional Practice -I	1		2						25	25	17/50	50	2
		Weekly Total	19	1	14							Total Marks		850	25
		contact hours	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 organization 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: Examination Scheme :

	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 Neumann 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	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.	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	Introduction to Operating System: Definition, single user and multi-user OS, different function performs by OS, various popular OS like DOS, Windows, UNIX/LINUX. DOS and UNIX commands.	10. Define operating system. 11. Operate different commands of DOS, Windows & UNIX/LINUX.	5
4	Computer Network and the Internet: 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.	12. Define network. 13. Describe different types of network. 14. Define network topology. 15. Describe different network devices. 16. Define internet & describe different internet services. 17. Explain use of different browsers & search engines.	6
5	Introduction to C programming: 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.	18. Write algorithm and flow charts for simple programs 19. Define basic terminology of C language. 20. Write small program using C language. 21. Write diversified solutions using C language. 22. Differentiate between IF..Else and Switch statement.	15
	Internal Assessment		3



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

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 input/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.



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 iii) Meaning and concepts of Utility, Consumption, Value, Price, Goods and National Income, inflation iv) Wants – Definition and characteristics v) 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 v) The Law of Supply, its limitations vi) 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 Organization :	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 Computerized Accounting System:	i) Components of Computerized Accounting Software ii) Need for Computerized Accounting iii) Difference between Manual Accounting and Computerized 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 v) Bank Reconciliation Statement – Basic idea	i) Differentiate different types of Cash Book ii) Record transactions in Cash Book	4
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 Organization	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	Compre-hension	Application	HA
7	(A) Introduction to Book-Keeping	3	7	5	0	0	0
	(B) Introduction to Computerized 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 Accountancy	3	7	5	0	0	0
12	Components of Final Accounts	3	7	2	3	0	0
Total		42 hrs	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 & Supply	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 Organization	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	Intro to B K	2	0	0	2	3	0	0	0	3	0	0	0	0	0	5
	Introduc to Comput	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	Compons 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	Dhanpat Rai Publication Pvt. Ltd.
2	Introductory Macro Economics	Sandeep Garg	Dhanpat Rai Publication Pvt. Ltd.
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
6			
7			
8			

b. List of Journals

c. Manuals

d. 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, Greenhouse 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.

REFERENCES

- 1. Environmental Education by Alan Reid



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

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

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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
		3	1
			P
			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 behave during static pressure,
- 3) how the fluid particles behave 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 Venturimeter 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 on

9.11 Books and References:

1. Fluid Mechanics by R K Jain
2. Fluid Mechanics by Bansal
3. Hydraulics by R H Khurmi

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	3
2	3	Physical Properties of Fluids	1	1	0	2	0	2	2	0	4	0	0	0	0	0	6
3	6	Fluid Statics	1	1	0	2	0	1	2	0	3	0	0	4	4	8	13
4	6	Fluid Kinematics	1	0	1	2	0	1	2	1	4	0	0	3	4	7	13
5	6	Fluid Pressure Measurement	2	0	0	2	0	0	1	2	3	0	0	4	4	8	13
6	6	Pipe Flow & Open Channel Flow	0	2	0	2	0	0	2	1	3	0	0	4	4	8	13
7	5	Fluid Machine	0	0	2	2	1	0	2	0	3	0	4	0	4	8	10
8	6	Hydraulic Turbines	1	1	0	2	1	2	0	0	3	0	4	4	0	8	13
9	6	Pumps	1	1	0	2	1	1	1	4	6	0	4	4	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

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX



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– Fundamentals of Electrical & Electronics Engineering

1. Course Code :- El/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	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	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 Wheastone bridge



<i>CO s</i>	<i>ILO s</i>
CO-3 operate motor and generator	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	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	1. Define semiconductor, energy band, intrinsic and extrinsic semiconductor 2. Doping of semiconductor 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.



CO s	ILO s
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 voltage, current, resistance, inductance, capacitance, different voltage sources, Ohm's law, series & parallel combination of resistance .	4

Chapter No	Chapter Title	Content	Duration (in hours)
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 (CE, CB, CC). Application of transistor as an amplifier. Elementary ideas of display - LED, LCD, Seven segment display.	5
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 Weightage (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.



SCTE, ASSAM | OCTOBER, 2018

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 & ELECTRONIC ENGINEERING (PRACTICAL)**

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
- b. Identify the instruments properly
- c. 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

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.

Table Of Specification for Manufacturing Technology I																	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	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



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

.....XXXXXXXXXXXXXXXXXXXXX-----



7:Course Title: Professional Practice-I

PROFESSIONAL PRACTICE I

Subject code-Me -310

Class hours	L	T	P
	1	0	2

Rationale :

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.

CO s

After studying the subject the student will be able to :

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

Activities

1. **INDUSTRIAL VISITS:** **10**
2. Structured industrial visits be arranged and report of the same should be submitted by the individual student to form part of the term work.

Visits to **any two** of the following :

- Nearby Petrol Pump (fuel ,oil , Density, product specifications)
- Automobile Service Station (Observation of Components/aggregates)
- Engineering Workshop (Layout, Machines)
- Dairy Plant / Water Treatment Plant

3. **GUEST LECTURE(S):** **6**

Lectures by Professional/ Industrial Expert / Student Seminars based on information search to be organized from any **THREE** of the following areas :

- Pollution Control



- Non destructive testing(NDT)
- Acoustics
- Illumination / Lighting System.
- Fire Fighting / Safety Precautions and First aids
- Computer Networking and Security.
- Topics related to Social Awareness such as – Traffic Control System, Career opportunities, Communication in Industry , Yoga Meditation , Aids awareness and health awareness etc.

4. : **GROUP DISCUSSION**

6

The students should discuss in a group of six to eight students and write a brief report on the same as a part of term work. Two topics for group discussion maybe selected by the faculty members. Some of the suggested topics are:

- i. Sports events
- ii. Current news items
- iii. Current topics related to mechanical engineering field.
- iv. Innovative news

5. **STUDENT ACTIVITIES:**

8

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

- I. Collect and study IS code for Engineering Drawing.
- II. Collecting information from Market : Nomenclatures and specifications of engineering materials.
- III. Specifications of Lubricants. SAE no
- IV. Draw orthographic projections of a given simple machine element using CAD software.
- V. Collect information on issuing of pollution certificate from the DTO's office

XX



FOURTH SEMESTER

MECHANICAL ENGINEERING BRANCH



COURSE STRUCTURE OF MECHANICAL ENGINEERING (4TH SEMESTER)

Sl No	Code No.	Subject	Study Scheme (Contact hours/week)		Evaluation Scheme										Total Marks(The ory+P ractic al)	Credit
					Theory					Practical						
			L	T	P	E S E	Sessional (SS)		Pass(E SE+SS)	Practi cal Test (PT) #	Pract ical Asses men t(PA) @	Pass (PT+P A)				
							TA	HA					Total (TA +HA)			
1	Me-401	Thermodynamics	3			70	10	20	30	33/100				100	3	
2	Me-402	Engineering Materials	3			70	10	20	30	33/100				100	3	
3	Me-403	Manufacturing Technology-II	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
4	Me-404	Theory of Machines	3		3	70	10	20	30	33/100	25	25	17/50	150	4	
5	Me-405	Strength of Materials	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5	
6	Me-406	Machine Drawing		1	6						100	50	50/150	150	4	
7	Me-410	Professional Practice -II	1		2						25	25	17/50	50	2	
		WeeklyTotal contact hours	16	2	17									850	25	
Grand Total			35			Total Marks										



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

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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 Snratag, 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. **“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

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



2: Subject Title: Engineering Materials

Subject Title	:	Engineering Materials		
Subject Code	:	Me-402		
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: The aim of the subject is to let the students know the properties of engineering materials, the internal structure, brief of heat treatment process of metals , applications.

Outcome Based Objectives:

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

1. Know the mechanical properties of materials
2. Analyze the structure of solids (ferrous metal, non-ferrous metal and alloys)
3. Know the advantage of plastics
4. Appreciate the importance of heat treatment and corrosion



5. Know the testing method of materials both destructive and non-destructive testing
6. Know how the corrosion can be prevented

CONTENTS

UNIT-1. MECHANICAL PROPERTIES OF MATERIALS

Introduction: Definition of mechanical properties such as strength- elasticity, plasticity, ductility, malleability, stiffness, toughness, brittleness, hardness, wear resistance, machinability, cast ability and weld ability-Fatigue, fatigue strength, creep-temperature creep-cyclic loading and repeated loading-endurance limit.

UNIT-2. STRUCTURE OF SOLIDS

Crystal Structure: Introduction to Atomic Structure-Crystal Structure: Unit Cell and Space Lattice-Crystal System: The seven basic crystal systems-Crystal Structure for metallic Elements: BCC, FCC and HCP- Coordination Number for simple Cubic, BCC and FCC –Atomic Packing Factor for simple cubic, BCC, FCC and HCP-Simple problems on finding number of atoms for a unit cell.

UNIT-3. FERROUS METALS AND IT'S ALLOYS

Iron and carbon steels: Introduction-Flow sheet for production of Iron and Steel-Iron Ores-Pig Iron: Classification, Composition and Effects of impurities on Iron-Cast Iron: Classification, Composition, Properties and uses-Wrought Iron: Properties, Uses/Applications of Wrought Iron.

Steel- Classification of Carbon Steels: Low Carbon Steel, Medium Carbon Steel and High Carbon steel- Composition, Properties and Uses-Comparison of Cast Iron, Wrought Iron and Mild Steel and High Carbon Steel or Hard Steel Standard Commercial Sizes of Steel as per BIS.

Ferrous Alloys: Alloy Steels – Purpose of alloying-Effects of alloying elements-Important Alloy Steels: Silicon Steels, High Speed Steel(HSS) , Heat Resisting Steel, Spring Steel, Stainless Steel (SS) : Types of SS , Applications of SS- Magnet Steel - Composition, Properties and Uses.

UNIT-4. NON- FERROUS METALS AND IT'S ALLOYS



Non –ferrous metals & Alloys: Properties and uses of Aluminium, Copper, Tin, Lead, Zinc, Magnesium and Nickel. Copper Alloys : Brasses, Bronzes- Composition, properties and uses. Aluminium Alloys: Duralumin, Hindalium, Magnesium- Composition, properties and uses. Nickel Alloys: Inconel, Monel, Nichrome –Composition, properties and uses. Anti-friction /Bearing Alloys : Various types of bearing Bronzes . Standard commercial sizes as per BIS.

Cutting Tool Materials : Characteristics of ideal Cutting tool materials- Types: Carbon Steels, Medium alloy steel – HSS – Satellites – Cemented Carbide _ CBN – Diamond and Abrasives.

Introduction to Metal Matrix Composites (MMC) and Nanomaterials.

UNIT-5. PLASTIC

Plastic: Properties , composition ,classification and production method, Uses of plastic as an engineering material, production defects and remedies- it's advantages and disadvantages.

UNIT-6. TESTING OF MATERIALS

Testing of materials: Destructive testing : Tensile Testing – Compression Testing– Hardness Testing :Brinell Rockwell, Scleroscope and Mohr's Test – Bend Test – Torsion Test- Fatigue Test _ Creep Test. Non –destructive Testing : Radiography- Magnetic Particle Inspection – Liquid penetrant test – Ultrasonic inspection, (Descriptive treatment only).

UNIT-7. HEAT TREATMENT

Heat treatment processes – purpose – procedures – applications of various heat treatment processes- Iron-carbon equilibrium diagram-full annealing-process annealing stress relief annealing-spheroidising annealing-isothermal annealing-normalizing-hardening-tempering-quenching medium-different types and their relative merits-case hardening-pack carburizing-cyaniding-nitriding-induction hardening and flame hardening.

UNIT-8. CORROSION &SURFACE ENGINEERING

Corrosion : Nature of corrosion: Why corrosion occurs ? Electro-chemical reactions, Electrolytes – Factors affecting corrosion : Environment ,Material properties and Physical conditions- Types of corrosion (eight types) – Determination of corrosion characteristics – Corrosion Control : Material selection , Environment control and Design.



Surface Engineering: Reasons for surface engineering – Surface engineering processes : Coatings and Surface treatments – Cleaning and Mechanical finishing of surfaces – Organic Coatings – Electro – plating and special metallic plating – Electro-polishing and Photo –etching – Conversion coatings: Oxide , Phosphate and Chromate coatings- Thin film coatings, PVD and CVD – Surface analysis – Hard – facing, Thermal spraying and High-energy processes – Process /Material Selection.

REFERENCE BOOKS :

1. **Workshop Technology by Hazara Choudhary VOL- I & VOL- II**
2. **Production Technology by Dr. P.C Sharma ,S.Chand& Co**
3. **Engineering Materials by S.C Rangwala, Charotar**
4. **Engineering Materials by P.D. Kulkarni**
5. **Material Construction by R.S Deshpande,United Book Cor. Pune**

Table Of Specification for Engineering Materials																	
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	7	Mechanical Properties Of Materials	2	2	0	4	0	2	2	0	4	0	2	4	0	6	14
2	8	Structure Of Solids	3	2	0	5	0	3	4	0	7	0	4	3	0	7	19
3	8	Ferrous Metals & its Alloys	2	2	0	4	2	4	2	0	8	0	4	4	0	8	20
4	7	Non Ferrous Metals & its Alloys	2	1	0	3	0	3	0	0	3	0	4	4	0	8	14
5	4	Plastic	2	0	0	2	0	2	0	0	2	0	4	0	0	4	8
6	4	Testing Of Materials	2	0	0	2	0	2	0	0	2	0	2	2	0	4	8
7	3	Heat Treatment	2	0	0	2	0	2	0	0	2	0	0	0	0	4	6
8	4	Corrosion & Surface Engineering	2	0	0	2	0	2	0	0	2	0	2	2	0	4	8



Annexure -I Engineering Materials								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total(97)
1	Mechanical Properties of Materials	7	15.56	2	6	6	0	14
2	Structure of Solids	8	17.78	3	9	7	0	19
3	Ferrous Metals and its Alloys	8	17.78	4	10	6	0	20
4	Non ferrous Metals and its Alloys	7	15.56	2	8	4	0	14
5	Plastic	4	8.89	2	6	0	0	8
6	Testing Of Materials	4	8.89	2	4	2	0	8
7	Heat Treatment	3	6.67	2	2	0	0	6
8	Corrosion And surface Engineering	4	8.89	2	4	2	0	8

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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 , planning, 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
	45		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

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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.

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4: 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
- 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

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
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97
1	1	Introduction	1	1	0	2	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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4: 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

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5: 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 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 an 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 contraflexure

3.0 Theory of simple bending and Deflection of beam

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- 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 $T/J = f_s/R = C\theta/L$
 - 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. Chakraborti S.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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5: 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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6: Course Title : MACHINE DRAWING

Subject Title	:	Machine Drawing		
Subject Code	:	Me-406		
Hours Per Week	:	06		
Hours Per Semester	:	90		
Class Test hrs	:	06		
Total hrs	:	96		
Full marks(Theory)	:	100		
Sessional Marks	:	50		
Class hours	L	T	P	
	0	1	6	

Note-----Final Exam will be of 100 marks and 4 hours duration

- Total marks of the question paper will be 130, out of which total 100 marks to be answered.

Outcome Based Objective

1. Draw the development of surface
2. Draw cutting geometric solids with planes
3. Draw joining elements like keys , cotter joints and pin joints
4. Identify pipe joins, welded joints and shaft coupling
5. Know the procedure of an assembled drawing of the parts of an engine or a machine
6. Know the basics of AutoCAD

Course Content

1. Cutting Geometric Solids with Planes (12hrs)Drawing Sheet-2nos
 - 1.1 True Shape of the section
 - 1.2 Development of surfaces of Geometric solids(parallel line and radial line development)
 - 1.3 Interpretation of solids

2. Keys, Cotter joints and Pin Joints(12 hrs)Drawing Sheet-2nos
 - 2.1 Keys and splines
 - 2.2 Cotter joints
 - 2.3 Knuckle Joints
3. Pipe drawings (6hrs)Drawing Sheet-1 no
 - 3.1 Pipe joints , pipe fittings
 - 3.2 Pipe drawing
4. Welded Joints (6hrs)Drawing Sheet-1 no
 - 4.1 Lap joints, Butt joints, Single And double butt
5. Shaft Coupling (9 hrs)Drawing Sheet-1no
 - 5.1 Fast or rigid coupling, flange and muff coupling
 - 5.2 Non rigid or flexible coupling
6. Shaft bearings and brackets (9 hrs)Drawing Sheet-2nos
 - 6.1 Bushed Bearing, Plummer Block, Footstep Bearing and Wall bracket
7. Pulleys (6hrs)Drawing Sheet-1no
 - 7.1 Fast and Loose Pulley, speed cones or stepped pulley
8. Valves (9 hrs)Drawing Sheet-1 no
 - 8.1 Stop Valve, Feed Check Valve
9. Engine Parts(15hrs)Drawing Sheet-2 nos
 - 9.1 Steam Engine Piston and rings and Piston rod assembly
 - 9.2 Stuffing box, cross head and eccentric
 - 9.3 IC Engine piston with rings and Gudgeon pin and connecting rod
10. Auto Cad (6hrs)
 - 10.1 Fundamentals of Auto Cad
 - 10.2 A comparison of conventional design and Auto Cad design
 - 10.3 Advantage of using Auto Cad in industry.
11. Class Test –(6 hrs)

Reference books

1. Machine Drawing by Bhatt and Bansal
2. A Text Book Of Engineering Drawing by R.B. Gupta
3. Machine Drawing P.S. Gill



4. Machine Drawing by R . K. Dhawan

Table Of Specification for Machine Drawing																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
	90		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	140
1	12	Cutting geometric solids with planes	1	2	0	3	1	2	0	0	3	0	5	9	0	14	20
2	6	keys , cotters joints and pin joints	2	1	0	3	1	1	0	0	2	0	0	5	0	5	10
3	6	Pipe drawings	0	2	0	2	1	2	0	0	3	0	0	5	0	5	10
4	9	Welded joints	2	0	0	2	1	2	0	0	3	0	4	5	0	9	14
5	9	Shaft coupling	0	2	0	2	1	2	0	0	3	0	4	5	0	9	14
6	9	Shaft bearing and brackets	2	0	0	2	1	2	0	0	3	0	4	5	0	9	14
7	9	pulleys	2	0	0	2	1	2	0	0	3	0	4	5	0	9	14
8	9	Valves	2	0	0	2	1	2	0	0	3	0	4	5	0	9	14
9	15	Engine parts	1	2	0	3	1	2	0	0	3	0	5	4	5	14	20
10	6	AutoCAD	2	2	0	4	2	0	2	0	4	0	0	2	0	2	10

Annexure -I Machine Drawing								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total(140)
1	Cutting geometric solids with planes	15	13.33	2	9	9	0	20
2	keys , cotters joints and pin joints	6	6.67	3	2	5	0	10
3	Pipe drawings	6	6.67	1	4	5	0	10
4	Welded joints	9	10.00	3	6	5	0	14
5	Shaft coupling	9	10.00	1	8	5	0	14
6	Shaft bearing and brackets	12	10.00	3	6	5	0	14
7	pulleys	9	10.00	3	6	5	0	14
8	Valves	9	10.00	3	6	5	0	14
9	Engine parts	18	16.67	2	9	4	5	20
10	AutoCAD	6	6.67	4	2	4	0	10

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7: Course Title : PROFESSIONAL PRACTICE II

Subject code-Me -410

Class hours	L	T	P
	1	0	2

Rational :

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

Outcome based Objectives:

The student will be able to :

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

Activities

6. INDUSTRIAL VISITS:

6

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

Two industrial visits maybe arranged in the following areas/industries.

- Manufacturing Organisations for observing various manufacturing processes including heat treatment.
- Material testing laboratories in industries or reputed organizations.
- Auto workshop / Garage
- Plastic material processing unit.



- v. State Transport workshop / City transport workshop
- vi. Ice Plant

7. Lectures by Professional/ Industrial Expert be organized from **ANY THREE** of the following areas:

6

- i. Use of plastics in automobile
- ii. Nonferrous Metals and alloys for engineering applications.
- iii. Surface treatment processes like electroplating , powder coating etc.
- iv. Selection of electric motors.
- v. Computer aided drafting
- vi. Industrial hygiene
- vii. Water treatment plants
- viii. Composite Materials
- ix. Heat treatment processes.
- x. Ceramics.
- xi. Safety Engineering and Waste elimination

8. INDIVIDUAL ASSIGNMENTS

6

Any two from the list suggested

- a) Process sequence of any two machine components.
- b) Write material specifications for any two composite jobs.
- c) Collection of samples of different plastic material or cutting tools with properties , specifications and applications.
- d) Preparing models using development of surfaces.
- e) Assignments on bending moment , shear forces, deflection of beams and torsion chapters of strength of material.
- f) Select different materials with specifications for at least 10 different machine components and list the important material properties desirable.
- g) Select 5 different carbon steels and alloy steels used in mechanical engineering applications and specify heat treatment processes employed for improving the properties. Also give brief description of the heat treatment processes.
- h) List the various properties and applications of the following materials –
 - i) i. Ceramics
 - ii. Fibre reinforcement plastics

- iii. Thermo plastic plastics
- iv. Thermo setting plastics
- v. Rubbers.

OR

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

- i. Rally for energy conservation/ tree plantation.
- ii. Survey for local social problems such as malnutrition ,Fluorides in drinking water , unemployment , cleanliness , illiteracy etc.
- iii. Conduct aptitude , general knowledge test , IQ test.
- iv. Arrange **any one** training in the following areas:
 - a) Yoga b) Use of firefighting equipment and First aid Maintenance of Domestic appliances.

9. MODULAR COURSES (OPTIONAL) : 6

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

Course maybe organized internally or with the help of external organizations.

- a) Forging Technology
- b) CAD-CAM related software
- c) Welding Techniques
- d) Personality development
- e) Entrepreneurship development.

10. 3-D DESIGN USING SOFTWARE 6

Computer screen,coordinate system and planes,definition of HP,VP,reference planes. How to create them in 2nd /3rd environment.Selection of drawing site & scale. Commands of 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,Constraints fit tangency,perpendicularity, dimensioning Line convention ,material conventions and lettering.

The student should draw – different orthographic views (including sections).Auxiliary views according to first / Third angle method of projection. (Minimum two sheets, each containing two problems)after learning the contents as above.

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FIFTH SEMESTER

MECHANICAL ENGINEERING

M | OCTOBER,2018

COURSE STRUCTURE OF MECHANICAL ENGINEERING (5TH SEMESTER)

S l N o	Code No.	Subject	Study Scheme (Contact hours/week)			Evaluation Scheme									
						Theory					Practical			Total Mark s(The ory+P ractic al)	C re di t
			L	T	P	ES E	Sessional (SS)		Total (T A+ H A)	Pass(E SE+SS)	Pra ctic al Test (PT) #	Pra ctic al Ass ess men t(P A) @	Pass (PT+P A)		
							TA	HA							
1	Me-501	Thermal Engineering-I	3	1	3	70	10	20	30	33/100	25	25	17/50	150	4
2	Me-502	Industrial Engineering	3			70	10	20	30	33/100				100	3
3	Me-503	Plant Maintenance Engineering	3			70	10	20	30	33/100				100	3
4	Me-504	Advance Workshop Practice and CNC machine	2		6	35	5	10	15	17/50	50	100	50/150	200	5
5	El/Me/Au/IPE-505	Non-Conventional Energy	3			70	10	20	30	33/100	-	-		100	3
6	Me-510	Professional Practice -III	1		2						25	25	17/50	50	2
	Elective (Any One)														
A	Me - 507	Automobile Engineering	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
B	Me-506	Refrigeration & Air Conditioning	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
C	Me/Mec-501	Mechatronics	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
		WeeklyTotal	18	2	14							Total Marks		850	25
		contact hours	34												

1: Course Title:THERMAL ENGINEERING-I

Subject Title	:	Thermal Engineering-I		
Subject Code	:	Me-501		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test	:	03		
Full marks(Theory)	:	70		
Sessional Marks	:	30		
Class hours		L	T	P
		3	1	3

Pre Requisite: Applied Physics Thermodynamics

Aim of the subject : The aim of the subject is to know about steam generators, Steam Nozzles, Steam turbines, Condensers , cooling towers and nuclear power plant and their related elements, and a brief knowledge about laws of heat transfer.

Outcome Based OBJECTIVES

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

1. Identify the components of a steam generator or boiler
2. Calculate the draught in chimney of a steam generator
3. Solve problems on steam turbines using velocity diagram
4. Explain the working principle of steam condensers and cooling towers
5. Know about the nuclear power plant
6. Know the basics of heat transfer.

COURSE CONTENTS



1.0 Steam generators

- 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

- 2.1 Introduction -Types of steam nozzles
- 2.2 Flow of steam through nozzle
- 2.3 Friction in a nozzle

3.0 Steam turbine

- 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

- 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

- 5.1 Elements of nuclear power plant
- 5.2 Nuclear reactor, fuels, moderators, coolants and control
- 5.3 Classification of nuclear power station

6.0 Heat transfer

- 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 Simple problems on above (conduction only)

REFERENCES

1. "Fundamental of thermodynamics" by Richard E Snatag, 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” by Lewitt.

7. “Heat engines” by Pandya and Shah

8. “A course in Thermodynamics & Heat Engines” Kothandaraman, Khajuria & Arora, Dhanpat Rai & Sons

Table Of Specification for Thermal Engineering -I																	
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	14	Steam Generators	3	3	0	6	3	3	0	0	6	0	6	6	6	18	30
2	5	Steam Nozzles	2	0	0	2	2	0	0	0	2	0	3	3	0	6	10
3	14	Steam Turbines	3	3	0	6	0	3	3	0	6	0	6	6	6	18	30
3	6	Steam condensers and cooling towers	2	1	0	3	2	2	0	0	4	0	3	3	0	6	13
5	4	Nuclear Power Plant	1	2	0	3	1	2	0	0	3	0	0	3	0	3	9
6	2	Heat Transfer	2	0	0	2	0	2	1	0	3	0	0	0	0	8	5

Annexure -I Thermal Engineering -I								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Steam Generators	14	31.11	6	12	6	6	30
2	Steam Nozzles	5	11.11	4	3	3	0	10
3	Steam Turbines	14	31.11	3	12	9	6	30
4	Steam condensers and cooling towers	6	13.33	4	6	3	0	13
5	Nuclear Power Plant	4	8.89	2	4	3	0	9
6	Heat Transfer	2	4.44	2	2	1	0	5

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1: Course Title: Thermal Engineering Laboratory – I

Outcome Based Objectives:

After performing the experiment the students will be able to

1. Identify the components of a fire tube and water tube boiler specially Cochran, Lancashire, Babcock and Wilcox
2. Determine experimentally the flash point of a liquid fuel oil
3. Determine the dryness fraction of steam by Throttling Calorimeter
4. Identify the components of a steam engine

Course Contents:

1. Study of Cochran, Lancashire, Babcock and Wilcox Boiler
 - 1.1. Observe the models of boiler in laboratory and make neat sketches labeling all the parts on it.
 - 1.2. List all the mountings and accessories of boiler and explain their functions and location in boiler.
 - 1.3. Using throttling calorimeter determine the dryness fraction of steam.
2. Fuels and Lubricants.
 - 2.1. Determine the flash point and fire points of fuels and lubricant using apparatus available in laboratory.
3. Analyse the flue gas using Orsat's apparatus.

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2: 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 X and R using statistical tables, construction of 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 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 (Pa)- 'OC' curves of a single sampling plan- Variables involved in double sampling plan- Calculation of Pa. 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
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97
1	14	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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3: Course Title: PLANT MAINTENANCE ENGINEERING

Subject Title	:	Plant Maintenance Engineering		
Subject Code	:	Me-503		
Hours Per Week	:	3		
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

Pre Requisites: None

Course Objectives(CO)

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

1. Interpret the need of the maintenance in industry
2. Know the way of maintenance of guide surface of machine tools
3. Explain the Use of seals , packing and gaskets
4. Acquire the knowledge of Installation procedure of engines and machines
5. Acquire the knowledge of maintenance of power plant
6. Justify the need of the preventive maintenance and repair cycle
7. Know about the electrical maintenance of plant/industry



COURSE CONTENT

Chapter-I- Introduction of maintenance ,

1. Maintenance and Industrialization of Mechanical Equipment
2. Fits and Tolerance , Tools and Equipment, Mechanical and Electrical instrument used in maintenance work.
3. Maintenance and guide surface of machine tools, fitting of keys, bearing coupling, clutches and other transmission devices, their defects and remedies
4. Repair on cracks of machine parts, restoration of parts by welding and building up, repairs of threaded parts
5. Seals packing and gaskets and their uses
6. Installation of Engine and Machines Marking out foundation work , levelling alignment, concreting of foundation bolts and final finishing up of engine and machine on foundation
7. Maintenance of mechanical equipment(fan, exhaust system, blowers and dust collecting equipment etc.)
8. Installation Starting and maintenance of pumps, air compressor, lifting machine, portable electrical and air tools, welding equipment etc.
9. Corrosion and its control using chemicals
10. Maintenance of Pipe lines and pipe fitting and maintenance.

Chapter –II Power Plant

1. Power Plant, Boiler and its mounting cleaning, inspection, test and repairs, maintenance of feed water heater, economizer, air preheater, super heater ,pre heater feed pump, feed pump, mechanical stocker, fuel burners, water treatment plant stone pipes and fittings
2. Periodic inspection of steam engine components, turbine components and their maintenance
3. IC engine top and major overhaul trouble shooting and rectification , ignition fuel, system maintenance

Chapter III –Maintenance and its type

1. Planning of preventive maintenance schedule, overhauling and repair cycle, spare parts planning, test charts, depreciation and machine life record , lubrication

Chapter IV – Electrical maintenance

1. Examination and testing of electrical fittings, motor, switch gear etc.



2. Locating faults and repairs , safety procedures to be adopted.

Reference:

1. Industrial Engineering by H P Garg
2. Industrial Engineering by S K Chakravorty

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	15	Introduction of Maintenance Engineering	3	3	0	6	0	4	4		8	6	6	6	0	18	32
2	15	Power Plant Maintenance	3	2	2	7	0	4	3		7	2	6	6	4	18	32
3	10	Preventive Maintenance	4	2	0	6	0	2	2		4	3	0	5	4	12	22
4	5	Electrical Maintenance	2	2	0	4	0	0	2		2	0	5	0	0	5	11

Annexure -I Plant Maintenance Engineering								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total 97
1	Introduction of Maintenance Engineering	15	33.33	9	13	10	0	32
2	Power Plant Maintenance	15	33.33	5	12	11	4	32
3	Preventive Maintenance	10	22.22	7	4	7	4	22
4	Electrical Maintenance	5	11.11	2	7	2	0	11

XX



4: Course Title: Advance Workshop Practice& CNC Machine(Theory Part)

Subject Title	:	Advance Workshop Practice& CNC Machine(Theory Part)
Subject Code	:	Me-504
Hours Per Week	:	2
Hours Per Semester	:	30
Class Test	:	02
Total hours	:	32
Theory Marks	:	35
Sessional Marks	:	15

Pre Requisites: Computer Applications and Programming, Manufacturing Technology

CO Out come based Objective

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

1. Justify the safety and security measures to be taken in the tool room
2. Identify the components of an CNC machine
3. Prepare a simple program for simple machining operation

Course Content

1. Introduction of the Shop Floor,
Safety and security measures inside the Tool Room

2. FUNDAMENTALS OF CAM 12hrs

1. Introduction
2. NC machine, basic components of NC systems (program of instruction, machine control unit & machine tool)
3. Problems with NC systems
4. NC programming (Simple example)
5. CNC machine tool (general configuration, function, advantages)
6. DNC (configuration, type of DNC, benefit)



6.1 Classification of CNC system(based on feed back system & based on motion control system)

6.2 Salient features of CNC machine components (feed back devices, spindle drives, axes feed drive, automatic tool changer, worktable, chip conveyer)

3.MANUAL PART PROGRAMMING 16 hrs

1.Axis identification and details

2.Co-ordinatesystem(absolute& relative co-ordinate referencing)

3.Zero point :Floating& Fixed (machine zero, job zero, zero shift)

4.Part programming format

Table Of Specification for Advance Workshop Practice & CNC																	
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	49
1	3	Introduction	2			2	1	2			3						5
2	12	Fundamentals of CAM	2	2		4	3	3			6		2	4	4	10	20
3	15	Manuals Part programming	2	2		4		3	2	3	8		4	4	4	12	24

Annexure -I Advance Workshop Practice & CNC								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total 49
1	Introduction	3	10.00	3	2			5
2	Fundamentals of CAM	12	40.00	2	7	7	4	20
3	Manual Part Programming	15	50.00	2	9	6	7	24

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4: Course Title: Advance Workshop Practice& CNC Machine Practical

Subject Title	:	Advance Workshop Practice& CNC Machine		
Subject Code	:	Me-504		
Hours Per Week	:	2(Th)+6 hrs practice		
Hours Per Semester	:	30(Th)+90(Pract)		
Class Test	:	02+06		
Total hours	:	32+96		
Full marks(Theory)	:	35		
Sessional Marks	:	15		
Total Marks	:	50		
Class hours	L	T	P	
	2	0	6	

Total Contact hours—90(Practical Part)

Theory—Contact hours -30

CO Out come based Objective

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

1. Follow the safety and security measures maintained in the tool room
2. Identify the components of an CNC machine
3. Execute a simple machining operation with CNC Machine

Unit-1

1. Introduction
2. Machine Tools: Definition and development
3. A few basic machine tools
4. Requirement of Machine Tools

5. Cutting tool specification, IS

Unit-2

1. Shop Talk and activities
2. Lathe Machine- Function classification and specification
3. Main Lathe parts and working principles
4. Feed mechanism , feed reversing mechanism, feed drive and apron mechanism

Unit-3

1. Lathe Accessories and Attachment
2. Lathe Centers and Carriers etc.
3. Chucks, face plate, angle plates
4. Mandrels, Steady Rest, follower rest

Unit-4

1. Lathe tools
2. Different types of lathe tools used
3. Lathe operations- Turning , Parting, Facing, Taper turning, grooving, boring, threading (External and Internal) and knurling

Unit-5

1. Metal Cutting and Cutting tools
2. Orthogonal cutting and Oblique cutting
3. Chip formation and types of chips
4. Reference planes
5. ORS system and ASA system
6. Merchant circle diagram for cutting forces

Unit-6

1. Use of single point cutting tool and multiple point cutting tools
2. Knowledge of rake, clearance and cutting angles
3. Influence of tool angles and tool setting
4. Importance of positive, negative and zero, rake angle and restricted cutting
5. Mechanism of cutting , cutting speed and feeds



6. Factors determining speeds , feeds and depth of cut
7. Various cutting fluids
8. Method of lubrication
9. Measurement on different type of operation

Unit-7

1. Fundamentals of CAM
2. NC machine and its introduction
3. Basic Components of NC machines
4. Problems with NC machines
5. NC simple programming
6. CNC machine Tool
7. DNC machine
8. Classification of CNC machines

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5: Course Title: NON CONVENTIONAL ENERGY

Subject Title	: No Conventional Energy		
Subject Code	:	El/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**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 Mc Graw Hill



3. Solar Energy Utilization G D Rai Khanna 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	
		Introduction to Non Conventional Energy sources																
1	2		2	0	0	2	0	2	0	0	2	0	0	0	0	0	4	
2	12	Solar Energy	2	3	0	5	0	2	3	0	5	0	4	4	7	15	25	
3	6	Wind Energy	0	2	0	2	2	1	0	0	3	2	0	5	0	7	12	
4	6	Ocean Energy	2	0	0	2	2	1	0	0	3	2	3	2	0	7	12	
5	4	Geo thermal Energy	2	0	0	2	0	2	0	0	2	2	4	0	0	6	10	
6	8	Energy for Bio mass	2	1	0	3	1	2	0	0	3	0	0	4	6	10	16	
		Direct Energy Conversion																
7	5		2	0	0	2	0	2	1	0	3	0	2	3	0	5	10	
		Chemical Energy Storage																
8	4		0	2	0	2	0	1	0	0	1	2	3	0	0	5	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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6: Course Title: PROFESSIONAL PRACTICE III

Subject code-Me -510

Class hours	L	T	P
	1	0	2

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.

Outcome Based Objectives:

The student will be able to :

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

Contents

Activities

11. INDUSTRIAL VISITS:

12

Structured industrial visits be arranged and report of the same should be submitted by the individual student to form part of the term work. The industrial visits maybe arranged in the following areas / industries : Sugar factory / Dairy / Chemical Industry / Thermal Power Plant.

- Machine shop having CNC machines
- ST workshop / Auto service station
- City water supply pumping station
- Manufacturing unit to observe finishing and super finishing processes.

12. LECTURES BY PROFESSIONAL/ INDUSTRIAL EXPERT LECTURES TO BE ORGANIZED FROM ANY THREE OF THE FOLLOWING AREAS :10

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- Interview Techniques
- Modern Boilers – Provisions in IBR
- Applications of Sensors and Transducers
- Alternate fuels- CNG / LPG, Biodiesel, Ethanol, Hydrogen
- Piping Technology

13. INFORMATION SEARCH: 10

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

Following topics are suggested:

- Engine lubricants and additives.
- Automotive gasket and sealants.
- Engine coolants and additives.
- Two and Four wheeler carburettor.
- Power steering.
- Filters.
- Different drives / Transmission systems in two wheelers.
- Types of bearings – applications and suppliers.
- Heat Exchangers.
- Maintenance procedure for solar equipment
- Tools holder on general purpose machines and drilling machines.
- Recent model of automobile sector
- Ice making plant

14. SEMINAR 13

Seminar topic shall be related to the subjects of fourth semester . Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation Time – 10 minutes)

Mini Project / activities (any one)

- Prepare one model out of cardboard paper /acrylic /wood / thermocol /metal such as
 - Elliptical trammel



- ii) Pantograph
 - iii) Coupling
 - iv) Cams and followers
 - v) General mechanism
- b) Dismantling of assembly (eg. jig /fixtures, tool post, valves etc.) Take measurement and prepare drawings/sketches of different parts.
- c) Make a small decorative water fountain unit.
- d) Toy making with simple operating mechanisms.



7: Course Title: AUTOMOBILE ENGINEERING(Elective)

Subject Title	:AUTOMOBILE ENGINEERING		
Subject Code	:	Me-507	
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	1	3

Prerequisite: Physics, Thermodynamics

COURSE OBJECTIVES

On completion of the course the student should be able to

1. Acquire the information about Self-propelled vehicle ,Chassis and Frame
2. Explain the Engine Fuel supply system
3. Explain the function of Engine Lubricating, Cooling , Intake & Exhaust system.
4. Identify the components of Automotive Electrical system.
5. Explain Suspension System, Front axle and Steering System.
6. Identify the components of Power Transmission system
7. Identify the components of Brake system
8. Know about the functions of Wheels and Tyres

COURSE CONTENT

1.0 Introduction

1.1 Introduction to Automobile, Classification of Automobiles.

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- 1.2 Chassis, layout of chassis and its main components ,classification of chassis. Chassis lubrication, Importance of chassis lubrication,Lubricants used for chassis lubrication
- 1.3 Frame, Functions of frame and different parts of a frame,
Types of frame sections , Sub frame, Functions of sub frame **4hrs**
- 2.0 Engine Operations and Constructions**
- 2.1 Heat Engines, Difference between I.C Engines and E.C engines
- 2.2 Engine operations of Four stroke and Two stroke - Spark Ignition Engines and Compression Ignition Engines, Comparison of Four stroke cycle Engines and Two stroke cycle Engines, Comparison between Petrol and Diesel Engines .
- 2.3 Scavenging: meaning and necessity of scavenging. Cross flow, back flow and uniform flow scavenging.
- 2.4 Diesel and Petrol Engines parts and their functions :
Material used , constructional details and function of cylinder block, cylinder Head , cylinder liner(dry and wet type),crank case, crankshaft, camshaft, piston Piston rings, piston pin, connecting rod, Gasket, inlet and exhaust manifolds, etc.
- 2.5 Valve mechanism, classification of engines according to valve arrangement, valve Timing diagrams(Theoretical and Actual) ,valve overlap, tappet clearance**8hrs**
- 3. Engine Fuel system:**
- 3.1 Line diagram of petrol engine fuel system , components of petrol engine fuel system and constructional details of mechanical and electrical fuel pump.
- 3.2 Atomization and vaporization, carburetion, air fuel ratio, Rich mixture , lean mixture, maximum power ratio, economic ratio for average cruising operation.
Carburetor- Working principles of simple carburetor, constructional details of different components of a simple carburetor -Choke, venturi, throttle valve, float chamber, needle valve, etc.
- 3.3 Line diagram of Diesel engine fuel system, components of Diesel engine fuel system and constructional details of fuel injector(Atomizer). Types of fuel injection systems, Types of fuel injection nozzles. Function of governors in Diesel engine. Concepts of CRDI system.
- 3.4 Concepts of Multi Point Fuel Injection system, Types of Multipoint Fuel Injection System.
supercharging, Object of Supercharging, Superchargers-centrifugal, van type, blower type etc. Turbo-supercharger and its uses. **5hrs**



4. Engine Lubricating , Cooling & Intake & Exhaust system :

- 4.1 Function of lubricating system , Parts of lubricating system ,constructional details of lubricating system: Pet roil type, splash type, forced feed lubrication ,dry sump ,wet sump system.
- 4.2 Functions of engine lubricants, physical and chemical properties of lubricants, rating of lubricants, viscosity, viscosity index, SAE numbers , specific gravity flash point, fire point, pour point etc.
crank case ventilation.
- 4.3 Necessity of engine cooling system, disadvantages of overheating and under cooling.
- 4.4 Cooling system: air cooling constructional details, fins
Water cooling system: types, thermo-siphon system, forced circulation system, constructional details of the systems.
Functions of different parts of water cooling system-water pump, radiator, thermostat, fan, water jacket.
- 4.5 Air cleaner, type and functions, intake and exhaust manifolds, silencer. **5hrs**

5. Automotive Electrical system:

- 5.1 Starting system: Introduction to starting system, Functions of Battery & Starting motor.
- 5.2 Charging system : Introduction to charging system ,Functions of Generator(Dynamo) and Alternator (A.C. generator).
- 5.3 Ignition System: Purpose of ignition system , Types of ignition system-Battery ignition and Magneto ignition system, comparison between these two circuit of the system. Voltage necessary for ignition, Ignition in single cylinder and multi cylinder engines, Firing order, Function of distributor, coil condenser, spark plug, battery, Effect of enhancing and retarding of ignition.

4hrs**6. Suspension System , Front axle and Steering System:**

- 6.1 Functions of Suspension System ,Rigid axle front wheel and independent front wheel suspension system, Types of suspension springs used in suspension system., Shock absorbers, principle, construction and working of a telescopic shock absorber, Functions of Shackle, Torsion bar, stabilizer
- 6.1Necessity of Front Axle, types, stub axles and types. Front wheel drive assembly, live axle, dead axle, Functions of Steering System, Different components of Steering System, Different type of steering gear mechanism, steering gear ratio



6.2 Fundamental equation for correct steering Factors effecting Wheel alignment, Steering geometry- camber angle, caster angle, king pin inclination, included angle, toe-in, toe-out Cornering force, slip angle, turning radius, under-steering, over steering, Concepts of Power Steering. Common defects and remedies in steering system. **4hrs**

7 Power Transmission system

7.1 Clutch: Function of clutch, Principles of operation of a clutch, Main parts of a clutch, concepts of different types of clutches- Friction clutch, centrifugal clutch, diaphragm clutch, dog and spline clutch, vacuum clutch, hydraulic clutch, Common defects and remedies in the clutch

7.2 Gear Box: Functions of Gear Box, Types of Gear Box-Sliding Mesh, Synchromesh, constant mesh Gear Box, epi-cyclic gear box.

7.3 Overdrive –Construction, operation and advantage

7.4 Common defects and remedies in the Gear Box

7.5 Propeller Shaft and Joints, Final Drive and Differential & Rear Axle:

Functions of propeller shaft. Universal joint, slip joints, Construction of Propeller shaft

7.6 Function of final drive, Function of Differential, principles of differential, description, differential lock

7.7 Rear axle drives-Hotchkiss drive, Torque tube drive Rear axle types- full floating, three quarter floating, semi floating axle, rear axle housings

7.8 Power transmission system of two wheelers like scooter, motor cycle etc. 9hrs

8 Brake System

8.1 Necessity of brakes, Functions of brake , classification of brakes.

8.2 Drum brake and Disc brake, Parking and Emergency brake. brake shoe, brake lining, brake drum.

8.3 Hydraulic brake system, master cylinder, Tandem master cylinder, wheel cylinder, piping, bleeding

8.4 Common defects and remedies

3hr

9 Wheels and Tyres

9.1 Function of wheels, type of wheels, hubs, rims, assembly.

9.2 Functions of Tyres , types of tyre-tube tyre and tubeless tyre, tyre construction, tyre tread pattern, tyre pressure and wear-under inflation, over inflation and proper inflation.

Causes of tyre wear, tyre size, tyre maintenance



Reference Books:-

1. Automobile Engineering - R.B. Gupta
2. Automotive Mechanics - S Srinivasan
3. Automotive Mechanics - Joseph Heitner
4. The Automobile - Harbans Singh Reyat

Table Of Specification for Automobile Engineering																	
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	4	Introduction	2	1	1	4	0	2	2	0	4	0	0	0	0	0	8
2	7	Engine Operations and Constructions	2	1	1	4	1	0	2	2	5	0	3	3	0	6	15
3	5	Engine Fuel system	2	1	0	3	0	2	2	0	4	0	0	3	0	3	10
4	5	Engine Lubricating , Cooling & Intake & Exhaust system	2	1	0	3	1	2	2	0	5	0	0	2	0	2	10
5	4	Automotive Electrical system	2	0	1	3	0	3	3	0	6	0	0	0	0	0	9
6	4	Suspension System , Front axle and Steering System	2	0	0	2	0	2	2	0	4	0	0	3	0	3	9
7	7	Power Transmission system	1	2	0	3	2	2	2	2	8	0	0	3	2	5	16
8	3	Brake System	2	0	0	2	0	2	3	0	5	0	0	0	0	0	7
9	6	Wheels and Tyres	2	1	0	3	0	2	2	0	4	0	0	3	3	6	13

Annexure -I Automobile Engineering								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total(97)
1	Introduction	4	8.89	2	3	3	0	8
2	Engine Operations and Constructions	7	15.56	3	4	6	2	15
3	Engine Fuel system	5	11.11	2	3	5	0	10
4	Engine Lubricating , Cooling & Intake & Exhaust system	5	11.11	3	3	4	0	10
5	Automotive Electrical system	4	8.89	2	3	4	0	9
6	Suspension System , Front axle and Steering System	4	8.89	2	2	5	0	9
7	Power Transmission system	7	15.56	3	4	5	4	16
8	Brake System	3	6.67	2	2	3	0	7
9	Wheels and Tyres	6	13.33	2	3	5	3	13



7: Course Title: Automobile Engineering Laboratory

Course Objectives:

After performing the experiment the students will be able to

1. Calculate the power developed at different loads and fuel consumption
- 2.Explain the function of cooling system
- 3.Illustrate the function of lubricating pump
- 4.Explain the function of gear box
- 5.Identify the components of differential wheel
6. Explain the function of braking system
- 7.Identify the components of steering mechanism
- 8.Know the function of electrical system

Aim of the Experiment

1. Determination of power of IC engine at different loads and fuel consumption
2. Dismantling of an engine- and reassembling of different parts
3. Study of cooling system
4. Study of Carburetor, Zenith Carburetor, fuel pump
5. Study the function of lubricating pump,
6. Study the function of clutch mechanism
7. Study the function of gear box, its servicing procedure
8. Study the function of differential wheel, dismantling and maintenance
9. Study of braking system, master cylinder, wheel cylinder, brake drum, bleeding
10. Observation of steering mechanism, dismantling and servicing procedure
11. Study the function of Electrical System including charging of battery

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8: Course Title: REFRIGERATION AND AIR CONDITIONING (Elective)

Subject Title	:REFRIGERATION AND AIR CONDITIONING		
Subject Code	:	Me-506	
Hours Per Week	:	04	
Hours Per Semester	:	45	
Class Test hrs	:	03	
Total hours	:	48	
Full marks(Theory)	:	70	
Sessional Marks	:	30	
Class hours	L	T	P
	3	1	3

Prerequisite: Thermodynamics, Applied sciences

CO----Outcome Based Objectives

After studying the course the students will be able to

1. Explain the principle of refrigeration, its different cycles & systems
2. Identify the components of refrigeration system
3. Compare the functions and properties of refrigerant
4. Recognize the psychometric processes
5. Identify the components of air conditioning system
6. Estimate the cooling load
7. Illustrate the application of refrigeration and air conditioning in day to day life



8. Apply different tools and measuring instruments for the maintenance of refrigeration and air conditioning system.

DETAIL COURSE CONTENT

1.0 INTRODUCTION

- 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)

2.0 AIR REFRIGERATION SYSTEM

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

3.0 VAPOUR COMPRESSION REFRIGERATION SYSTEM

- 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

4.0 VAPOUR ABSORPTION SYSTEM

- 4.1 Flow diagram and operation of NH₃- WATER cycle, components- absorber, 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

- 5.1 Definition and function of refrigerant
- 5.2 Desirable properties of refrigerant
- 5.3 Classification of refrigerant
- 5.4 Important requirements, secondary requirements
- 5.5 Selection of refrigerant for required purpose



6.0 REFRIGERATION COMPONENTS, CONTROL AND SAFETY DEVICES

- 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 Brief description 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

- 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
- 7.8 Refrigerated Truck

8.0 INTRODUCTION TO AIR CONDITIONING

- 8.1 Definition of air conditioning , factors affecting human comfort and comfort values

9.0 PSYCHOMETRICS

- 9.1 Definitions of different terminology
- 9.2 Psychometric properties, relations , processes and use of psychometric charts



10.0 Cooling load Estimation

10.1 A brief idea ,factors forming the cooling load in an air conditioning space

10.2 Cooling and heating load estimation

11.0 Air Conditioning System

11.1 Summer Air Conditioning

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

12.1 Residential building , office, Schools, Commercial Establishments

12.2 Industrial Applications

12.3 Automobile , train and air craft air conditioning system

12.4 Computer centre , TV , telephone exchange and hospital air conditioning

Table Of Specification for Refrigeration and Air Conditioning																	
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	
1	1	Introduction	2			2											2
2	4	Air Refrigeration system	2			2		2			2	2		2		5	8
3	6	Vapour Compression Refrigeration System	2	1		3	2	1			3		3	4		7	13
4	3	Vapour Absorption Refrigeration System		1	1	2			1	1	2		3			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		2	2	1			3		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

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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

References:

- 1.A Text Book of Refrigeration and Air Conditioning(For Polytechnics)by R K Rajput-Katsons
2. Refrigeration and Air Conditioning by C P Arora . Tata McGraw Hill Publishing
3. Refrigeration and Air Conditioning by Manohar Prasad , Wiley Eastern Limited



8: Course Title: Refrigeration and Air-conditioning Laboratory

CO- Course Objectives

After performing the course the students will be able to

1. Know the use of different tools used in refrigeration and air conditioning Laboratory
2. Identify the components of vapour compression refrigeration system
3. Identify the components of a window type air conditioning system
4. Explain the operation of a small ice making plant.

Course Content:

1. Use of tools and equipment in Refrigeration laboratory
 - i) Flaring tool
 - ii) Brazing tool
 - iii) Pipe bender
 - iv) Pipe cutter
 - v) Halide torch etc.
2. Study the working of a Simple vapour compression refrigeration system and determine the COP at different evaporating temperature (using expansion valve and capillary tubes)
3. Study of working of a window air conditioner system
4. Study of Psychometric chart
5. Humidity determination and use of dry & wet bulb thermometer
6. Study and operation of a small ice making plant
7. To demonstrate a water cooling system at different temperatures.
8. Study and demonstrate a central air conditioning system
9. Visit to a local Air conditioning / Cold Storage unit



9: Course Title: MECHATRONICS

Subject Title	:	MECHATRONICS		
Subject Code	:	Me/Mc-501		
Hours Per Week	:	3		
Hours Per Semester	:	45		
Class Test	:	03		
Total Marks	:	100		
Theory	:	70		
Sessional	:	30		
Class hours		L	T	P
		3	1	3

Course Objectives:

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

- 1) Know the performance of commonly used sensors and evaluate them
- 2) Explain the requirements for signal conditioning and data acquisition
- 3) Illustrate the importance of digital logic
- 4) Describe the basic structure of a microprocessor and microstructure
- 5) Justify the interface requirements
- 6) Explain the structure of PLC and develop programs using ladder logic
- 7) Explain the importance of communication systems and its interfaces
- 8) Find possible solutions to design problems from mechatronics point of view

Course contents

Chapter-I----Introduction to Mechatronics



- 1.1 Introduction
- 1.2 Systems
- 1.3 Measurement systems
- 1.4 Control systems
- 1.5 Mechatronics approach to problems

Chapter –II ----Sensors and transducers

- 2.1 Sensors and Transducers
- 2.2 Performance terminology
- 2.3 Displacement, position and proximity
- 2.4 Velocity and motion
- 2.5 Force
- 2.6 Fluid power
- 2.7 Liquid flow, Liquid level
- 2.8 Temperature
- 2.9 Light sensors
- 2.10 Selection of sensors
- 2.11 Entering of data by switches

Chapter –III ---- Signal Conditioning

- a. Signal Conditioning
- b. The Operational amplifier
- c. Protection
- d. Filtering
- e. Wheatstone Bridge
- f. Digital Signals
- g. Multiplexers
- h. Data Acquisition
- i. Signal data processing
- j. Pulse modulation

Chapter---IV---Digital Logic

- 4.1 Digital Logic



- a. Number systems
- b. Logic gates
- c. Boolean Algebra
- d. Karnaugh Maps
- e. Application of Logic Gates
- f. Sequential Logic

Chapter—V---- Microprocessors

- 5.0 Control
- 5.1 Microcomputer Structure
- 5.2 Microcontrollers
- 5.3 Applications

Chapter –VI---Input/Output Devices

- 6.1 Interfacing
- 6.2 Input/output ports
- 6.3 Interface requirements
- 6.4 Peripheral Interface Adapters
- 6.5 Serial communication interface
- 6.6 Examples of interfacing

Chapter---VII-----Programmable Logic Controllers(PLC)

- 7.0 Programmable Logic Controller
- 7.1 Basic Structure
- 7.2 Input Output Processing
- 7.3 Programming
- 7.4 Mnemonics
- 7.5 Timers, Internal relays and counters
- 7.6 Shift Registers
- 7.7 Master and Jump Controls
- 7.8 Data Handling

7.9 Analogue input/output

7.10 Selection of a PLC

Chapter -----VIII----- Communication systems

8.0 Digital Communication Systems

8.1 Centralized , Hierarchical and Distributed Control

8.3 Networks

8.4 Protocols

8.5 Open Systems Interconnections communication Model

8.6 Communication Interfaces

Chapter ----IX-----Design of Mechatronics Systems

9.1 Designing

9.2 Possible Design solution-case studies

Table Of Specification for Mechatronics																	
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	4	Introduction to Mechatronics	2	1		3		2			2		2	3		5	10
2	5	Sensors & Transducers	1	1	1	3		2	2		4			5		5	12
3	5	Signal Conditioning	2	2		4		2	2		4			4		4	12
4	5	Digital Logic	2	2		4		2			2		2	2	2	6	12
5	4	Microprocessors	1	1		2		1	1		2		2	3		5	9
6	5	Input Or Output System	2			2		2			2		3	5		8	12
7	6	Programmable Logic Controllers(PLC)	1	1	1	3		2	1		3			4	4	8	14
8	5	Communication System	1	1	1	3			1	1	2		2	2	3	7	12
9	6	Design Of Mechatronics Systems		1	1	2		1	1	1	3			4	5	9	14



Annexure -I Mechatronics								
SI No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction to Mechatronics	4	8.89	2	5	3		10
2	Sensors & Transducers	5	11.11	1	3	8		12
3	Signal Conditioning & DAQ system	5	11.11	2	4	6		12
4	Digital Logic	5	11.11	2	6	2	2	12
5	Microprocessors	4	8.89	1	4	4		9
6	Input Or Output System	5	11.11	2	5	5		12
7	Programmable Logic Controllers	6	13.33	1	3	6	4	14
8	Communication System	5	11.11	1	3	4	4	12
9	Design Of Mechatronics Systems	6	13.33		2	6	6	14

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9: Course Title: MECHATRONICS (Laboratory)

Subject Title	:	MECHATRONICS LAB
Subject Code	:	Mc-507
Hours Per Week	:	3
Hours Per Semester	:	45
Total Marks	:	50
Practical	:	25
Sessional	:	25

Course Objectives:

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

- 1) Design and Simulate Digital circuits using Multisim or digital circuit simulator
- 2) Construct a timing circuit
- 3) Design and Simulate Ladder diagram to execute small operation

Section—I

Design and Simulatethe following digital circuits using Multisim or any digital circuit simulator

1. Basic Logic Gates
2. DE Morgan's theorem
3. Combination Logic
4. Encoders and Decoders
5. Digital Oscillator
6. Flip Flops



Section -----II

1. Draw the ladder rungs to represent
 - i) Two switches normally open and both have to be closed for the motor to operate
 - ii) Either of the normally open switches to be closed for the coils to be energized
2. Device a timing circuit, that will switch on for 20s and then switch it off.
3. Device a timing circuit that will switch on for 10s and off 20s and so on...
4. Device a circuit that can be used to start a motor and then to start a pump after delay of 50s. Then the motor is switched off 10s before the pump is switched off when the pump remains on for 50s.
5. Device a circuit that can be used with the domestic washing machine to switch on a pump to pump water for 100s into the machine. Then switch on a heater for 50s to heat the water. The heater is switched off and another pump is switched on to empty the water for 100s.

Section – III

Design and simulate the following systems using automation studio/any equivalent simulator software.

1. Design and simulate a ladder diagram for the forward and reverse movement of the piston in a pneumatic cylinder. The output 01 and 02 of the PLC are to be connected to the forward and retract coil of the cylinder.
2. Design and simulate a ladder diagram to operate a garage door.
3. Design and simulate a ladder diagram for car parking (hint-car is to be detected and entered into the parking space to a particular location if space is available, if there is no space a lamp should indicate that parking is full).
4. Design and simulate a ladder diagram to detect a bottle without cap on a conveyer in a bottling plant and indicate the same through an indicator.

System Requirements

1. Computers with latest configuration CPU-3.0 GHz / RAM-2 GB / hdd-250 GB / Dedicated graphics card 1 GB
2. UPS minimum 7.5 kVA



3. Printer – Laser 2 Nos.
4. LCD projector 2 Nos.

Software Requirements

1. MultiSim/similar software – Latest version with 20 user licenses
2. Automation Studio – Latest educational version with 20 user licenses
3. PLC Trainer kit 5 Nos. (Siemens/Allen Bradley/Keyence/Fanuc)

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SIXTH SEMESTER

MECHANICAL ENGINEERING BRANCH



COURSE STRUCTURE OF MECHANICAL ENGINEERING (6TH SEMESTER)

COURSE STRUCTURE OF 6th SEMESTER (MECHANICAL)															
Sl No	Code No.	Subject	Study Scheme (Contact)			Evaluation Scheme									Credit
			L	T	P	ESE	Theory			Pass(ES E+SS)	Practical			Total Marks(Theory+Practical)	
							TA	HA	Total (TA+HA)		Practical Test (PT) #	Practical Assessment(PA)@	Pass (PT+PA)		
1	Hu-601	Industrial Management & En	3			70	10	20	30	33/100				100	3
2	Me-602	Thermal Engineering-II	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
3	Me-603	Drawing,Estimating & Costin	3		3	100	20	30	50	50/150				150	4
4	Me-604	Metrology	3			70	10	20	30	33/100				100	3
5	Me-611	Project & Seminar		1	6						100	50	50/150	150	3
6	Me-612	General Viva		2							50		17/50	50	2
7	Me-610	Professional Practice IV	1		2						25	25	17/50	50	2
	Optional (Any One)														
A	Me-605	CAD, CAM & Robotics	3	-	-	70	10	20	30	33/100	-	-	-	100	3
B	Me-606	Advance Machining Method	3	-	-	70	10	20	30	33/100	-	-	-	100	3
B	Me-607	Power Plant Engineering	3	-	-	70	10	20	30	33/100	-	-	-	100	3
			16	4	14										
Grand Total		WeeklyTotal contact hours	34									Total Marks		850	25



1: Course Title : Industrial Management and Entrepreneurship (All Branches)

Course Code: **Hu – 601**

Semester : **VI**

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

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.

Teaching Scheme (in hours)

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

Examination Scheme:

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

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 –	i) State selection procedure of employees ii) Distinguish Time rate and Piece rate system of wage payments iii) Explain causes and	5

		definition, its causes, impact and remedy	impact of labour turnover	
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 iii) Inventory Management, Basic idea	i) State the objectives and functions of Production management	3
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	i) State the qualities and functions of an entrepreneur	3

		entrepreneur iv) Entrepreneurial motivation		
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	i) identify the supporting agencies to entrepreneurs ii) Explain the role of financial	5



		various National & State level organizations – DICC, NSIC, IIE, MSME - DI, Industrial Estates	support organisations	
		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	Compre- hension	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
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	Total
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 C = Comprehension A = Application

HA = Higher Than Application T = Total

Higher than Application (Analysis, Synthesis, Evaluation)

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

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2: Course Title : THERMAL ENGINEERING-II

Subject Title	:	Thermal Engineering-II		
Subject Code	:	Me-602		
Hours Per Week	:	03		
Hours Per Semester	:	45		
Class Test	:	03		
Total	:	48		
Total Marks	:	100		
Theory	:	70		
Sessional	:	30		
Class hours	L	T	P	
	3	1	3	

Prerequisite: Applied Science, Thermodynamics, Thermal Engineering –I

Aim :The aim of the subject is to include study in detail the principle of Internal combustion Engines along with their thermodynamic cycle, Single stage air compressor and its operation and Gas turbine cycle

CO -----Outcome Based Course Objectives

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

- 1) Explain the working principle of Internal Combustion Engine
- 2) Explain the thermodynamic cycles working on Otto, Diesel and Dual Cycle
- 3) Solve problems on SI and CI engines
- 4) Explain the functions of a Carburetor
- 5) Solve simple problems on Compressor
- 6) Compare the principle of operation of an open cycle with closed cycle gas turbine
- 7) Explain the principle of refrigeration system



COURSE CONTENTS

1.Internal Combustion Engine

- 1.0 Introduction- Definition of Internal combustion engine, Difference between IC engine and EC engine, Classification of IC engines
- 1.1 Main components of IC engine and operation
- 1.2 Cycle of operation- Otto, Diesel and Dual combustion cycle- Actual p-v diagram, Air standard efficiency and mean effective pressure, simple problem
- 1.3 Four-stroke diesel engine and two-stroke diesel engine –principle, working and valve timing diagram
- 1.4 Four-stroke petrol engine and two-stroke petrol engine –principle, working and valve timing diagram
- 1.5 Carburation of fuel, air fuel mixture, single jet and multiple jet carburetor, knocking in SI engine, Working of S.U electrical and A.C mechanical pump, Fuel filters
- 1.6 MPFI system,
- 1.7 Ignition systems- Battery and magneto ignition system, effect of advancing and retarding of ignition on engine performance, octane number, effect of compression ratio in different fuels i.e., ordinary petrol, high octane petrol, Electronic Ignition system
- 1.8 Fuel injection system- Air injection and airless injection, fuel pump, fuel injector, combustion in CI engine, Cetane number, Delay period and Diesel knock, CRDI system and new updated system
- 1.9 Cooling system of IC engine- Air cooling and water cooling, calculation of heat carried away by cooling water
- 1.10 Exhaust system- Exhaust manifold, Muffler, different types of muffler, heat carried away by exhaust gases
- 1.11 Governing of IC engine- Hit and miss, Quality and Quantity governing
- 1.12 Lubrication of IC engine- purposes of lubrication, properties of lubricant, S.A.E rating of lubrication system and common methods of lubrication
- 1.13 Testing of IC engines- Measurement of Brake power, Indicated power of single cylinder and multi cylinder engine, Mechanical efficiency, Indicated thermal efficiency, Brake thermal efficiency, Airstandard efficiency, Relative efficiency, Volumetric efficiency
- 1.14 Concept of Heat balance sheet for an engine
- 1.15 Simple problems on testing of I.C. engines and heat balance sheet



1.16 Troubles in IC engine and their remedies

2. Air compressors

- 2.1 Air compressor-Introduction, classification and terminology, Function of compressor
- 2.2 Single stage reciprocating air compressor- construction and working (with line diagram)
- 2.3 Expression for work done by single stage reciprocating compressor without clearance volume and with clearance volume by using p-v diagram
- 2.4 Multi stage compression – advantages of multistage compression
- 2.5 Two stage reciprocating compressor with intercooler
- 2.6 Simple problems on calculation of work done and power required.

3.0 Gas turbine and propulsion

- 3.1 Introduction-classification of gas turbines
- 3.2 Analysis of Constant pressure gas turbine- Closed cycle gas turbine-Schematic diagram-explanation
- 3.3 Open cycle gas turbine-schematic diagram-explanation
- 3.4 Comparison of open cycle and closed cycle gas turbines.
- 3.5 Methods of improving thermal efficiency of gas turbine- Intercooling, Reheating and Regeneration
- 3.6 Jet propulsion- Screw propeller, Turbojet and Ramjet-principle and working, Rocket propulsion- its principle & application.

4.0 Refrigeration Cycle

- 4.1 Introduction
- 4.2 Vapour Compression Refrigeration cycle and its components
- 4.3 Vapour Absorption Refrigeration cycle and its components
- 4.4 Applications of refrigeration cycle. Domestic refrigerator, Ice plant



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.“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

8.“A course in Thermodynamics & Heat Engines”Kothandaraman, Khajuria& Arora,

Dhanpat Rai& Sons

Table Of Specification for Thermal Engineering II																	
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	20	Internal Combustion Engine	4	2	2	8	3	3	3	0	9	5	8	8	6	27	44
2	10	Air Compressor	2	2	1	5	1	3	0	0	4	0	3	4	4	11	20
3	10	Gas Turbine & Propulsion	2	1	0	3	2	1	3		5		3	12	0	14	22
4	5	Refrigeration cycle	2	1	0	3	0	2	3	0	5	0	0	3	0	3	11

Annexure -I Thermal Engineering -II								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Internal Combustion Engine	20	44.44	12	13	13	6	44
2	Air Compressor	10	22.22	3	8	5	4	20
3	Gas Turbine & Propulsion	10	22.22	3	4	12	3	22
4	Refrigeration Cycle	5	11.11	2	3	6	0	11

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2: Course Title: Thermal Engineering-II laboratory

CO— Outcome based objectives

After performing the experiment the students will be able to

1. Explain the difference between SI and CI engines
2. Prepare a heat balance sheet of an IC engine
3. Explain the Valve setting diagram of SI and CI engine
4. Illustrate the importance of Calorific value of a fuel
5. Explain the function of a calorimeter
6. Explain the principle of operation of Gas turbine

Course Details

1. Study the internal combustion engine and it's principles.
 - 1.1. Study the classification of I.C Engine.
 - 1.2. Study the difference between S.I and C.I engine.
2. To measure the power, efficiency , fuel consumption and preparation of heat balance sheet of S.I & C.I Engine.
3. Study of Valve Setting Diagram of S.I and C.I engine.
4. Calorific value of fuel.
 - 4.1. Understand the Calorific Value of fuel and it's importance .
 - 4.2. Know about the various types of Calorimeter.
 - 4.3. Perform test to determine the Calorific Value of various types of fuels.
5. Study of Gas Turbine Model
 - 5.1. Study Of Model.
6. Industrial Visit to power plants

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3: Course Title: Drawing, Estimating & Costing

Subject Title	: Drawing, Estimating & Costing
Subject Code	: Me-603
Hours Per Week	: 3(T)+3(Dr)
Hours Per Semester	: 45+45
Class Test	: 1+3
Exam Hours	: 4 hrs
Full Marks	: 100
Sessional Marks	: 50

Pre requisite: Engineering Drawing ,Machine Drawing, Applied Mathematics

Rationale

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

1. Draw Jigs and Fixtures
2. Know the fundamentals of estimating and costing
3. Estimate the cost of production of machine or engine components
4. Calculate the depreciation cost of a machine
5. Estimate the machining time of a final product
6. Estimate the fabricating time of a simple component

Subject Content Details

Chapter I

1. Jigs and Fixtures:

1.1 Drawing of Jigs and Fixtures, such as Drill Jigs, Bushing and Tool Guides,

1.2 Lever Clamps , Locating Devices, Indexing Jigs, Milling Fixtures(Any Two)

2. Assembly Drawing

2.1 Valves , (Stop Valve, Non return Valve)



2.2 Engine parts(Stuffing box, Connecting Rod)

2.3 Machine tools (Tool post, tail stock)

(6 nos of Drawing Sheets to be submitted)

2. Introduction to Estimation and costing

- 2.1 Estimation - Definition, Importance and Aims
- 2.2 Qualities and functions of an Estimator
- 2.3 Source of errors in estimation
- 2.4 Constituents of Estimation
- 2.5 Costing - Definition and Aims
- 2.6 Standard cost and its Advantages
- 2.7 Difference between estimation and costing
- 2.8 Advantages of efficient costing

3.0 Elements of costs

- 3.1 Elements of cost- material, labour, expenses
- 3.2 Material - Direct material, indirect material and examples
- 3.3 Calculation of Material cost
- 3.4 Labour - direct, indirect labour and examples
- 3.5 Calculation of labour cost
- 3.6 Expenses - direct, indirect expenses and examples
- 3.7 Classification of expenses - factory, administrative, selling and distribution expenses and examples
- 3.8 Fixed and variable expenses and examples
- 3.9 Components of cost - prime cost, factory cost, office cost, total cost
- 3.10 Selling price
- 3.11 Block diagram to show the relationship between elements and components of cost
- 3.12 Simple problems on above
- 3.13 Allocation of on-cost - methods and simple problems

4.0 Indirect expenses and depreciation

- 4.1 Indirect expenses - depreciation, obsolescence, inadequacy, idleness, repair and maintenance
- 4.2 Depreciation - causes, methods of calculating depreciation
- 4.3 Simple problems on each method

5.0 Mensuration and Estimation of material cost

- 5.1 Area of regular plane figures
- 5.2 Volume and surface area of solids (formulae only)
- 5.3 Estimation of material costs of step block, spindle lathe center, Rivets, V block and different types of components

6.0 Estimation of Machining Time

- 6.1 Estimation in machine shop - Definition of cutting speed, feed, depth of cut
- 6.2 Estimation of time for various operations like Turning, Knurling, Facing, Drilling, Boring, Reaming, Threading, Tapping, Milling, Grinding, Shaping

7.0 Estimation of Welding & Fabrication Time Sheet metal

- 7.1 Estimate the material required for preparation of container open on one side Cylindrical drum
- 7.2 Estimation in welding shop - estimation of gas welding cost -Simple problems

References:

1. Drawing Estimating and Costing by Banga and Sarmah
2. Drawing Estimating and Costing by KP S Rao

Table Of Specification for Drawing, Estimating and Costing																	
Sl No	Hrs	Topic	Objective Type				Short Answer Type					Essay Answer Type					Total
	90		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	140
1	45	Jigs and Fixtures	3	2	0	5	2	3	0	0	5	0	0	10	20	30	40
2	6	Introduction to Estimating and costing	1	2	0	3	0	1	2	0	3	0	3	4	0	7	13
3	8	Elements of Cost	2	2	0	4	0	2	4	0	6	0	4	4	2	10	20
4	8	Indirect expenses and depreciation	2	2	0	4	0	2	0	2	4	0	4	4	4	12	20
5	8	Mensuration and Estimating of material cost	2	2	1	5	0	3	2	0	3	0	3	3	6	12	20
6	8	Estimation of machining time	2	2	1	5	1	4	0	0	5	0	0	5	5	10	20
7	7	Estimation of welding and fabrication time	1	2	1	4	0	2	3	0	5	0	0	4	4	8	17



Annexure -I Drawing Estimating and Costing								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total 140
1	Jigs and Fixtures	45	50.00	5	5	10	20	40
2	Introduction to Estimating and costing	6	6.67	1	6	6		13
3	Elements of Cost	8	8.89	2	8	8	2	20
4	Indirect expenses and depreciation	8	8.89	2	8	4	6	20
5	Mensuration and Estimating of material cost	8	8.89	2	8	4	6	20
6	Estimation of machining time	8	8.89	3	6	6	5	20
7	Estimation of welding and fabrication time time	7	7.78	1	4	8	4	17

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4: 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
	45		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	97
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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5: Course Title: PROFESSIONAL PRACTICE IV

Subject code-Me -610

Class hours	L	T	P
	1	0	2

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.

Outcome Based Objectives:

The student will be able to :

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

Activities

15. INDUSTRIAL VISITS:

8

Structured industrial visits be arranged and report of the same should be submitted by the individual student to form part of the term work.(2 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 /service units /industries /workshops
- Automobile service stations for four wheelers.
- Co-ordinate measuring machine to observe its construction working specifications and applications.
- Auto Engine Testing unit to gather details regarding the testing procedures /parameters etc.
- Wheel balancing unit for light and/or heavy motor vehicles



- vii. Food processing unit.
- viii. Textile industry machinery manufacturing / servicing units.
- ix. Hydroelectric and Thermal power plants.
- x. Solar power stations
- xi. Engine testing, exhaust gas analysis and vehicle testing
- xii. PWD workshop

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

From field /industry experts, professionals to be arranged (1 Hrs duration) minimum 1 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) Biotechnology
- j) Nanotechnology
- k) Rapid prototyping
- l) Programmable logic controllers
- m) TQM
- n) MPFI
- o) Hybrid motor vehicles
- p) Packaging Technology
- q) Appropriate technology
- r) Six sigma systems
- s) LPG/CNG conversion kit.

17. Group discussion**4**

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

- v. CNG versus LPG as a fuel
- vi. Petrol versus Diesel as a fuel for cars
- vii. Trends in automobile market
- viii. Load shading and remedial measures
- ix. Rain water harvesting
- x. Trends in refrigeration Technology
- xi. Disaster Management
- xii. Safety in day to day life
- xiii. Energy saving in Institute
- xiv. Nano technology

18. SEMINAR 8

Seminar topic shall be related to the subjects of fifth semester/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)

19. MINI PROJECTS (IN GROUP OF 4-5 STUDENTS) 6

- 1. Design/drawing of simple jigs/fixtures.
- 2. Thermocouple based temperature controller.
- 3. Pump on/ off timer
- 4. Models of jigs/ fixtures
- 5. Layout design of SSI units/ factory /workshop of the institute.

6. MODELS OF MATERIAL HANDLING ROUTE SYSTEMS OR MODULAR COURSE ON ANY ONE OF THE SUGGESTED OR ALIKE RELEVANT TOPIC BE UNDERTAKEN BY A GROUP OF STUDENTS (MIN 10):

- a) LPG/CNG conversion of vehicles



- b) Advance features in CAD-CAM
- c) Basics of PLC programming
- d) Die design
- e) Non traditional manufacturing methods
- f) Jigs & fixture design
- g) 3D modelling
- h) Finite element method
- i) Mechatronics
- j) Advanced computer programming
- k) Maintenance of home appliances
- l) Value stream mapping
- m) Piping Technology

20. STUDENT ACTIVITIES:**5**

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

ACTIVITIES :

- VI. Collection of data regarding loan facilities or other facilities available through different organizations/ banks to budding entrepreneurs
- VII. Survey and interviews of successful entrepreneurs in nearby areas.
- VIII. Survey of opportunities available in thrust areas identified by Government or DIC
- IX. Measuring Screw thread parameters on floating carriage dial micrometre and select the optimum diameter of wire.
- X. Survey of data regarding different types of pumps with specifications from manufacturers catalogue , local markets, end users (any other engineering products may be considered for survey)
- XI. Survey of farm implements used by farmers



Text Books:

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

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6: Course Title: CAD , CAM & Robotics (Elective)

Subject Title	:	CAD, CAM& Robotics
Subject Code	:	Me-605
Hours Per Week	:	03
Hours Per Semester	:	45
Class test	:	3 hrs

1) INTRODUCTION :

1. Computers in industrial manufacturing
2. Definition of CAD & CAM, Product cycle
3. Automation & CAD/ CAM

2) FUNDAMENTALS OF CAD

2.1) Introduction

2.2) Conventional design process

2.3) Computer aided design process (Geometric Modelling, Engineering analysis, Design review & Evaluation, Automated Drafting),

2.4) Benefits of CAD in Engineering industry

3) HARDWARE IN CAD

3.1) Function of CAD workstation

3.2) Component of CAD workstation

3.3) Comparative study of various types of graphics terminal considering image generation techniques

3.4) Colour& animation capability

3.5) Use of input devices (keyboard, joystick, light pen, digitizers)

3.6) Use of output devices (plotter, printer)

3.7) Function of CPU (registers)

3.8) Types & purpose of storage devices



4) FUNDAMENTALS OF CAM

- 4.1) Introduction
- 4.2) NC machine, basic components of NC systems (program of instruction, machine control unit & machine tool)
- 4.3) Problems with NC systems
- 4.4) NC programming (Simple example)
- 4.5) CNC machine tool (general configuration, function, advantages)
- 4.6) DNC (configuration, type of DNC, benefit)
- 4.7) Adaptive control system (configuration & benefit)
- 4.8) Classification of CNC system (based on feedback system & based on motion control system)
- 4.9) Salient features of CNC machine components (feedback devices, spindle drives, axes feed drive, automatic tool changer, worktable, chip conveyor)

5) MANUAL PART PROGRAMMING

- 5.1) Axis identification
- 5.2) Co-ordinate system(absolute & relative co-ordinate referencing)
- 5.3) Zero point : Floating & Fixed (machine zero, job zero, zero shift)
- 5.4) Part programming format
- 5.5) Symbols preparatory function (absolute & incremental function, metric system , codes like G01, G02, G00, G71, G90, G03, G04 etc.)
- 5.6) Miscellaneous function (M code)
- 5.7) Tool information (T code, tool offset)
- 5.8) Speed & feed data (S & F data)
- 5.9) Interpolation (linear & circular)
- 5.10) Cutter radius compensation (G40, G41, G42)
- 5.11) Pre-set & programme dwell (G92 & G04)
- 5.12) Parametric sub routine
- 5.13) Simple part programme of turned components through turning centre (T70 Lathe) & any simple milling operation through machining centre (CNC Milling)

6) GROUP TECHNOLOGY

- 6.1 Introduction, Part families



6.2 Parts classification & coding (design & manufacturing attributes, classification & coding system , coding structure)

6.3 Discussion on MICLASS system

6.4 Group technology machine cell

6.5 Benefits of group technology

7) INDUSTRIAL ROBOTICS

7.1 Introduction

7.2 Specification of a industrial robot (physical configuration of a robot,basic robot motion,workvolume,precession of movement,speed of movement, weight carrying capacity, type of drive system)

7.3 End effectors

7.4 Robotic sensors (vision sensors, tactile & proximity sensors, voice sensor)

7.5 General considerations in robotic application

7.6 Application areas for industrial robot (material handling , welding, spray coating, processing operations, assembly & inspection)

Books: 1) CAD/CAM by Mikelle.Groovier& Emory W Zimmer

Published by Prentice Hall of India

2) CAD/CAM by R.Kumar published by Dhanpat Rai & Sons

3) CNC Technology by Samuel Raja & K Ravi Kumar published by Dhanpat Rai Publications

Table Of Specification for CAD CAM & Robotics																	
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	1	1		2		1	1	1	3						5
	4	Fundamentals of CAD		1	1	2			1	1	2		2	3		5	9
3	7	Hardware in CAD	1	2		3		2	1		3		3	3	3	9	15
4	10	Fundamentals of CAM	3	2		5	1	2	2		5	4	3	5		12	22
5	12	Manual Part Programming	1	2	2	5	1	2	2		5		10	5		15	25
6	4	Group Technology	1	1		2		2	2		4		1		2	3	9
7	6	Industrial Robotics		1	1	2			2	2	4		3	3		6	12



Annexure -I CAD CAM Robotics								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction	2	4.44	1	2	1	1	5
2	Fundamentals of CAD	4	8.89		3	5	1	9
3	Hardware in CAD	7	15.56	1	7	4	3	15
4	Fundamentals of CAM	10	22.22	8	7	7		22
5	Manual Part Programming	12	26.67	2	14	9		25
6	Group Technology	4	8.89	1	4	2	2	9
7	Industrial Robotics	6	13.33	1	4	5	2	12

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7: Course Title: .Advanced Machining Methods (Elective)

Subject Title	:	Advanced Machining Methods
Subject Code	:	Me-606
Hours Per Week	:	3
Hours Per Semester	:	45
Total Marks	:	100
Theory	:	70
Sessional	:	30

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

1. Appreciate the need of advanced machining methods
2. Acquire the knowledge of Spark Erosion Machine
3. Know the advantages of Ultra Sonic Drilling
4. Know about the Abrasive Jet Machining
5. Explain the basic technology of Chemical Machining including Electro Chemical machining
6. Know about the working principle of PAM LBM and, EBM

Course Contents

Chapter I Introduction

- 1.1 Need for Non conventional Machining Methods
- 1.2 Characteristics features of Advanced Machining Process
- 1.3 Basic principle of New Machining Methods
- 1.4 Advantages of non traditional machining process
- 1.5 Limitations of non traditional machining process
- 1.6 Classification of new machining methods
- 1.7 Abbreviations used for non conventional machining methods

Chapter –II- Spark Erosion Machining

- 2.0 Basic Principle of Spark Erosion

- 2.1 Tools materials used in Spark Erosion Machining
- 2.2 Dielectric Fluid
- 2.3 Servo System to provide controlled feed rate
- 2.4 Characteristics of EDM Process
- 2.5 Construction details of EDM
- 2.6 Description of process
- 2.7 Application and uses of EDM
- 2.8 Advantages and disadvantages of EDM
- 2.9 Wire cut EDM

Chapter –III- Ultrasonic Drilling (USD)

- 3.0 Basic Principle of the process
- 3.1 Different parameters of USD
- 3.2 Description of process
- 3.3 Hollow tools vs solid tools used in USD method
- 3.4 Applications of USD
- 3.5 Advantages and Limitations of Ultrasonic Machining
- 3.6 Characteristics of USD process

Chapter-IV---Abrasive Jet Machining (AJM)

- a. Process Description
- b. Tool material and Abrasive Particles used in AJM
- c. Mixing ratio, Importance of maintaining an optimum mixing ratio in an abrasive Machining Process
- d. Applications of AJM
- e. Advantages and limitations of AJM

Chapter –V Chemical Machining(Chemical Milling)(CHM)

5.0 Basic Techniques of CHM

Non selective metal removal

Selective Metal removal

5.1 Steps involved in Chemical Milling

5.2 Mechanism of metal removal

5.3 Applications

5.4 Advantages and limitations of CHM



Chapter –VI-- Electro Chemical Machining (ECM)

- 6.0 Principle of ECM
- 6.1 ECM process Details
- 6.2 Chemical reaction in ECM
- 6.3 Applications
- 6.4 Advantages and limitations of ECM
- 6.5 Comparison between EDM and ECM

Chapter VII----Electro Chemical Grinding(ECG)

- a. Description of the ECG process
- b. Electrolyte used in ECG process
- c. Metal Removed rate in ECG process
- d. Important points to be observed during the ECG process for successful results
- e. Advantages over conventional grinding
- f. Types of grinding wheels used in ECG
- g. Applications of ECG
- h. Advantages and Disadvantages of ECM

Chapter VIII-----Plasma Arc Machining(PAM)

- 8.0 Introduction
- 8.1 Description of the process
 - 8.2 Mechanism of metal removal
 - 8.3 Types of PAM
- 8.5 Application of the process
- 8.6 Advantages and limitation of the process.
- 8.7 Characteristics of PAM
 - 8.8 TIGwelding Comparison between Plasma Arc Welding and TIG welding

Chapter (IX) Laser Beam Machining(LBM)

- 9.0 Introduction
- 9.1 Laser Process
- 9.2 Description of the Process



9.3 Application of the process

9.4 Advantages and Disadvantages of the Process

Chapter X____(Electron Beam Machining(EBM)

10.0 Introduction of the process

10.1 Description of the process

10.2 Need for high vacuum in EBM

10.3 Applications of the EBM

10.4 Advantages and Disadvantages of EBM

10.5 Electron Beam Welding

10.6 Application of the EBM in Nuclear and Atomic Energy, Industries Aerospace industries and electronic industries

Table Of Specification for Advanced Machining Methods																	
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	2	2		4											4
2	5	Spark Erosion Machining	2			2		2	1		3	2	4			6	11
3	6	Ultra Sonic Drilling	2	1		3		2			2		4	5		9	14
4	4	Abrasive Jet Machining	1	1		2		1			1		2	2		6	9
5	5	Chemical Machining Methods	1	1		2		2			2	2	4			6	10
6	5	Electro Chemical Machining	2	1		3		2			2	3	3			6	11
7	4	Electro Chemical Grinding	2			2		2			2		2	3		5	9
8	5	Plasma Arc Machining	2	1		3		2			2		2	3		5	10
9	5	Laser Beam Machining	1	1		2		2			2		2	4		6	10
10	4	Electron Beam Machining	1	1		2		1	2		3		4			4	9

Annexure -I Advanced Machining Methods								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction	2	4.44	2	2			4
2	Spark Erosion Machining	5	11.11	2	4	5		11
3	Ultra Sonic Drilling	6	13.33	2	7	5		14
4	Abrasive Jet Machining	4	8.89	5	4			9
5	Chemical Machining Methods	5	11.11	3	7			10
6	Electro Chemical Machining	5	11.11	5	6			11
7	Electro Chemical Grinding	4	8.89	2	4	3		9
8	Plasma Arc Machining	5	11.11	2	5	3		10
9	Laser Beam Machining	5	11.11	1	3	6		10
10	Electron Beam Machining	4	8.89	1	2	6		9

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8: Course Title: POWER PLANT ENGINEERING (Elective)

Subject Title	: Power plant engineering
Subject Code	: Me-606
Hours Per Week	: 03
Hours Per Semester	: 45
Class test	: 03
Total	: 48
Full marks(Theory)	: 70
Sessional	: 30

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

1. Know about power plant engineering and its importance
2. Appreciate and know the economics of power plant
3. Explain the working of thermal power plant
4. Know the various components of hydroelectric power plant and its importance
5. Explain the working principle of diesel power plant
6. Explain the working principle of gas turbine power plant
7. Know the working of nuclear power plant
8. Know the various environmental and safety aspects related to power plant.

COURSE CONTENTS

1.0 Introduction to Power plant

- 1.1 Introduction to power plant
- 1.2 Location of power plant
- 1.3 Choice of Power plant
- 1.4 Classification of power plant
- 1.5 Various factor affecting the operation of power plant
- 1.6 Performance and operating characteristics of power plant



2.0 Thermal power plant

- 2.1 Role of thermal power plant in current power generation scenario
- 2.2 Selection site for thermal power plant
- 2.3 General lay out of a thermal power plant
- 2.4 Advantages and disadvantages of thermal power plant

3.0 Hydro power plant

- 3.1 Introduction to Hydroelectric power plant
- 3.2 Selection of sites for hydroelectric power plant
- 3.3 General layout of Hydroelectric power plant and its working
- 3.4 Advantages and disadvantages of hydroelectric power plant

4.0 Diesel and Gas turbine plant

- 4.1 The layout of diesel power plant.
- 4.2 Components and the working of diesel power plant.
- 4.3 Advantages and disadvantages of diesel power plant.
- 4.4 Gas turbine power plant-Schematic diagram, components and its working

6.0 Nuclear power plant

- 5.1 Introduction
- 5.2 Thermal fission Reactors- PWR, BWR and gas cooled reactors
- 5.3 Advantages and Disadvantages of Nuclear power plant

7.0 Power plant safety

- 7.1 Plant safety concept
- 7.2 Safety policy to be observed in power plants
- 7.3 Safety practices to be observed in boiler operation



Reference:

1. Power Plant Technology by M M EI Wakil , Tata McGraw Hill
2. Power Plant Technology G D Rai, Khanna Publishers
3. Power Plant Engineering by G D Nagpal Khanna publishers
4. Power Plant Engineering By- Dr. P.C.Sarma S.K.Kataria & Sons
5. Power Plant Engineering by P.K.Nag ,

Table Of Specification for Power Plant Engineering																	
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	3	Introduction to Power Plant	2			2	2				2		2			2	6
2	10	Thermal Power Plant	1	1		2		2	2		4	4	8	4		16	22
3	10	Hydroelectric Power Plant	1	1		2		2	2		4	4	8	4		16	22
4	10	Diesel & Gas Turbine Power Plant	1	1		2		2	2		4	4	4	8	1	17	23
5	8	Nuclear Power Plant	1	1		2		2			2	4	4	4		12	16
6	4	Power Plant Safety	1			1		1	1		2	2	4			6	9

Annexure -I Power Plant Engineering								
Sl No	Topic	Time Allotted(hrs)	Percentage Weightage	K	C	A	HA	Total
1	Introduction to Power Plant	3	6.67	4	2			6
2	Thermal Power Plant	10	22.22	5	11	6		22
3	Hydroelectric Power Plant	10	22.22	5	11	6		22
4	Diesel & Gas Turbine Power Plant	10	22.22	5	7	10	1	23
5	Nuclear Power Plant	8	17.78	5	7	4		16
6	Power Plant Safety	4	8.89	3	5	1		9

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