SYLLABI BOOK

BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING

Department of Mechanical Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

TEACHING SCHEME FOR THE COURSE
B. TECH., MECHANICAL ENGINEERING

SEMESTER - I

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
AF111	MATHEMATICS - I	4	0	0	60	40	---	---	100	4.0
CT212	ENGINEERING GRAPHICS	4	0	3	60	40	---	50	150	5.5
AF117	ENGINEERING MECHANICS	3	0	2	60	40	25	25	150	4.0
AF122	BASIC ELETRICAL AND ELECTRONICS ENGINEERING	4	0	2	60	40	25	25	150	5.0
AF136	WORK SHOP-I	0	0	2	---	---	---	50	50	1.0
AM110	ENGG. ECONOMICS & PRINCIPLES OF MANAGEMENT	3	0	0	60	---	40	---	100	3.0
AX123	PROGRAMMING IN C	4	0	2	60	40	25	25	150	5.0
									850	27.5

To check the detailed syllabus click on subject code

SEMESTER - II

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
AF201	MATHEMATICS - II	4	0	0	60	40	---	---	100	4.0
AF212	ELECTRONICS PRINCIPLES	4	0	2	60	40	25	25	150	5.0
AF214	MECHANICS OF SOLIDS	3	0	2	60	40	25	25	150	4.0
AF215	HEAT POWER	4	0	2	60	40	25	25	150	5.0
AF217	WORK SHOP - II	0	0	2	---	---	---	50	50	1.0
AX223	ADVANCED C PROGRAMMING	4	0	2	60	40	25	25	150	5.0
ES210	ENVIRONMENTAL SCIENCE	3	0	0	60	---	40	---	100	3.0
									850	27.0

SEMESTER - III

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
AF301	MATHEMATICS-III	4	0	0	60	40	---	---	100	4.0
MH302	KINEMETICS OF MACHINES	4	0	2	60	40	25	25	150	5.0
MH303	ENGINEERING THERMODYNAMICS	4	0	0	60	40	---	---	100	4.0
MH304	MATERIAL SCIENCE & METALLURGY	4	0	2	60	40	25	25	150	5.0
MH307	ELECTRICAL MACHINES	4	0	2	60	40	25	25	150	5.0
MH308	MACHINE DRAWING & INDUSTRIAL DRAFTING	3	0	3	60	40	25	25	150	4.5
									800	27.5

SEMESTER - IV

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
AF410	FINANCIAL & MANAGERIAL ACCOUNTING	3	0	0	60	40	---	---	100	3.0
MH408	ADVANCE STRENGTH OF MATERIALS	4	0	0	60	40	---	---	100	4.0
MH409	MANUFACTURING TECHNOLOGY-I	4	0	3	60	40	25	25	150	5.5
MH410	FLUID MECHANICS	4	0	2	60	40	25	25	150	5.0
MH411	DYNAMICS OF MACHINE	4	0	2	60	40	25	25	150	5.0
MH412	NUMERICAL TECHNIQUES	3	0	2	60	40	25	25	150	4.0
									800	26.5

SEMESTER - V

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
AF501	PROFESSIONAL COMMUNICATION - I	1	0	2	50	---	50	---	100	2.0
MH508	INTERNAL COMBUSTION ENGINES	4	0	2	60	40	25	25	150	5.0
MH509	MANUFACTURING TECHNOLOGY-II	3	0	3	60	40	25	25	150	4.5
MH510	MACHINE DESIGN-I	4	0	2	60	40	25	25	150	5.0
MH511	POWER PLANT ENGINEERING	4	0	2	60	40	25	25	150	5.0
MH512	MECHANICAL MEASUREMENT & METROLOGY	4	0	2	60	40	25	25	150	5.0
MH513	FLUID MACHINES	4	0	2	60	40	25	25	150	5.0
									1000	31.5

SEMESTER - VI

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
AF601	PROFESSIONAL COMMUNICATION - II	1	0	2	50	---	50	---	100	2.0
MH610	CAD-CAM	4	0	2	60	40	25	25	150	5.0
MH611	CONTROL ENGINEERING	4	0	2	60	40	25	25	150	5.0
MH612	HEAT & MASS TRANSFER	4	0	2	60	40	25	25	150	5.0
MH613	MACHINE DESIGN-II	4	0	2	60	40	25	25	150	5.0
ELECTIVE - I										
MH614	STEAM AND GAS TURBINES	4	0	0	60	40	---	---	100	4.0
MH615	OPTIMIZATION TECHNIQUES									
---	ALTERNATIVE ENERGY SOURCES									
---	ENERGY CONSERVAITON & MANAGEMENT									
ELECTIVE - II										
MH616	AUTOMOBILE SYSTEMS	4	0	2	60	40	25	25	150	5.0
MH617	QUALITY MANAGEMENT & RELIABILITY									
---	DESIGN OF PRESSURE VESSELS & PIPINGS									
---	TRIBOLOGY									
									950	31.0

SEMESTER - VII

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
MH710	MECHANICAL VIBRATIONS	3	0	2	60	40	25	25	150	4.0
MH711	PRODUCTION PLANNING & CONTROL	3	0	0	60	40	---	---	100	3.0
MH712	PRODUCTION TECHNOLOGY	3	0	2	60	40	25	25	150	4.0
MH713	REFRIGERATION & AIR CONDITIONING	3	0	2	60	40	25	25	150	4.0
MH714	PROJECT	0	0	2	---	---	---	100	100	1.0
ELECTIVE - III										
MH715	ADVANCED MANUFACTURING PROCESSES	3	0	2	60	40	25	25	150	4.0
MH716	THERMAL SYSTEM DESIGN									
---	HYDRAULIC & PNEUMATIC SYSTEMS									
ELECTIVE - IV										
---	MACHINE TOOL DESIGN	3	0	2	60	40	25	25	150	4.0
MH717	FINITE ELEMENT METHODS									
---	ROBOTICS AND AUTOMATION									
									800	20.0

SEMESTER - VIII

Code	Subject Title	Teaching Scheme (Hours/week)			Examination Scheme					
		Lect	Tut	Prac	Th.	Sess.	Prac	TW	Total	Credit
AF801	PROJECT/INDUSTRIAL TRAINING	0	0	28	---	---	300	100	400	14.0
AF802	SEMINAR	0	4	0	---	---	50	50	100	4.0
									500	18.0

(AF111) MATHEMATICS – I

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

- Ability to analyse and solve problems in both familiar and unfamiliar situations including those in real-life contexts with better accuracy.
- Able to apply knowledge of key theories, concepts, tools and techniques of Mathematics to solve structured and unstructured Engineering problems.
- Understand and be able to use the language, symbols and notation of mathematics
- Use different forms of mathematical representation (formulae, diagrams, tables, charts, graphs and models)
- Generate and/or analyze information, find relationships and patterns, describe these mathematically as general rules, and justify or prove them.

DETAILED SYLLABUS

1 DIFFERENTIAL CALCULUS

Pedal equation, radius of curvature of plane curves in cartesian, polar and parametric equations, radius of curvature at origin by Newton's method and by method of expansion

2 SUCCESSIVE DIFFERENTATION

Leibnitz's theorem, Maclaurin's theorem, Taylor's theorem, Applications to obtain expansion of functions, Indeterminates forms

3 BETA & GAMMA FUNCTION

Definition, Properties, Relation between Beta & Gamma Function, Use in evaluation of definite integrals, Error and elliptic functions

4 ORDINARY DIFFERNTIAL EQUATIONS

Variables, Separators, Homogeneous & Non-homogeneous Equations, Exact Equations & reducible to these forms, Application to Geometrical & Physical Problem

5 INTEGRALCALCULUS:

Applications for finding area, length of arc, volume and surface area of solids of revolutions

6 REDUCTIONFORMULAFOR

$$\int_0^{\frac{\pi}{2}} \sin^n x dx, \int_0^{\frac{\pi}{2}} \cos^n x dx, \int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx, \int_0^{\frac{\pi}{4}} \tan^n x dx, \int_0^{\frac{\pi}{4}} \cot^n x dx \text{ etc...}$$

LEARNING OUTCOMES

- To answer at least about the convergence or divergence of integral when integral is not easily evaluated using techniques known.
- Able to evaluate the volume and surface area of the solid generated by revolving the solids by Integration.
- Apply the knowledge of differential equation to solve some practical problems such as electrical circuits, Newton's Law of cooling and problem related to orthogonal trajectories.
- Apply the knowledge of differentiation to obtain the series of function.
- Able to evaluate curvature of the given function.

TEXT/ REFERENCE BOOKS

1. Engineering Mathematics-II, Shanti Narayan,S.Chand &Company(PVT.)Ltd.
2. Higher Engineering Mathematics, Dr. B. S. Grewal,Khanna publishers
3. Engineering Mathematics-I, Shanti Narayan,S. Chand & Company(PVT.)Ltd.
4. Applied Mathematics, P. N. & J. N. Wartikar
5. Engineering Mathematics-I, I. B.Prasad

(AF117) ENGINEERING MECHANICS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- To provide comprehensive and theory-based understanding of the natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.

DETAILED SYLLABUS

STATICS

1. **Introduction, engineering and S.I. units, accuracy in engineering calculations, Vectors composition and resolution, concept of Rigid Body**
2. **Concurrent co-planar Force System and their Resultant of a force system using analytical as well as graphical method**
3. **Non-concurrent co-planar Force System, parallel and non-parallel force system**
4. **Equilibrium of force system. Concept of internal force, free body diagram**
5. **Friction: Friction on an inclined plane, ladder friction, wedge friction, screw friction,belt and rope drive**
6. **Centre of gravity of lines, plane figures, volumes, bodies and Pappu's Theorems**
7. **Principle of Virtual Work and its application**
8. **Support Reaction for statically determinate beams, Types of Beams, Types of Supports**
9. **Simple cases of concurrent force system in space, Equation of Static for rigid body assemblies for general force system**

DYNAMICS

10. **Review of Particle Kinematics, Motion of connected bodies, D'Alembert principle**
11. **Impact, Momentum and Principle of Momentum**
12. **Instantaneous centre in plane motion**

13. **work power and Energy**

14. **Mass Moment of Inertia in Rotational Motion**

15. **Vibrations of SDOF system**

LEARNING OUTCOME

After successful completion of the course, the students will be able to;

- Acquire knowledge of methods of analysis, use scalar and vector analytical techniques
- Determine resultants and apply conditions of static equilibrium to plane force systems
- Apply fundamental concepts of kinematics and kinetics of particles and rigid bodies to the analysis of simple and practical problems
- Solve problems in kinematic and dynamic systems
- develop basic understanding of the laws and principles of mechanics

TEXT/ REFERENCE BOOKS

1. Engineering Mechanics, A. K. Tayal
2. Engineering Mechanics Vol-I and II, Beer & Johnson
3. Engineering Mechanics by R.S. Khurmi
4. Engineering Mechanics by S. Ramamrutham
5. Engineering Mechanics byRussell Hibbeler

(AF122) BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To expose the concepts of various types of electrical, electronic and magnetic circuits and their applications to the students.

DETAILED SYLLABUS

1 FUNDAMENTALS OF CURRENT ELECTRICITY AND DC CIRCUITS

Introduction, Computation of Resistance at constant temperature, Temperature dependence of Resistance, Computation of Resistance at different temperatures, Ohm's law statement, Illustration and limitation, Kirchhoff's laws-statement and illustration, Resistance in parallel and current division technique, Method of solving a circuit by Kirchhoff's laws

2 MAGNETIC CIRCUITS

Introduction, Definition of Magnetic quantities, Magnetic circuit, Leakage flux, Fringing effect, Comparison between magnetic and electric circuits

3 ELECTROMAGNETIC INDUCTION

Introduction, Magnetic effect of electric current, Current carrying conductor in magnetic field, Law of electromagnetic induction, Induced emf, Self-Inductance(L), Mutual Inductance(M), and Coupling coefficient between two magnetically coupled circuits(K), inductor in series

4 AC FUNDAMENTALS

Introduction, Waveform terminology, Concept of 3-phase emf generation, Root mean square (RMS) or effective value, Average Value of AC, Phasor representation of alternating quantities, Analysis of AC circuit

5 SINGLE PHASE AC CIRCUITS

Introduction, j operator, Complex algebra, Representation of alternating quantities in rectangular and polar forms, RL series circuit, RC series circuit, RLC series circuit, Admittance and its components, Simple method of solving parallel AC circuits, Resonance

6 ELECTRICAL MACHINES

Working principles of DC machine, Transformer, Three phase Induction Motor

7 DIODE THEORY

Semiconductor theory, Conduction in crystals, Doping source, The unbiased diode, Forward bias, Reverse bias, Linear devices, The diode graph, Load lines, Diode

approximations, DC resistance of a diode

8 DIODE CIRCUITS

The sine wave, The transformer, The half wave rectifier, The full wave rectifier, The bridge rectifier, The capacitor input filter, Diode clipper and clamper circuit

9 SPECIAL PURPOSE DIODES

The Zener diode, The Zener regulator, Optoelectronic devices

LEARNING OUTCOMES

At the completion of the course, students will be able to …

- Analyse the various electric and magnetic circuits.
- Understand 1-phase and 3-phase supply terminology.
- Understand the effect of R, L and C in single phase ac circuit.
- Compare various diode circuits and rectifier circuits.
- Understand significance of resonance in series and parallel RLC circuit.
- Identify the various parts of electrical machines and their working.

TEXT/ REFERENCE BOOKS

1. Basic Electrical, Electronics and Computer Engineering, R. Muthusubramanian, S. Salivahanan, K. A. Muraleedharan, Second Edition,Tata McGraw Hill
2. Electronics Principles, Albert Paul Malvino, Sixth Edition,Tata McGraw Hill
3. Electrical Engineering, B. L. Theraja, 23rd Edition, S. Chand & Company Ltd
4. Electrical Machines, B. L. Theraja,23rd Edition, S. Chand & Company Ltd

(AX115) ELEMENTS OF MECHANICAL ENGINEERING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- Students belonging to all branches of engineering are made to learn certain fundamental topics related to mechanical engineering so that they will have a minimum understanding of mechanical processes and basic equipment like boilers, compressors, I.C. engines, refrigeration and air conditioning etc.

DETAILED SYLLABUS

1 INTRODUCTION

Systems of units, Pure and working substance, properties of substance, energy, thermodynamic system, surroundings and system boundary, Path and point functions, Thermodynamic equilibrium, law of conservation of energy, Specific heat capacity, thermodynamic process and cycle

2 PROPERTIES OF STEAM:

Distinction between gas and vapour, Steam formation, Sensible heat, Latent heat, Total heat and super heat of steam, Condition of steam, Dryness fraction, Properties of steam i.e. Enthalpy, Internal energy, Density and Specific volume, Critical pressure and temperature of steam, External work of evaporation and internal latent heat. Combined separating and throttling calorimeter

3 PROPERTIES OF GASES

Zeroth, first and second laws of thermodynamics, laws of perfect gases (Boyle's law, Charle's law, Regnault's law, Joule's law), Characteristic equation of gas, gas constants, internal energy, specific heat at constant pressure and specific heat at constant volume, relationship between specific heats, thermodynamic processes of perfect gases (constant volume, constant pressure, constant temperature, isentropic and polytropic)

4 FUELS AND COMBUSTION

Introduction, Classification of Solid fuels, Liquid Fuels, Gaseous fuels, LPG, CNG and bio fuels, Calorific values, Combustion of fuels, Minimum air required for combustion of fuels

5 REGRIGERATION AND AIR CONDITIONING

Introduction, Evaporation, Refrigerating effect, Unit of refrigeration and COP, Important refrigerants, Refrigerating systems i.e. Air refrigerating system, Ammonia absorption refrigerating system and Vapour compression refrigerating system, Analysis of vapour compression refrigeration system, i.e. COP, mass flow rate, heat rejected from condenser, power consumption etc. Window and split air conditioners: principles and

working

6 BOILERS

Introduction, Classification, Cochran & Babcock-Wilcox boiler, Evaporation in boiler, Equivalent evaporation, Boiler efficiency, Functioning of boiler mountings and accessories. Boiler draught, Classification and comparison of boiler draught systems

7 I. C. ENGINES

Prime mover and its classification, advantages of I.C. engines over E.C. engines, classification of I.C. engines, thermodynamic air cycles i.e. Carnot cycle, Constant volume OTTO cycle and Diesel cycle, Air standard efficiency, construction and working of 2–stroke and 4–stroke cycle engines, p-v diagrams, I.C. engine performance. Calculations of Indicated power, brake power, efficiencies, specific fuel consumption

8 AIR COMPRESSORS

Introduction, Classification, Working of reciprocating air compressors, air compressor terminology, Work of compression, Reciprocating compressor efficiency, Introduction and classification of rotary air compressors, Comparison between reciprocating and rotary compressor

LEARNING OUTCOMES

- After successful completion of this course, students belonging to all branches of Engineering would be able to understand fundamental aspects related to important mechanical processes and basic equipment like boilers, compressors, I.C. engines etc…

TEXT/ REFERENCE BOOKS

1. Elements of Heat Engines (S.I. Units) Vol. 1, R. C. Patel & C. J. Karamchandani, Acharya Book Depot, Vadodara
2. Elements of Mechanical Engineering, A. V. Mehta, Everest publishing house, Pune
3. Elements of Mechanical Engineering, P. S. Desai & S. B. Soni, Atul Prakashan, Ahmedabad
4. Heat Engine, P. L. Ballaney, Khanna Publishing Company
5. A course in Thermal Engineering, Domkundwar, S and Kothandaraman, C. P., Dhanpat Rai and Sons

(AX123) – PROGRAMMING IN C

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To provide adequate knowledge on the fundamentals of computer hardware and operating systems.
- To understand basic structure of the C-program, declaration and usage of variables.
- To teach C-programming using operators, conditional statements, looping structures and arrayed data types.
- To teach efficient C-programming using user defined functions for problem solving.

DETAILED SYLLABUS

1 INTRODUCTION

Introduction to Computer Hardware & Operating System, Introduction to DOS commands & languages, Introduction to Programming in C.

2 CONSTANTS, VARIABLES AND DATA TYPES

Constants, Variables & Data types in C, Declaration & Initialization of a variable in C, Basic C programs, Defining symbolic constants in C.

3 OPERATORS AND EXPRESSIONS

Operators in C, & The ternary Operator, Arithmetic Expressions & Precedence Rule, Type conversion in C, Mathematical Functions.

4 MANAGING INPUT AND OUTPUT OPERATORS

Reading / Writing of characters, Formatted Input operations, Formatted Output operations.

5 DECISION MAKING AND BRANCHING

Decision making with If & If...else statements, If... else statements (Nested …. Ladder), The switch &*goto* statements.

6 DECISION MAKING AND LOOPING

The while statement, the break statement & the do... while loop, the for loop, Jump within loops - Programs.

7 ARRAYS

Development of simple programs using loops, Introduction to one dimensional array, Array Programs, Two dimensional arrays, Initializing 2D arrays, Multidimensional arrays, Case studies on 2D and Multidimensional arrays.

8 CHARACTER STRINGS

Introduction, Declaring and initializing of string variables, Reading strings from terminal, Writing strings on to screen, Arithmetic operations on characters, Putting strings together, Comparison of two strings, String Handling functions, Table of strings, case studies on strings.

9 USER DEFINED FUNCTIONS

Introduction, Need for user defined functions, A multifunction program, The form of C functions, Return values and their types, Calling a function, Category of functions, functions with No Argument and no return values, Arguments but no return values, Arguments with return values, Handling of non-integer functions, Nesting of functions, Recursion, Functions with arrays, The scope and lifetime of variables in functions, ANSI C functions, Points to remember, Case studies on functions.

LEARNING OUTCOMES

After completion of the course, students will be able to;

- Write and execute C programs.
- Select the most appropriate data type for information processing in C.
- Develop complex C program by appropriate use of C tokens.
- Define functions in C for specific purpose and appropriately utilize them in order to provide a comprehensive program.

TEXT/ REFERENCE BOOKS

1. Programming in ANSI C, E. Balagurusami, 3rd Edition, Tata McGraw Hill
2. Let us C, Yashavant Kanetkar, 12th Edition, BPB Publications
3. Journey to C, Punit Ganshani, 1st Edition, Mahajan Publication House
4. 3. The C Programming Language, Brian W. Kernighan, 2nd Edition, Prentice Hall of India

(AM110) ENGG. ECONOMICS & PRINCIPLES OF MANAGEMENT

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	---	40	---	100	3	0	0	3

OBJECTIVES OF THE COURSE:

- The need to understand the basics concepts of economics & management are important for the allocation of scarce resources of economy and proper utilization to generate the required products and services. Demand analysis and consumer behavior are the factors which teach about the equilibrium price. Knowledge about types of markets, product pricing and factor pricing leads to a better understanding of a particular product or service demanded by the consumers. Production cost and revenue analysis is important for operation of a profitable business. Monetary & fiscal policies are important for the understanding of consumption, government expenditure, investment, exports and imports. It also educates us about the ways in which the government generates revenue and handles its expenditure for a stable economy.

DETAILED SYLLABUS

1 BASIC CONCEPTS AND DEFINITIONS

Marshall, Robbins and Samuelson's Definition of Economics, Positive and Normative Economics, Micro and Macro Economics, Utility, goods and services, Money and wealth, Consumer Surplus and producer's surplus

2 DEMAND ANALYSIS AND CONSUMER BEHAVIOUR

Demand Function, law of demand, elasticity of demand and its types, price, income and cross elasticity. Measures of demand elasticity Factors of production. Advertising elasticity. law of supply, equilibrium between demand & supply Elasticity

3 MARKETS, PRODUCT PRICING AND FACTOR PRICING

Concept of perfect competition, monopoly and monopolistic competition (meaning and characteristics), Control of monopoly, Price discrimination and dumping, Concept of Duopoly and Oligopoly, Kinky demand curve (price leadership model with reference to oligopoly)

4 PRODUCTION, COST AND REVENUE ANALYSIS

Production and production function, short run and long run production function, Cost analysis, various concepts of cost, Total fixed cost, total variable cost, total cost, average fixed cost, average variable cost, average cost and marginal cost, Opportunity cost, Basic concepts of revenue, Relationship between average revenue and marginal revenue, Break even analysis, meaning, explanation

5 MONEY

Meaning, functions, types Monetary policy- meaning, objectives, toolsFiscal policy-meaning, objectives, tools Banking-meaning, types, functions Central Bank-RBI, its

functions Concepts- CRR, bank rate, repo rate, reverse repo rate, SLRFunctions of central and commercial banks Inflation, Deflation, Stagflation, Monetary and cycles, new economic policy, Liberalization, Globalization, privatization, fiscal policy of the government

6 PRINCIPLES OF MANAGEMENT

Meaning of management, Management process: planning, organizing, leading and controlling Managerial role, types of managers, management skills

Theory of management by Taylor, Gilbreth, Gantt, Fayol, Weber, Barnard, Follett, McGregor

Planning: Meaning, goals, feature, steps in planning process, hierarchy of organizational plans, importance and limitations, types of planning, BCG matrix, Porter's Five forces model

Organization: Organizational design and structure, types of organizational structure, integration, downsizing, power and its types, human resource management, HR planning, recruitment, selection, socialization, training and development

Leading: Meaning, qualities of a leader, types of leadership styles, Maslow's hierarchy of needs, Theory X and Theory Y, Herzberg's dual factor theory

Control: Meaning, steps in control process, key result areas, responsibility centers, role of budget personnel, budget department, budget committee, types of budgets, different types of costs, and auditing

LEARNING OUTCOMES

After completion of this course students will be able to understand;

- The definitions of economics, micro & macroeconomics, utility, money, wealth, consumer and producer surplus.
- Demand, function of demand, elasticity, factors of production, supply & demand equilibrium.
- Types of markets, price discrimination, dumping and kinked demand curve.
- Production, short & long run production function, cost analysis, fixed cost, variable cost, revenue, break-even analysis.
- Monetary policy, fiscal policy, banking, instruments of monetary policy, liberalization, globalization, privatization, role of government in policy making and business cycles
- Process of management, planning, organizing, leading, controlling, organization, departments involved in organization, theories related to management, tools used in management.

TEXT/ REFERENCE BOOKS

1. Modern economics, H. L. Ahuja, S. Chand
2. Modern economics theory, K. K. Dewett, S Chand
3. Monetary economics, M. L. Seth, Lakshmi Narain Agarwal
4. Engineering Economics, R.Paneerselvam, PHI publication
5. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo Davida

6. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
7. Introduction to economics, T. R. Williamson, D. C. Health & Company

(AF136) WORKSHOP– I

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
0	0	2	---	---	---	50	50	0	0	1	1

OBJECTIVES OF THE COURSE:

- Students belonging to all branches of engineering are made understand workshop layout, importance of various sections/shops of workshop, General safety rules and work procedure of work shop
- Students belonging to all branches of engineering are made understand importance or workshop practice in engineering and are given exposure to use of basic tools and equipment used for performing basic operations related to carpentry, tin smithy and plumbing

DETAILED SYLLABUS

1 INTRODUCTION TO WORKSHOP

Workshop layout, importance of various sections/shops of workshop, type of jobs done in each shop, General safety rules and work procedure of work shop

2 TIN SMITHY (ONE JOB)

Tin smithy tools like –hammers, stakes, scissors etc. sheet metal operations such as shearing, bending, joining, safety precautions, demonstration of various operations

3 CARPENTRY (ONE PRACTICE JOB AND ONE JOINT JOB)

Carpentry tools like –saw, planner, chisels, hammers, pallet, making gauge, vice, tee square, rule etc., carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining, type of woods and carpentry hardware, safety precaution, demonstration of various operations by using hardware

4 PIPE FITTING (ONE JOB)

Pipe fitting tools, pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling etc. Types of various spanners such as flat, fix, ring box-adjustable etc, Safety precautions, demonstration of various operations.

LEARNING OUTCOMES

- After successful completion of this course, students belonging to all branches of engineering would be able to understand use of basic workshop tools used in carpentry, tin smithy and plumbing

TEXT/ REFERENCE BOOKS

1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik

(AF201)MATHEMATICS – II

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

- Ability to analyse and solve problems in both familiar and unfamiliar situations including those in real-life contexts with better accuracy.
- Able to apply knowledge of key theories, concepts, tools and techniques of Mathematics to solve structured and unstructured Engineering problems.
- Understand and be able to use the language, symbols and notation of mathematics
- Use different forms of mathematical representation (formulae, diagrams, tables, charts, graphs and models)
- Generate and/or analyze information, find relationships and patterns, describe these mathematically as general rules, and justify or prove them.

DETAILED SYLLABUS

1 PARTIAL DIFFERENTIATION & ITS APPLICATIONS

Partial derivatives, Homogenous functions, Euler's theorem, Total Derivatives-Differentiation of implicit functions, Change of variables, errors and approximations, Maxima &Minima of functions of two variables, Lagrange's method of undetermined multipliers

2 MULTIPLE INTEGRALS &THEIRAPPLICATIONS

Double integrals, definition evaluation, change of order of integration, double integral sin polar co-ordinates, area enclosed by plane curves, Triple integrals, change of variables, volume of solids

3 INFINITE SERIES

Introduction, Definitions, Convergence, divergence and Oscillation of a series, P-test, Comparison test, Ratio test,Root test,Higher ratio test, Rabbe's test, Logtest, Alternating Series, Leibnitz's rule

4 COMPLEX NUMBER

Definition, elementary operations, Argan's diagram, De-Moivre's theorem, and its applications To expand$\sin n\theta$,$\cos n\theta$in powers of$\sin\theta$,$\cos\theta$respectively, To expand $sin^n\theta$, $cos^n\theta$ and $sin^m\theta \cdot cos^n\theta$ in a series of Sines or Cosines of multiples of θ,Hyperbolic functions, Formulae of hyperbolic functions, Inverse hyperbolic functions, Logarithm of complex quantities, Separation of real and imaginary parts, C+iS method

5 LAPLACE TRANSFORMS

Introduction, Definition Transforms of elementary functions, properties of Laplace transforms, Inverse transforms, Note on partial fractions, Transforms of derivatives, Transforms of integrals, Multiplication and division by t, convolution theorem

LEARNING OUTCOMES:

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

- Obtain Laplace transform of standard Mathematical functions.
- Evaluate Partial Derivatives and apply the knowledge to solve some practical problems such has constrained optimization problems and other problems involving Partial Differentiation.
- Understand the concept of Multiple Integration and its applications viz. Area and Volume.
- Obtain the behaviour of Infinite series.
- Evaluate Exponential, Trigonometric and Hyperbolic Functions of a complex number

TEXT/ REFERENCE BOOKS

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna publishers
2. Applied Mathematics for Engineers and Physicists, by Pipes & Harvill, Mc-Graw Hill Kogakusha Ltd
3. Applied Mathematics, P. N. & J. N. Wartikar

(AF212)ELECTRONICS PRINCIPLES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To present a perceptive understanding of the fundamentals of a bipolar junction transistor and its application. Further, nurturing the ability to design and analyze the performance of transistor amplifier using different types of biasing techniques. Expose the students to the concepts of various types of digital circuit as well as concept of signal and systems.

DETAILED SYLLABUS

1 BIPOLAR JUNCTION TRANSISTOR

The unbiased transistor, The biased transistor, Forward-reverse bias, The CE connection, Transistor characteristics, The Base and Collector curves

2 TRANSISTOR FUNDAMENTALS

DC load lines, Base bias, Emitter bias, The Operating Point, The Transistor switch

3 TRANSISTOR BIASING

Voltage divider bias, VDB analysis, VDB load line, Two-supply emitter bias, other types of bias, PNP Transistors

4 AC MODELS

Base biased amplifier, Coupling and bypass capacitors, The superposition theorem for amplifiers, AC resistance of the emitter diode, AC beta, The grounded emitter amplifier, The AC model of a CE stage, Introduction to h - Parameters & Comparison with T & PI models.

5 VOLTAGE AMPLIFIERS

Voltage gain, The loading effect of input impedance, Multistage amplifiers, Swamped amplifier

6 CC AND CB AMPLIFIERS

The CC amplifier, the AC model of an Emitter Follower, Types of coupling, Direct coupling, Darlington connections

7 CLASS A AND B POWER AMPLIFIERS

The AC load line of a CE amplifier, AC load lines of other amplifier, Class A operation.

8 OSCILLATORS

Theory of sinusoidal oscillation

9 FREQUENCY DOMAIN

The Fourier series, The spectrum of a signal, Frequency spectrum of periodic signal

10 FREQUENCY MIXING

Nonlinearity, Medium-signal, operation with one sine wave, Medium signal operation with Two sine waves

11 AMPLITUDE MODULATION

Basic idea, Percent modulation, AM spectrum, the envelope detector, the super heterodyne Receiver

LEARNING OUTCOMES

- After completion of the course, students will be able to …
- Analyse and designing of the various transistor amplifier circuits.
- Understand the importance of RE, RC, CB and CE in transistor circuit.
- Compare various biasing techniques and its importance in design of circuit.
- Understand significance of feedback in amplifier circuit.
- Build their notion about the digital electronics circuit and its applications.
- Gain the insight of the signal and its frequency spectrum for random signal.
- Understand the concept of the modulation and its application in wireless communication.

TEXT/ REFERENCE BOOKS

1. Electronic Principles, Albert Malvino and David J. Bates, 7th Edition, Tata McGraw Hill
2. Digital Electronics, Morris Mano, 3rd Edition, Prentice Hall of India
3. Electronic Devices and Circuit Theory, Robert Boylestad and Louis Nashelsky, 7thEdition, Prentice Hall of India
4. Digital Electronics, 1st Edition, Anand Kumar, 1st Edition, Prentice Hall of India

(AF214)MECHANICS OF SOLIDS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	2	4

OBJECTIVES OF THE COURSE

- The objective of this course is to make the students understand the concept of stress and strain under different type loading conditions and different types of structures
- Understanding of basic knowledge of maths and physics to solve real-world problems and to analyse simple problems in solid mechanics

DETAILED SYLLABUS

1 SIMPLE STRESSES AND STRAINS

Introduction, stress, strain, tensile, compressive and shear stresses, Elastic limit, Hooke's law, Poisson's Ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus, Bars of Varying sections, Extension of tapering rods, Bars of uniform strength, temperature stresses, Hoop stress, stress on oblique sections, State of simple shear, Relation between Elastic constants

2 MECHANICAL PROPERTIES OF MATERIALS

Ductility, Brittleness, Toughness, Malleability, Behaviour of ferrous and nonferrous metals in tension and compression, shear and bending tests, Standard test pieces, Influence of various parameters on test results, True and nominal stress, Modes of failure, Characteristic stress-strain curves, Strain hardening, Hardness, Different methods of measurement, Izod, Charpy and tension impact tests, Fatigue, Creep, Correlation between different mechanical properties

3 BENDING MOMENT AND SHEAR FORCE

Bending moment, shear force in statically determinate beams subjected to uniformly distributed, concentrated and varying loads. Relation between bending moment, shear force and rate of loading

4 MOMENT OF INERTIA

Concept of moment if Inertia, Moment of Inertia of plane areas, polar moment of Inertia, Radius of gyration of an area, Parallel Axis theorem, Moment of Inertia of composite Areas, product of Inertia, Principal axes and principal Moments of Inertia

5 STRESSES IN BEAMS

Theory of simple bending, bending stresses, moment of resistance, modules of section, Built up and composite beam section, Beams of uniform strength, Distribution of shear stress in different sections

6 TORSION

Torsion of circular. solid and hollow section shafts, shear stress angle of twist, torsional moment of resistance, power transmitted by a shaft, keys and couplings, combined bending and torsion, close coiled helical springs

7 STRESSES IN CYLINDRICAL AND SPHERECAL SHELLS UNDER FLUID PRESSURE

8 INELASTIC BENDING OF BEAMS

9 PRINCIPAL STRESSES AND STRAIN

LEARNING OUTCOMES

The students get knowledge of

- Solve practical problems through evaluating the relationship between stress and strain
- Generate and sketch shear force and bending moment diagrams
- Derive and apply stress and strain relationships in single and compound members subject to axial force, bending moment and torsion
- Analysis of composite beams and shafts

TEXT/ REFERENCE BOOKS

1. Strength of Materials, S. Ramamrutham
2. Strength of Materials, Dr. Sadhu Singh. Khanna Publishers
3. Mechanics of Solid by R.S. Khurmi
4. Introduction to Solid Mechanics by Shames and Pitarresi
5. Strength of Materials S. S. Bhavikatti
6. Mechanics of Solid by Stephen H. Crandall

(CT212) ENGINEERING GRAPHICS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	3	60	40	50	---	150	4	0	1.5	5.5

OBJECTIVES OF THE COURSE

- The course is aimed at developing basic graphic skills in preparation of basic drawings
- Developing skills in reading and Interpretation of engineering drawings to efficiently communicate ideas graphically
- To understand dimension and annotate two-dimensional engineering drawings
- To understand objects in two-dimensional views to improve visualization skills
- Comprehend general projection theory, with an emphasis on the use of orthographic projection to represent three-dimensional

DETAILED SYLLABUS

1 ENGNEERING CURVES

Constructions of curves used in engineering such as Conics (Ellipse, Parabola, Hyperbola), Cycloidal curves (Cycloid, Epi-Cycloid, Hypo-Cycloid), Involutes,Archemedian spirals.

2 PROJECTIONS OF POINTS AND STRAIGHT LINES

Projections of points, Projections of Lines, construction for H.T. & V.T. Simple applications of projection of points and lines

3 PROJECTIONS OF PLANES

Projections of regular planes such as square, rectangle, triangle, circle, pentagon, hexagon, rhombus etc.

4 PROJECTIONS OF SOLIDS

Projections of Right & Regular Solids (Prisms, Pyramids, Cylinder and Cone).

5 ORTHOGRAPHIC PROJECTIONS

First angle projection method and third angle projection method. Dimensioning techniques and methods, Conversion of pictorial views into Orthographic Projections with dimensions, Sectional orthographic projection, Orthographic vies with full and half section, special sections.

6 ISOMETRIC PROJECTIONS

Conversion of Orthographic views into Isometric Projections and views

7 DEVELOPLMENT OF SURFACES

Introduction, methods of development, Development of lateral surfaces of right regular

solids (Prism, Cylinder, Pyramid and Cone)

LEARNING OUTCOMES

- After successful completion of this course, students belonging to all branches of engineering would be able to understand fundamental aspects related to engineering graphic, preparation of basic drawings and acquire skills in reading and Interpretation of engineering drawings to efficiently communicate ideas graphically which can be further applied in their relevant practical field. Students will be able to understand objects in two-dimensional and three-dimensional views to improve visualization skills.

TEXT/ REFERENCE BOOKS

1. Engineering Drawing, N. D. Bhatt, Charotar Publication
2. Engineering Drawing Vol.1 & Vol. 2., P.J. Shah
3. Fundamentals of Engineering Drawing, Luzadder
4. A Text Book of Geometrical Drawing, P. S. Gill, S. K. Kataria Publication
5. A Text Book of Machine Drawing, P. S. Gill, S. K. Kataria Publication

(AX223) ADVANCED C PROGRAMMING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

The purpose of this course is to;

- Provide the deep knowledge of Advanced topics of C programming language
- Learn about advanced programming concepts like Pointers, File handling, Pre-processor, Macro, etc.
- Learn about advanced programming concepts like graphics and mouse programming.

DETAILED SYLLABUS

1 STRUCTURES AND UNIONS

Introduction, Structure definition, Giving values to members, Structure initialization, Comparison of structure variables, Arrays of structures, Arrays within structures, Structures within structures, Structures and functions, Unions, Size of structures, Bit fields, Case studies on structures and unions

2 POINTERS

Introduction, Understanding pointers, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and character strings, Pointers and functions, Pointers and structures, Pointers on pointers, Case studies on pointers

3 FILE MANAGEMENT IN C

Introduction, Defining and opening a file, Closing a file, Input/output operations on Files, Error handling during i/o operations, Random access to files, Command line arguments, Case studies on file management

4 DYNAMIC MEMORY ALLOCATION AND LINKED LISTS

Introduction, Dynamic memory allocation, Concept of linked lists, Advantages of linked lists, Types of linked lists, Pointers revisited, Basic list operations, Application of linked lists, Case studies on Dynamic memory Allocation and linked lists

5 THE PREPROCESOR

Introduction, Macro Substitutions, File inclusion, Compiler control directives, ANSI additions

6 C GRAPHICS AND MOUSE PROGRAMMING

Introduction to C Graphics and Mouse Programming

LEARNING OUTCOMES

- After completion of the course, students will be able to;
- Have deep knowledge of C language.
- Apply his programming knowledge to develop C programs on Pointers, File handling, Pre-processor, Macro, etc.
- Able to implement C Codes on graphics and mouse programming.

TEXT/ REFERENCE BOOKS

1. Programming in ANSI C, E. Balagurusamy, 3rd Edition, Tata McGraw Hill
2. Let us C, Yashavant Kanetkar, 12th Edition, BPB Publications
3. Journey to C, Punit Ganshani, 1st Edition, Mahajan Publication House
4. The C Programming Language, Brian W. Kernighan, 2nd Edition, Prentice Hall of India

(ES210) ENVIRONMENTAL SCIENCE

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
3	0	0	60	---	40	---	100	3	0	0	3

OBJECTIVES OF THE COURSE

- The objective for this course is to bring awareness about sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. Managing environmental hazards have become very important. It is now even more critical than ever before for mankind as a whole to have a clear understanding of environmental concerns and to follow sustainable development practices.

DETAILED SYLLABUS

1 THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance, Need for public awareness

2 NATURAL RESOURCES

Renewable and non-renewable resources, Natural resources and associated problems

Forest resources: Use and over exploitation, deforestation case studies. Timber extraction, raining, dams and their effects on forests and tribal people.

Water resources: Use and over utilization of surface and ground water, floods drought, conflicts over water dams, benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture overgrazing, effects of modern agriculture, fertilizer pesticide problems, water logging, salinity, case studies

Energy resources: Growing energy needs, renewable and non-renewable energy resources, case studies.

Land resources: Land as a resource, land degradation man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles

3 ECOSYSTEMS

- Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem

- Ecological succession, Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem

a. Forest ecosystem b. Grass land ecosystem c. Desert ecosystem d. Aquatic ecosystem (ponds, streams , lakes , rivers, oceans , estuaries)

4 BIODIVERSITY AND ITS CONSERVATION

Introduction definition: Genetic, species and ecosystem diversity

Bio-geographical classification of India

Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels

India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India

Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

5 ENVIRONMENTAL POLLUTION

Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards

Solid waste management, causes, effects and control measures of urban and industrial wastes

Role of an individual in prevention of pollution, Pollution case studies

Disaster management: floods, earthquake, cyclone and landslides

6 SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development, Urban problems related to energy

Water conservation, rain water harvesting, watershed management

Resettlement and rehabilitation of people: its problems and concerns. Case studies

Environmental ethics: Issues and possible solutions

Climate change: Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Case studies

Wasteland reclamation, Consumerism and waste products

Environment Protection Act: Air (Prevention and Control of Pollution) Act, Water (Prevention &Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act

Issues involved in enforcement of environmental legislation

Public awareness

7 HUMAN POLULATION AND THE ENVIRONMENT

Population growth, variation among nations, population explosion, Family Welfare Program, environment and human health, human rights, Value education

HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environmental and human health

Case studies

8 FIELD WORK

Visit to a local area to document environmental assets (river, forest, grassland, hill, mountain)

Visit to a local polluted site - Urban/Rural/Industrial/Agricultural

Study of common plants, insects, birds

Study of simple ecosystems – pond, river, hill, slopes etc…

LEARNING OUTCOMES

- After completion of this course students will be able to understand;
- The meaning of environment, ecology, ecosystems, biotic & abiotic components, food chains & webs
- Natural resources, biodiversity, hotspots, threats to biodiversity
- Factors causing environmental pollution, prevention of pollution, role of an individual in pollution control & abatement and disaster management
- Social issues related to environmental science, water conservation, rain water harvesting, environmental ethics, climate change, wasteland reclamation, consumerism and waste products, environment protection act and public awareness
- Issues of population growth, population explosion, human health and rights
- Field work related to ecosystems, polluted sites, and species

TEXT/ REFERENCE BOOKS:

1. Textbook of Environmental Studies, ErachBharucha, 2nd Edition, Universities Press
2. Environmental Studies, M. P. Poonia, S. C. Sharma, Khanna Publishing House
3. Environmental Studies, R. Rajagopalan, Oxford University Press
4. Basics of Environmental studies, N. S. Varandani, Lambert Academic Publishing
5. Environmental Studies, A. Basak, Dorling Kindersley
6. Environmental studies, S. K. Dhameja, S. K. Kataria and Sons
7. Environmental Pollution Control Engineering, C. S. Rao, Wiley publishers
8. Hazardous Waste Incineration, R. C. Brunner, McGraw Hill
9. Marine Pollution, R. S. Clark, Clanderson Press Oxford
10. Handbook of Environmental Laws, Acts, Guidelines, Compliances & standards, R. K. Trivedi, B. S. publications
11. Environmental Protection and Laws, H. Jadhav, V. M. Bhosale, Himalaya Pub. House
12. Environmental Biology, K. C. Agarwal, Nidhi Publication
13. The Biodiversity of India, E. Bharucha, Mapin Publishing
14. Environmental Encyclopedia, W. P. Cunningham, Cooper, T. H. E. Gorhani, M. T. Hepworth, Jaico Publication House
15. Environmental Chemistry, A. K. De, Wiley Eastern

16. Encyclopedia of Indian Natural History, R. E. Hawkins, Bombay Natural History Society
17. Global Biodiversity Assessment, V. H. Heywood, R. T. Waston, Cambridge Universit Press
18. Environmental Science systems & Solutions, M. L. Mckinney, R. M. School, Web enhanced edition
19. Environmental Science, T. G. Miller, S.E. Spoolman, Cengage learning: Wadsworth
20. Fundamentals of Ecology, E. P. Odum, W. B. Saunders
21. Waste Water treatment, M. N. Rao, A. K. Datta, Oxford & IBH Publication
22. Environmental Chemistry, B. K. Sharma, Goel Publication House
23. Essentials of Ecology, C. Townsend, J. Harper, B. Michael, Blackwell: Oxford
24. Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, R. K. Trivedi, Vol I and II; B. S. Publications
25. Introduction to air pollution, R. K. Trivedi, P. K. Goel, ABD Publishers
26. Environmental Management, K. D. Wanger, W. B. Saunders Co.

(AF217) WORKSHOP – II

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
0	0	2	---	---	50	---	50	0	0	1	1

OBJECTIVES OF THE COURSE

- Students belonging to Mechanical, Chemical and Civil Engineering branches are given exposure to use of basic tools and equipment used for performing basic operations related to fitting and assembly, cold smithy work and basic welding operations
- Student shall be given utility job in a group in carpentry to develop their ability to work in team and understand the applications of various tools in making the useful products

DETAILED SYLLABUS

1 FITTING (ONE JOB)

Fitting tools like –files, vice, chisels, punch, scriber, hammers, surface plate, try square, calipers etc., fitting operations such as filling, grinding, sawing , marking, drilling, tapping, safety precaution, Demonstration of various operations, Preparation of male –female joints

2 COLD FORGING (ONE JOB)

Smithy tools like hammer, anvil, flatteners etc. Smithy operations such as upsetting, drawing down, bending, setting down, fork cutting, punching and fullering etc., Safety precautions

3 CARPENTRY (ONE JOINT JOB)

Carpentry tools like –saw, planner, chisels, hammers, pallet, making gauge, vice, tee square, rule etc., carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, type of woods and carpentry hardware, safety precaution, demonstration of various operations by using hardware

4 WELDING (ONE JOB)

Electric arc welding, welding machines, different types of electrodes, screen, fixers, hand gloves, demonstration of welding operation

LEARNING OUTCOMES

- After successful completion of this course, students would be able to understand use of basic workshop tools and machines used in carpentry, cold smithy, fitting and assembly and welding.

REFERENCE BOOKS

1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik

(AF301) MATHEMATICS-III

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

- Ability to analyse and solve problems in both familiar and unfamiliar situations including those in real-life contexts with better accuracy.
- Able to apply knowledge of key theories, concepts, tools and techniques of Mathematics to solve structured and unstructured Engineering problems.
- Understand and be able to use the language, symbols and notation of mathematics
- Use different forms of mathematical representation (formulae, diagrams, tables, charts, graphs and models)
- Generate and/or analyze information, find relationships and patterns, describe these mathematically as general rules, and justify or prove them.

DETAILED SYLLABUS

1 FOURIER SERIES

Euler's Formulae, condition for a Fourier expansion, functions having points of discontinuity, change of interval, odd & even functions, Expansion of odd & even periodic functions, Half-range series

2 MATRICES

Fundamental concepts, operations, associated with matrices, matrix method of solution of simultaneous equations, Rank of Matrix, Linear dependence of vectors, consistency of a system of linear equations, characteristic equations, Eigen vectors and Eigen roots, Cayley Hamilton theorem

3 ORDINARY DIFFERENTIAL EQUATIONS

Linear differential equations of higher order with constant coefficients, equations reducible to linear equations with constant coefficients, Simultaneous linear equations with constant coefficients. Application to engineering problems

4 PARTIAL DIFFERENTIAL EQUATIONS

Introduction, formation, linear equation of first order, non-linear equations of first order-Charpit's method, homogenous linear equations with constant coefficient to find the complementary functions & the particular integral, non-homogenous linear equations with constant coefficients. Method of separation of variables-vibrating string problem, Heat flow equation etc.

5 LAPLACE TRANSFORMS

Application to differential equation, simultaneous linear equation with constant coefficients

LEARNING OUTCOMES:

At the end of the course students are able to;

- Obtain Fourier series of a periodic function into the sum of a (possibly infinite) set of simple oscillating functions, namely sines and cosines.
- Model physical processes using partial and ordinary differential equation and same can be solved analytically as well numerically.
- Solve basic initial value problems, directly without determining a general solution with the help of Laplace Transformation.
- Characterize the solutions of a differential equation with respect to initial values and analyze the behavior of solutions.
- Use numerical methods to find an approximate solution of algebraic and transcendental equations using appropriate method and will be able to solve wave and heat equation.

TEXT/ REFERENCE BOOKS

1. Higher Engineering Mathematics, Dr.B. S. Grewal
2. A Text Book of Applied Mathematics, P.N.&J.N.Wartikar
3. Mathematics for Engineering, Chandrika Prasad
4. A Text Book of Engineering Mathematics, Dr.K. N. Srivastva &G. K. Dhawan

(MH302) KINEMATICS OF MACHINES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- This course is included in the curriculum to fulfill following objectives;
- Students will learn about various types of mechanisms used in machines such as four bar mechanisms, slider crank mechanisms, pantograph, and straight line motion mechanisms.
- Students will become familiar with different types of motion and power transmission mechanisms like, belt drive, chain drive, gear drive, cam and follower, etc.
- Students will understand velocity and acceleration analysis as well as synthesis of mechanisms.

DETAILED SYLLABUS

1 SIMPLE MECHANISMS

Introduction to theory of machines, Machines, mechanisms and structures. Rigid and resistant bodies, Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Classification of Kinematic pairs, Types of joints, Degrees of freedom, Kinematic Chain, Linkage, Mobility of mechanisms- Kutzback's criterion, Gruebler's criterion. Four bar chain and its inversions, Single and Double slider crank chain and their inversions.

2 MECHANISMS WITH LOWER PAIRS

Pantograph, Straight line motion mechanisms such as Paucellier mechanism, Hart's mechanism, Scott- Russell and Modified Scott- Russell mechanisms, Watt's mechanism, Robert's mechanism, Tchebicheff's mechanism, Grasshopper mechanism. Steering gear mechanisms- condition of correct steering, Davis and Ackermann Steering gear mechanisms. Hooke's Joint, Double Hooke's Joint.

3 VELOCITY ANALYSIS

Absolute and relative velocity of a moving body, Velocity vectors, Motion of a link- translation and rotation, Velocity analysis of various mechanisms by relative velocity method (graphical)- velocity diagram, linear velocities of the points and angular velocities of the links of the mechanism, velocity of rubbing, velocity image of ternary or quaternary link. Velocity analysis of various mechanisms by Instantaneous centre method- Instantaneous centre, centrode, Instantaneous axis, axode, Properties of instantaneous centres, types of Instantaneous centres and how to locate them. The Aronhold Kennedy's theorem, Angular velocity ratio theorem.

4 ACCELERATION ANALYSIS

Acceleration of a moving body, centripetal and tangential components of acceleration in

a rotating link, Acceleration analysis of various mechanisms by relative acceleration method (Graphical)- acceleration diagram, acceleration image of ternary or quaternary link. The Coriolis component of acceleration in a rotating-sliding link.

5 SYNTHESIS OF MECHANISMS

Introduction, Analytical and Graphical methods of synthesis of mechanisms, Freudenstein's method, Relative pole method- two position synthesis, three position synthesis etc.

6 BELTS, ROPES AND CHAINS

Introduction, Belt and rope drives, Types of belt drive- Open and crossed belt drives, simple and compound belt drive etc., Velocity ratio, Slip, Materials for belt and ropes, Types of pulleys, Law of belting, Length of open and crossed belt, Ratio of friction tensions, Power transmitted, Centrifugal effect on belts, Maximum power transmitted by a belt, Initial tension, Creep, Chain drive, Chain length, Angular speed ratio, Classification of chains.

7 GEARS AND GEAR TRAINS

Introduction, Classification of gears, Gear terminology, Law of gearing, Velocity of sliding, Forms of teeth, Cycloidal profile teeth, Involute profile Teeth, Comparison of cycloidal and involute tooth forms, Path of contact, Arc of contact, number of pairs of teeth in contact, Interference in involute gears, Minimum number of teeth, Interference between rack and pinion, Undercutting, Gear trains-simple, compound, reverted, epicyclic. Epicyclic gear train analysis by analytical and tabular methods.

8 CAMS AND FOLLOWERS

Introduction, Types of cams, Types of followers, Cam terminology, Displacement diagrams, Motions of the follower, Graphical construction of cam profile.

LEARNING OUTCOMES

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

- Determine mobility and constraints of various mechanisms.
- Perform kinematic analysis on various mechanisms for determination of displacement, velocity and acceleration of various links.
- Carry out motion synthesis of simple mechanisms like four bar mechanism.
- Construct different types of cam profile to impart specific motion to follower.

TEXT/ REFERENCE BOOKS

1. Theory of Machines, Rattan, S.S., Tata McGraw Hill publication
2. Theory of Machines, Khurmi R. S. and Gupta J. K., S. Chand Publication
3. Theory of Machines and Mechanisms, Shigley J. E. and Uicker J.J., Oxford University Press India
4. Theory of Mechanisms and Machines, Ghosh Amitabha and Mallik Asokkumar, East-West Press Pvt. Ltd.

5. Mechanism and Machine Theory, Rao J. S. and Dukkipati R.V., Wiley Eastern
6. Theory of machines: Kinematics and Dynamics, Sadhu Singh, Pearson India

(MH303) ENGINEERING THERMODYNAMICS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

The objectives of this course are;

- To introduce the basic principles of thermodynamics via real-world engineering examples to students
- To show students how thermodynamics is applied in engineering practice
- To explain basic thermodynamic laws and applications to students
- To explain concept of entropy and irreversibility to students
- To explain fuel combustion process and analysis of flue gases

DETAILED SYLLABUS

1 INTRODUCTION AND BASIC CONCEPTS

Thermodynamics and Energy, Systems and Control Volumes, Properties of a System, Continuum, Density and Specific Gravity, State and Equilibrium, Processes and Cycles, Zeroth Law of Thermodynamics, Pressure

2 ENERGY AND ENERGY TRANSFER

Forms of Energy, Energy Transfer by Heat, Energy Transfer by Work, Mechanical Forms of Work

3 FIRST LAW OF THERMODYNAMICS

Energy Balance, Energy Change of a System, Mechanisms of Energy Transfer.

Energy Balance for Closed Systems: Moving Boundary Work, Energy Balance for Closed Systems, Specific Heats, Internal Energy, Enthalpy, and Specific Heats of Ideal Gases, Internal Energy, Enthalpy, and Specific Heat of Solids and Liquids.

Mass and Energy Analysis of Control Volumes: Conservation of Mass, Flow Work and the Energy of a Flowing Fluid, Energy Analysis of Steady-Flow Systems, Some Steady-Flow Engineering Devices, energy analysis of unsteady flow processes.

4 SECOND LAW OF THERMODYNAMICS

Introduction to the Second Law, Thermal Energy Reservoirs, Heat Engines, Kelvin–Planck Statement, Refrigerators and Heat Pumps, Coefficient of Performance, Clausius Statement, Equivalence of the Two Statements, Perpetual-Motion Machines, Reversible and Irreversible Processes, The Carnot Cycle, The Carnot Principles, The Thermodynamic Temperature Scale, The Carnot Heat Engine

5 ENTROPY

Increase of Entropy Principle, Entropy Change of Pure Substances, Isentropic Processes, Property Diagrams Involving Entropy, What Is Entropy, The T-ds Relations, Entropy Change of Liquids and Solids, Entropy Change of Ideal Gases, Reversible Steady-Flow Work, Isentropic Efficiencies of Steady-Flow Devices, Entropy Balance, Exergy

6 EQUATION OF STATES FOR REAL GASES AND FLUIDS

Ideal gas equation, Van-der-Waal equation of state, Berthelot equation of state, Dietetic equation of state, Beattie-Bridgeman equation of state, law of corresponding states, virial equation, Compressibility factor, Compressibility chart

7 THERMODYNAMIC PROPERTY RELATION

Property relation, Maxwell relations, Clapeyron equation, , Helmholtz and Gibbs functions, General relations for change in internal energy, enthalpy and entropy, Specific heat relations, Joule-Thompson coefficient and their relation

8 PROPERTIES OF PURE SUBSTANCE

Definition of pure substance, Phases of pure substance, phase change processes of pure substance, property diagrams for phase change processes, property table

9 FUELS AND COMBUSTION

Definition of fuel, calorific values, theoretical determination of calorific value of fuel, Experimental determination of calorific value of fuel using bomb calorimeter, boy's calorimeter and Junker's gas calorimeter, Carbon value of fuels, Dry flue gas analysis by Orsat apparatus, Combustion of various fuel elements, Exercise on Flue gas analysis on mass basis and volume basis

LEARNING OUTCOMES

After completion of this course, student will be able to;

- Analyze the work and heat interactions associated with a prescribed process path, and to perform a first law analysis of a flow system
- Understand fundamentals of thermodynamics laws and their applications.
- Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
- Understand the use of the Gibbs and Helmholtz free energies as equilibrium criteria.
- determine the equilibrium states of a wide range of systems,
- To determine minimum air required for complete combustion and analyze the products of combustion by mass and volume bases.

TEXT/ REFERENCE BOOKS

1. Engineering Thermodynamics, P. K. Nag, Tata McGraw Hill Publication

2. Thermodynamics An Engineering Approach, Yunus A. Cengel& Michael A. Boles, McGraw Hill Publication
3. Engineering Thermodynamics, R. K. Rajput, Laxmi Publication
4. Fundamentals of Thermodynamics, Claus Borgnakke, Richard E Sonntage ,Wiley publication
5. Fundamentals of Engineering Thermodynamics, Moran and Shapiro, John Wiley & sons publication
6. Advanced engineering thermodynamics, Adrian Bejan, Wiley publication

(MH304) MATERIAL SCIENCE AND METALLURGY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- Expose students to different classes of materials, their properties, structures and imperfections present in them.
- To learn structure of material based on its atomic structure.
- To understand importance of phase diagrams which effects mechanical properties like strength, ductility, brittleness.
- Selection of material is always based on certain technical reasons. Those reasons can be easily understand
- To get required shape in material, it has to processes in specific manner. Such concepts can be easily understand by knowing material science.

DETAILED SYLLABUS

1 INTRODUCTION TO ENGINEERING MATERIALS

Classification of Engineering Materials, Engineering requirements of materials, Properties of engineering materials, Criteria for selection of materials for engineering applications

2 STRUCTURE OF MATERIALS

Crystalline structure of solids, Concept of unit cell and space lattice, lattice parameters, miller indices, Crystal structure of ferrous and nonferrous metals. Crystal imperfections, atomic packing factors for various cubic systems, crystalline materials, amorphous materials, structure of atoms, bonds, forces between particles, particle arrangements in solids, structure of metals, growth of metal crystals, slip, dislocation, movements of dislocation, Phase and phase equilibrium, solidification of pure metals and alloys, solid solution, phase diagrams, Lever rule, Gibb's solid phase rule, phase diagram of binary alloys, properties and phase diagrams

3 STEELS AND HEAT TREATMENTS

Introduction, Allotropy of iron and Fe-C diagram. Various phases in Fe-Fe3c diagram. Property variation with microstructure, classification and application of steels, specifications of steels, transformation product of austenite, TTT and CCT curves, critical cooling rate, heat treatment of steels, cooling media, austenitic and ferritic grain size in steels. Introduction and purpose of heat treatment, classification of heat treatment processes, Introduction and applications of various case hardening and surface hardening treatments. Engineering alloys steel

4 BEHAVIOUR OF MATERIAL

Elastic Behaviour, plastic deformation, strengthening Mechanisms, creep, mechanism of

creep fracture, ductile, brittle, fracture toughness, ductile brittle transition, fracture mechanism maps, methods of protection against fracture, fatigue fracture

5 ENGINEERING NON-FERROUS ALLOYS

Equilibrium diagram for non-ferrous alloys, copper and copper alloys, brasses, equivalent zinc in brasses, season cracking of brasses, aluminum bronzes, tin bronzes, beryllium bronzes, silicon bronzes, copper nickel alloys, aluminum and aluminum alloys, nickel and nickel alloys, lead and lead alloys, tin and tin alloys, bearing materials

6 INTRODUCTION TO POLYMER, CERAMICS, COMPOSITE AND ADVANCED MATERIALS

Thermoplastics, Thermosets, elastomers, engineering ceramics, glasses, cement, fiber reinforced materials, particle reinforced materials, Dispersion strengthened metals, laminates, additive manufacturing methods

7 FERROUS EXTRACTIVE METALLURGY

Pig Iron, Manufacture of Pig Iron, Cast Iron and its production, Steel Making and various methods of making steel, crucible process, Bessemer converter process, Open hearth process, oxygen steel making, L-D process, LD-AD process, Electric furnaces, Spray refining processes

8 MATERIAL SELECTION: BASICS

Introduction, selection strategy, material indices, selection procedure, structural index

9 POWDER METALLURGY

Concept, applications, advantages and limitations, blending, mixing, compacting, sintering

10 MATERIAL CHARACTERISATION TECHNIQUES

Introduction to Non-destructive testing, Radiography Testing, Dye Penetration Testing, Magnetic Particle Testing, Ultrasonic Testing, Jominy end quench test, Macro-examination, Spark Test, Macro-etching, Microscopic examinations, Electron Microscopy, Magnetic Testing, Chemical analysis of steel and Iron, Hardness test- Brinell Vickers Rockwell. Micro hardness test, Fatigue and creep test, concept of fracture toughness testing, Crystal structure determination by X-ray diffraction

LEARNING OUTCOMES

- By completing this course student will easily identify basic classification of materials surrounded by him.
- Students can easily identify various mechanical properties required in material in order to serve its function.
- Learning various destructive and non-destructive testing, it becomes easy for students how to develop defect free product in market.
- Importance of iron-iron carbide phase diagram's usefulness can be easy understand by knowing variety of steel available in industries.

TEXT/ REFERENCE BOOKS

1. Material Science and Engineering, V. Raghvan, Prentice Hall of India
2. Metallurgy for engineers, V. Raghvan
3. Material Science and Engineering, Callister
4. Material science and metallurgy for Engineers, Dr V. D. Kodgire
5. Introduction to Physical Metallurgy, Sidney Avner
6. Engineering Materials Technology, W. Bolten
7. The science and engineering of Materials, Donald Askland and Pradeep Phule
8. Material Selection in Mechanical Design, Michael F Ashby
9. Material Science and Metallurgy, O. P. Khanna

(MH307) ELECTRICAL MACHINES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To improve knowledge of students about DC Generator & DC Motor
- To improve knowledge of students about Alternator & Induction Motor
- To enhance ability of student to calculate electrical consumption& electric bill of various machines
- To understand about power factor improvement
- To enhance drive design capability of student for Induction motor

DETAILED SYLLABUS

1 TRANSFORMERS

General aspects, Basic definition, working principle of transformer, Types of transformers, Transformer construction: core/shell/spiral transformers, Transformers on No load & on load, vector diagrams, Equivalent Circuit, Losses & condition for maximum efficiency, All day efficiency, Sumpner's Test, Conditions for parallel operation, Introduction to 3-phase transformer, Construction, Instrument transformers

2 ALTERNATOR / SYNCHRONIZE MACHINE

Introduction, construction, details, exciters, Armature Winding, EMF equation, Factor affecting size of Alternator, Alternator operation on load, voltage regulation, losses & efficiency, parallel operation of alternators, Armature reaction, damper winding, V Curves, Synchronizing of Alternators

3 DC GENERATOR

Classification, working principle of generator, construction of DC Machines, types of DC generator, open circuit characteristic, external characteristic and internal characteristic of DC generator. Efficiency &Power stage with example, Condition for maximum efficiency

4 DC MOTORS

Construction, Types, Principle of operation, torque equation, losses and efficiency, speed torque characteristics of shunt, series and compound motor, D.C. shunt motor 3–point starter, speed control of D.C. shunt and series motors

5 3-PHASE INDUCTION MOTOR

Construction, principle of operation, speed and slip, rotor current, relation between rotor copper loss and rotor input, torque of an induction motor, torque slip curve, Losses and Efficiency, starters for 3 phase induction motor, speed control

6 SINGLE PHASE INDUCTION MOTOR

Production of magnetic field, comparison between three phase & single phase Induction motors, starting of single phase induction motor by capacitor and Stepper motor

7 TARIFFS AND POWER FACTOR IMPROVEMENT

Types of Tariffs, Energy bill calculations, disadvantages of low power factor, causes of low power factor, power factor improvement, calculation of power factor correction, importance of power factor improvement, most economical power factor

8 INTRODUCTION TO DRIVES

Introduction to Thyristor, Insulated Gate Bipolar transistors (IGBTs), Power MOSFET, Speed torque characteristics of Industrial Equipment, joint speed-torque characteristics, Stability of drives systems, Force and torque acting in Electric drives, Method of speed control for different drives, modes of operation, block diagram and DC drive examples

9 INTRODUCTION TO SWITCH GEARS

Relay, Circuit Breaker and Isolator, Fuses, Bus-bar

LEARNING OUTCOMES

After learning the course the students should be able to

- Understand working principle, operation, control & applications of AC & DC machines.
- Perform basic experiments on AC, DC machine & Transformer.
- Explain the construction and characteristics of Power semiconductor devices and fundamental of thyristors and family.
- Understand circuit behaviour & working of Drives used for Motors.

TEXT/ REFERENCE BOOKS

1. Power systems,V. K. Mehta
2. Principles of power systems, V.K. Mehta, S. Chand publication
3. Electrical Technology- Vol. II, B. L. Theraja
4. Power electronics, M D Singh and K B Khanchandani, Tata McGraw Hill
5. A Course in power systems, J. B. Gupta, S. K. Kataria Publication
6. Electrical Power, S. L. Upal
7. A course in Electrical Power, Sony, Gupta & Bhatnagar
8. Theory & Performance of Electrical Machines, J. B. Gupta
9. Power Electronics, P.S. Bimbhra, Khanna Publishers

(MH308) MACHINE DRAWING AND INDUSTRIAL DRAFTING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	3	60	40	25	25	150	3	0	1.5	4.5

OBJECTIVES OF THE COURSE

- This course is included in the curriculum to fulfil following objectives.
- To impart fundamental knowledge about principles and methods related to projections of one-, two- and three-dimensional objects to students
- To inculcate the imagination and mental visualization capabilities amongst students for interpreting the geometrical details of various mechanical engineering components like pulleys, gears, coupling, joints, shafts, fasteners, etc.
- Students should become familiar with different types of fasteners like threaded fasteners, permanent fasteners and how to designate them.
- Students should understand the systematic method of preparing detail drawing and assembly drawing of various machines, mechanisms and structures.
- Students will learn about design and production drawings and how to prepare them.
- Students will learn computer aided drafting using a drafting software.

DETAILED SYLLABUS

1 INTRODUCTION TO MACHINE DRAWING

Machine drawing, detail drawing and assembly drawing, design drawing and production drawing

2 PRINCIPLES OF DRAWING

Drawing sheet: sizes and designations, title block, borders and frames, grid reference system, metric reference graduation, centre and trimming Examination Scheme, etc. Scales: engineering scale and drawing scale, Designation, recommended scales, specifications, types of lines and their applications in drawing, lettering, Drawing views: orthographic, isometric and perspective views, sectional views, enlarged detail view, broken view etc., conventional representations of various machine elements, dimensioning, standard abbreviations, missing view representation

3 DETACHABLE FASTNERS

Screw threads, nomenclature of screw thread, forms of thread, Thread designation, representations of threads: normal, schematic and conventional, specifications. Threaded fasteners: bolts, nuts, screws, studs, foundation bolts, nut locking arrangements (Purposes, Classification, principles of operation, standard types and their proportions)

4 PERMANENT FASTNERS

Rivets (Standard forms and proportions), Riveted joints (Common types of joints, terminology, proportions and representations), Design of various types of riveted joints, efficiency of riveted joints.

Types of welds and welded joints, edge preparation, specifications and representation of welds on drawings, IS designation of weld symbols. stresses in butt and fillet welds, strength of butt, parallel and transverse fillet welds, axially loaded unsymmetrical welded joints, eccentric load in plane of welds, welded joints subjected to bending and torsional moments

5 ASSEMBLY DRAWING

Review of sheet preparation, boundary lines, zones, title block, revision panel, parts list, numbering of components and associated detail drawing, bill of materials, assembly drawings of various machine sub-assemblies and assemblies from detail drawings, sketches and actual machine components

6 PRODUCTION DRAWING

Introduction to limits, fits, dimensional tolerance, surface roughness and their drawing representation. Geometric dimensioning and Tolerancing: basic terminology, Tolerance frame, Tolerance characteristics and symbols, Modifiers, Indication of geometric tolerance in drawing

7 Introduction and basics about AutoCAD software various commands and their practice. (As per APPENDIX - A)

LEARNING OUTCOMES

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

- Imagine, visualize and interpret various components by observing their drawings.
- Communicate creative design of mechanical systems with others.
- Prepare design and production drawing of various machines, mechanisms and structures.
- Design simple components and permanent fasteners.
- Prepare drawings using computer aided drafting software.

TEXT/ REFERENCE BOOKS

1. Machine Drawing, K. L. Narayana, P. Kannaiah, K. Venkata Reddy, 3rd edition, New age international (P) Ltd.
2. Machine Drawing, Basudeb Bhattacharyya, Oxford University Press
3. Machine Drawing, N. D. Junnarkar, Pearson Education Pvt. Ltd
4. Machine Drawing, P.S. Gill, S.K. Kataria & Sons
5. Machine Drawing,N. Sidheshwar, P. Kannaiah. McGraw-Hill India
6. AutoCAD 2012–A problem solving approach, Sham Tickoo, Delmar Cengage Learning.
7. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd.

8. PSG Design data

(AF410) FINANCIAL AND MANAGERIAL ACCOUNTING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	3	60	40	---	---	100	3	0	0	3

OBJECTIVES OF THE COURSE

- The need to understanding concepts of accountancy is essential in daily life of individuals as well as company where engineering is applied. Thus for better decision making, principles of accounting are applied to produce financial statements which can be appealing to the prospective stakeholders. Traditional and modern approach provides learning to understand different perspectives of accountancy which have evolved over the years. Management accounting is for understanding the Cost-Volume-Profit analysis. Concepts such as ratio analysis along with breakeven analysis are important to compare different companies of the same industry, to do fundamental analysis of a company's financial statements.

DETAILED SYLLABUS

1 FINANCIAL ACCOUNTING – AN INTRODUCTION

Introduction, Meaning of Accountancy, book-keeping and Accounting , Accounting Process, Objectives for accounting, Differences between book-keeping and accounting Users of accounting information, Limitations of Accounting, Basic terminologies

2 ACCOUNTING CONCEPTS, PRINCIPLES, BASES AND POLICIES

Introduction, Accounting Concepts, Principles, Policies and Standards, Types of accounting concepts - Business Separate entity concept - Going concern concept - Money measurement concept - Periodicity concept - Accrual concept, Accounting Principles - Principle of Income recognition - Principle of expense - Principle of matching cost and revenue - Principle of Historical costs - Principle of full disclosure - Double aspect principle - Modifying Principle - Principle of materiality - Principle of consistency - Principle of conservatism or prudence, Accounting Policies - Changes in Accounting Policies - Disclosure in case of changes in Accounting Policies, Accounting Standards - Scope and functions of Accounting Standards Board - International Financial Reporting System

3 DOUBLE ENTRY ACCOUNTING

Introduction, Meaning of double entry accounting, Classification of accounts under Traditional approach, Classification of accounts under Accounting Equation approach, Comparison of traditional approach with Modern approach equal approach, Accounting Trail, Transactions and events, Meaning and roles of debit and credit, Accounting equation

4 SECONDARY BOOKS

Introduction, Secondary books, Purchases Book/Purchases Day book - Cash discount,

Trade discount - Difference between cash discount and trade discount, Sales Book or Sales Day book - Purchase Returns Book - Sales Returns Book, Bills receivable book - Bills payable book - Cash book, Posting to Ledger accounts Posting to Ledger

5 TRIAL BALANCE

Introduction, Meaning, Objectives of preparing a trial balance, Methods of preparing a trial balance, Preparation of Trial balance, Adjusting Entries, Errors and their rectification, Errors disclosed by Trial Balance, Errors not disclosed by Trial Balance, Steps to locate the errors

6 FINAL ACCOUNTS

Introduction, Adjustments before preparing final accounts, Depreciation, Bad Debts and accounting treatment of bad debts, Provision for doubtful debts, Reserves for Discount on Debtors, Reserve for Discount on Creditors, Closing Stock, Trading Account, Profit and Loss Account, Balance Sheet

7 INTRODUCTION TO MANAGEMENT ACCOUNTING

Introduction, Meaning of Management accounting, The Role of Management Accounting, Management Accounting Framework, Functions of Management Accounting, Tools of Management Accounting, The Balanced Scorecard, Cost Management System, Value Added Concept, Merits of Management Accounting, Demerits of Management Accounting, Distinction between Management Accounting and Financial Accounting

8 FINANCIAL STATEMENT ANALYSIS

Introduction, Meaning of Ratio, Steps in Ratio Analysis, Classification of Ratios, Du Pont Chart, Solved Problems, Advantages of Ratio Analysis, Limitation of Ratio analysis

9 CASH FLOW ANALYSIS

Introduction, Meaning of Cash Flow Statement, Purpose of Cash Flow Statement, Preparation of Cash Flow Statement, Format of Cash Flow Statement (AS3: Revised Method), Cash Flow from Operating Activities, Cash Flow Statement under Direct Method, Different between Cash Flow Analysis and Fund Flow Analysis, Uses of Cash Flow Statement

10 MARGINAL COSTING AND BREAK EVEN ANALYSIS

Introduction, Concept of Marginal Costing, Characteristics of Marginal Costing, Difference between Absorption Costing and Marginal Costing, Marginal Cost, Contribution, Cost Volume Profit (CVP) Analysis, Break Even Chart, Break Even Point, Profit Volume ratio or MCSR, Target profit, Margin of Safety, Application of Marginal cost, Limitations of Marginal cost, Solved Problems

11 BASICS OF FINANCIAL MANAGEMENT

Introduction of Financial Management, objectives of financial management, role of finance manager, functions of financial management, concept of time value of money, present value, future value, annuity concept, solved problems

LEARNING OUTCOMES

After completion of this course students will be able to understand:

- Concepts and principles of accounting, double-entry bookkeeping, limitations and objectives of accounting.
- Process of accounting
- Balance sheet, profit & loss statement, cash flow statement, and contents of an annual report.
- Breakeven point, marginal cost and breakeven analysis
- Concepts of time value of money, present value, future value, annuity, growing annuity, and perpetuity.

TEXT/ REFERENCE BOOKS

1. Financial Accounting for Managers–Text book & cases, S.K. Bhattacharya , John Dearden, 3rd Edition,Vikash Publishing House Private Limited
2. Management Accounting, Ravi M. Kishore, Taxman
3. A Text Book of Cost Accountancy, M.N. Arora, Vikas Publishing Pvt. Ltd.
4. Cost Accounting: Method & Problems, B.K. Bhar, Academic Publishers
5. Cost Accounting – A Managerial Emphasis, Horngren, Foster &Datar, Prentice Hall
6. Cost Accounting, Bhabatosh Banerjee, World Press
7. Fundamental Managerial Accounting Concept, Edmonds, Edmonds and Tsay, Irwin, McGraw Hill
8. Principles and Practice of Cost Accounting by Asish Bhattacharya, S. Chand
9. Management Accounting, R.S.N. Pillai &Bhagavati, S. Chand
10. Advanced Cost and Management Accounting (Text) (Vol – 1 & 2), V.K. Saxena& C.D. Vashist, S. Chand
11. Cost Accounting–Theory & Practices, Bhabatosh Banerjee, S. Chand
12. Advanced Cost & Management Accounting–Problems & Solutions, V.K. Saxena& C.D. Vashist, Prentice Hall of India (P) Ltd.
13. Cost and Management Accounting, M.E. Thukaram Rao, New Age International
14. Management Accounting, M.E. Thukaram Rao, New Age International

(MH408) ADVANCE STRENGTH OF MATERIALS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

- To explain fundamentals of stresses and strain in three dimension
- To explain various failure theories for static loading within elastic limit and explain how to apply these theories for predicting failure of mechanical components
- Explain the slope and deflection relations of beams using different methods.
- To explain the concepts of stresses developed in rotating parts
- To explain bending stresses setup in curved members

DETAILED SYLLABUS

1 STRESSES IN THREE DIMENSIONS

Concept of Continuum, homogeneity and Isotropy, types of forces on a body, state of stress at a point, equality of cross shear, Cauchy formula, principal stresses and planes, stress invariants, hydrostatic and deviatoric stress tensor, Mohr's circle for general state of stress, stress transformations, octahedral stresses, plane of maximum shear stress, differential equation of equilibrium

2 STRAINS IN THREE DIMENSIONS

Types of strain, strain displacement relationship, shear strain, total strain, cubical dilatation, rigid body rotation, principle strain and axes, isotropic strain and shear strain, strain invariants, Saint Venant's strain compatibility conditions, strain transformation, concept of plane stress and plane strain, stress strain relationship for different types of materials

3 THEORIES OF ELASTIC FAILURE UNDER STATIC LOADING

Concept of factor of safety, maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear strain energy theory

4 THICK CYLINDERS

Cylinder classification, design of thick cylinders, Lame's theory, design based on various failure theories, cylinders subjected to external pressure, methods of pre-stressing of cylinders, Analysis of compound cylinders

5 SLOPE AND DEFLECTION OF BEAMS

Introduction, beam deflection, relation between slope, deflection and radius of curvature, slope and deflection at a section by various methods

6 COLUMNS AND STRUTS

Classification of columns, strength of columns, end conditions and equivalent length, Euler's formula, Rankine's hypothesis, columns subjected to eccentric loading, beam columns

7 STRESSES DUE TO ROTATION

Rotating ring, rotating thin solid and hollow disc, thin disc with a pin hole, disc of uniform strength, rotating long solid and hollow cylinders

8 BENDING OF CURVED BARS

Introduction, stresses in curved bars (Winkler-Bach theory) (Rectangular section, Circular section, Triangular section, Trapezoidal section, T-Section)

LEARNING OUTCOMES

After successful completion of the course, student will be able to;

- Analyse the stresses and strain on mechanical components in three dimensions
- Evaluate elastic failure under static loading using different failure theories
- Design and analyse thick cylinders as well as compound cylinder subjected to internal and external pressure
- Analyze slope and deflection of beams subjected to various types of loads
- Analyze long and short columns and struts subjected to axial and transverse loads
- evaluate stresses in rotating parts
- Analyze bending stresses in curved bars with different cross-sections

TEXT/ REFERENCE BOOKS

1. Advanced Mechanics of Solids, L. S. Srinath, Tata McGraw Hill
2. Strength of Materials, R. K. Rajput, S. Chand & Co. Ltd.
3. Solid Mechanics, S. M. A. Kazimi, Tata McGraw Hill
4. Strength of Materials, D. S. Bedi, Khanna book publishing co. pvt ltd.

(MH409) MANUFACTURING TECHNOLOGY – I

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	3	60	40	25	25	150	4	0	1.5	5.5

OBJECTIVES OF THE COURSE

- The course focuses on understanding the basics of science and technology of manufacturing processes.
- Student will learn various aspects of different manufacturing techniques such as various casting methods and different conventional machine tools.
- One of basic purpose of this course is to provide a sound understanding of concepts and principles of machine tools and casting technology so as to enable them to be conversant with advances in these methods in the long run towards increasing the productivity of manufacturing industries.
- By preparation of jobs on various machine tools, students will be prepared for practical aspect of this course.

DETAILED SYLLABUS

1 INTRODUCTION TO MANUFACTURING PROCESSES

Importance of manufacturing processes as a fundamental discipline, classification of manufacturing processes, examples and application of each process.

2 METAL CASTING

Principal of casting process, casting terms- pattern, mould molding box, runner, riser, Sprue, gate, core, core print, advantages, application and limitation of casting process, sand mould procedure, steps involved in making a casting

3 PATTERNS, MOULDING MATERIALS AND CORE

Definition of pattern, difference between pattern and casting, different types of patterns, pattern materials, pattern allowances, Shrinkage allowance, machining allowance, draft allowance, Distortion allowance, shake allowance, Moulding sands and their essential properties, effect of grain size and shape on properties of sand binders additives. Moulding hand tools, testing moulding sand core definition and uses, types of core print, pattern colors, core boxes.

4 MOULDING PROCESS

Green sand Moulding methods of green sand Moulding, (Bedded in method, turn over method and open sand method) dry sand moulding, skin dried molding, CO2 moulding, shell moulding, advantages, disadvantages, applications of each moulding

5 SPECIAL CASTING PROCESSES

Gravity die casting, pressure die casting, Comparison of permanent mould casting with

sand casting and applications, centrifugal casting true centrifugal casting semi centrifugal casting centrifuging. Continuous casting, vacuum casting, investment casting, squeeze casting, Advantages of special casting or conventional casting

6 FATELING AND CASTING DEFECTS

Shake out operation, cleaning and finishing of casting, Casting surface finishing methods, Sand blasting, Shot blasting and Hydro blasting. Gas defects, shrinkage, cavities, moulding material defects, pouring metal defects, metallurgical defects, inspection of casting

7 GATING DESIGN AND RISERING DESIGN

Elements of Gating system, directional and progressive solidification, Types of gate, Choke and choke area, gating ratio, pouring time calculation, aspiration ratio, condition of aspiration, function and types of riser, requirement of riser, Cain's method, Modulus method , NRL Method/shape factor method, examples based on these topics.

8 LATHE

Function, Working Principle, Classification, Specifications, Main Parts, Feed Mechanism, Lathe Accessories, Lathe Operations, Cutting tool Materials, Tool geometry of Single Point cutting tool, Cutting Parameters: Speed, feed and Depth of Cut, Machining Time, Material Removal Rate (MRR), Example based on Machining time and MRR. Specification of Lathe Machine, Capstan and Turret Lathe, Working Principle, Parts.

9 SHAPING AND PLANNING

Function of Shaper, Working Principle, Classification, Main Parts, Driving mechanism of shaper, feed mechanism of shaper, different Operations on Shaper Machine, Cutting Parameters: Speed, feed and Depth of Cut, Machining Time, Specification of Shaper Machine, Working Principle of Planer, Classification, Difference between shaper and Planer, Planner Operations, Specification of Planner Machine.

10 DRILLING AND BORING

Function, Working Principle, Classification, Main Parts, Specification, Different Operations on Drilling, Twist Drill Nomenclature, Drill Size, Designation of Drill, Cutting Parameters :Speed, feed and Depth of Cut, Machining Time, Working Principle & Types of Boring Machines, Boring Tools

11 MILLING AND BROACHING

Working Principle, Main Parts, Classification of Milling Machines, Specification, Milling Machine Mechanism, Work Holding Devices, Cutter Holding Devices, Different Milling cutters, Tool Geometry of Plain Milling Cutter, Milling Operations, Cutting parameters, Machining Time, Milling attachments, Principle of Indexing, Types of Indexing, Working Principle, Classification, Advantages and Disadvantages of Broaching machines, Application of Broaching Machine.

12 GRINDING

Working Principle, Main Parts, Classification of Grinding Machines, Specification, Grinding Operations, Types of Grinding Wheels, Wheel Marking, Truing, Glazing, Loading, Balancing of Grinding Wheel, Wheel selection.

LEARNING OUTCOMES

Students will be able to;

- Understand the basic concept of machining operations and foundry technology.
- Analyze any conventional machining processes and select appropriate machine tool
- Interpret the various factors affecting casting & machining quality
- Perform practical work for machining processes

TEXT/ REFERENCE BOOKS

1. Foundry Technology, O. P. Khanna
2. Workshop Technology, HajraChoudhary S.K. and HajraChoudhary A.K. Media Promotors and Publishers
3. A text book of production technology vol-II, O.P. Khanna, Dhanpat Rai publishers
4. Production technology, R.K. Jain, Khanna publishers.
5. Manufacturing Engg. And Technology, S. Kalpakajain, PHI/Pearson
6. Production Technology, H.M.T, Tata McGraw Hill
7. Workshop Technology, by Bawa H.S., Tata McGraw Hill
8. Workshop Technology, Arora B.D., SatyaPrakashan
9. Manufacturing Processes for Engineering Materials, Kalpakjain S. and Schmid Steven R., Pearson Publication
10. Workshop Technology Vol. I, II & III, W.A.J. Chapman
11. Principles of Metal casting, R. W. Heine, P. C. Rosenthal McGraw Hill
12. Manufacturing Science, Amitabha Ghosh, East-west Press
13. Manufacturing Technology volume – I Foundry, Forming and Welding,P. N. Rao

(MH410) FLUID MECHANICS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To teach basics – Fluid properties, Types of Fluid Flow and Forces acting in Fluid at rest and in motion
- To teach conservation of mass, momentum and energy in different flow situations
- To teach application of Bernoulli's theorem in practical situation
- To teach kinematics and dynamics of flow.
- To teach mathematical techniques like dimensional and model analysis, explaining significance of dimensionless numbers in analysis of real fluid problems.
- To teach about the losses and parameter affecting when there is fluid flow in different situations (Flow thorough pipes)

DETAILED SYLLABUS

1 FLUIDS AND THEIR PROPERTIES

Fluid Properties , Types of fluid, Newton's law of Viscosity, Newtonian and Non-Newtonian Fluid, continuum concept of a fluid, viscosity, Dimensional formula and units of viscosity, Causes of viscosity in fluids, Effect of temperature of Viscosity, Cohesion and adhesion, Surface tension, capillary, Vapour pressure, cavitation, compressibility and the bulk modulus

2 PRESSURE AND ITS MEASUREMENT

Pressure, Pascal's law of pressure at a point, Hydrostatic law (fundamental law of fluid statics), Hydrostatic Paradox, Absolute and Gauge pressures, measurement of pressure, manometers: simple and differential manometers

3 FLUID STATICS

Total Pressure force and Centre of Pressure, Hydrostatic Force on submerged surfaces - Horizontal, Inclined, Vertical and Curved surfaces, Buoyancy, Stability of Submerged Body, met centre, Stability of Floating body, determination of metacentric height, Relative Equilibrium under Linear Acceleration : liquid in container subjected to uniform acceleration in horizontal and vertical directions

4 FLUID KINEMATICS

Methods of Analysing fluid motion: Langrangian Method and Eulerian Method, Types of flow : Laminar Flow and turbulent flow, steady and unsteady flow, Uniform and non-uniform flow, Compressible and incompressible flow, One, Two and Three Dimensional Flows, Rotational and irrotational flows, Steam Lines and Stream Tubes, Path Lines,

Streak Lines, Flow rate and continuity equation, Continuity equation in differential form for Cartesian coordinate and cylindrical coordinate system, Acceleration field of fluid : Local and convective acceleration, Translation, Rotation and Deformations, Circulation of fluid element, Rotational flow, rotation and Vorticity, Stream Function and Velocity Potential function, Stream lines and Equipotential lines, Relation between Stream Function and Velocity Potential, Flow nets

5 FLUID DYNAMICS

Newton's Laws of Motion, Euler's Equation, Bernoulli's Equation, Static pressure, Dynamic pressure, Stagnation and Total pressure, Measurement of flow rates: venturimeter, Orifice meter and Pitot tube, Reynolds's Transport Theorem, Momentum equation, Application of momentum equation: Forces due to fluid flow in the bends, Moment of momentum equation, Vortex flow, Forced and Free Vortex flow, equation of motion for vortex flow, Equation of Forced and Free Vortex flow

6 DIMENSIONAL AND MODEL ANALYSIS

Dimensional analysis, Basic and derived quantities, Dimensional Homogeneity , methods of Dimensional Analysis : Rayleigh's method, Buckingham π – theorem,

Model Analysis, Similitude, Geometrical, Kinematics and Dynamic Similarity, forces influencing hydraulic phenomenon, dimensionless parameters and their significance, Model Laws, Model testing

7 LAMINAR AND TURBULENT FLOWS

Concepts of Laminar and Turbulent Flows, Reynolds number and Reynolds experiment, Navier-Stokes Equation, Exact solution of Navier -Stokes Equation for simple flows, Relation between shear stress and pressure gradient, concept of developing and fully developed flow, Flow of Viscous fluid in circular pipes - Hagen-Poiseuille law, Laminar Flow between Parallel Plates for Moving and Stationary plates, Flow through Concentric annulus, Power absorbed in bearings, loss of head due to fluid friction in pipes, Hydrodynamically smooth and rough boundaries, Boundary Layer and its characteristics, Boundary layer Thickness

8 FLOW THROUGH PIPES

Loss of energy in pipes, Friction factor, Moody's Chart, Friction loss in pipe flow -Darcy Weisbach Equation, Chezy's Formula, Major and Minor losses in pipes, Hydraulic Gradient Lines and Total Energy line, Pipes connected in Series and Parallel, Equivalent pipe, Branched Pipes, Power Transmission Through Pipes, Syphon, Flow Through Orifices and Mouthpieces, Flow through open channel, Chezy's Formula in open channel, Uniform and Non Uniform flow, Hydraulic Jump

9 FLOW AROUND SUBMERGED BODIES

Force exerted by flowing fluid on a body, Expression for Drag and Lift, Co-efficient of drag and life, streamlined and bluff bodies, Drag on different geometry, examples

LEARNING OUTCOMES

Students who successfully complete this course will have ability to:

- Apply the basic equation of fluid statics to determine forces on planar and curved surfaces that are submerged in a static fluid, to manometers

- Use of conservation laws in differential forms and apply them to determine velocities, pressures and acceleration in a moving fluid.
- Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids.
- Understand the concepts of rotational vs. irrotational flows, stream functions, velocity potentials. Laplace equation, vortex flows.
- Apply principles of dimensional analysis and similitude to simple problems and use dimensionless parameters. g, j)
- Determine flow rates, pressure changes, and minor and major head losses for viscous flows through pipes.
- Understand the concepts of viscous boundary layer.
- Understand the mechanics of viscous flow about immersed bodies, drag coefficients and the determination of drag co-efficient.

TEXT/ REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines,R.K. Bansal, Laxmi Prakashan
2. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons
3. Fluid Mechanics, Yunus A. Cengel, McGraw Hill Publication
4. Fluids Mechanics, White F. M., McGraw-Hill Inc., 3rd. Ed., New York
5. A text Book on Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw-Hill Inc.
6. Introduction to Fluid Mechanics and Fluid Machines, Som S. K., Biswas G., Tata McGraw Hill Co. Pvt. Ltd.

(MH411) DYNAMICS OF MACHINE

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanism.
- To understand undesirable effects of unbalances resulting from prescribed motion of mechanism.
- To understand the principles in mechanism used for speed control and stability control.

DETAILED SYLLABUS

1 STATIC FORCE ANALYSIS

Introduction, conditions of static equilibrium, equilibrium of two and three force member, member subjected to force couple and torque, free body diagrams, principle of super position, static force analysis of various mechanism, principle of virtual work, static force analysis with friction.

2 DYNAMIC FORCE ANALYSIS

Introduction, D –Alembert's principle, equivalent offset inertia force, dynamic analysis of simple mechanisms, combined static and inertia force analysis of different mechanisms, Dynamic force analysis of reciprocating engine: Inertia of reciprocating mass and connecting rod, Dynamically equivalent system, Turning-moment diagrams, Fluctuation of energy, Flywheels, Dimensions of flywheel rims, Punching presses.

3 BALANCING

Introduction, static balancing, dynamic balancing of several masses in different planes, force balancing of linkages, balancing of reciprocating & rotary masses.

4 GOVERNORS

Introduction, analysis of different types of governors: mechanical type governor, spring-loaded type governor, various terminologies, effort and power of a governor, controlling force.

5 GYROSCOPE

Concept of gyroscope, angular velocity, angular acceleration, gyroscopic couple, gyroscopic effect on aviation, marine and automobiles.

6 FRICTION

Types of friction, laws of friction, coefficient of friction, pivots and collars, Friction clutches & its types, rolling friction, anti-friction bearings, greasy friction, greasy friction at journal, friction axis of a link, film friction, Mitchell thrust bearing

LEARNING OUTCOMES

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

- Predict the force analysis in mechanical system
- Find unbalance force in rotary and reciprocating system
- Related gyroscopic effect on different system and able to solve the problem.

TEXT/ REFERENCE BOOKS

1. Theory of Machines, Rattan, S.S., Tata McGraw Hill
2. Mechanical Vibration, Grover G. K., 7th Ed., New Chand and Brothers
3. Theory of Machines and Mechanisms, Shigley J. E. and Uicker J.J., McGraw Hill
4. Theory of Mechanisms & Machines, Amitabha Ghosh & Ashok Mallik, Affiliated East-West Press Pvt. Ltd.
5. Kinematics & Dynamics of Machinery, Charles Wilson & J. Peter Sadler, Pearson Education
6. Dynamics of Machinery, Farazdak Haideri, Nirali Publication
7. Mechanism and Machine Theory, Rao J. S. and Dukkipati R.V., Wiley Eastern
8. Theory of Machines, Thomas Bevan, CBS Publishers
9. Theory of Machines, Dr. Sadhu Singh, Pearson Education
10. Mechanical Vibration, Schaum Series, Mc-Graw Hill

(MH412) NUMERICAL TECHNIQUES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- With present development of mechanical engineering, it is necessary to solve complicated mathematical formulation and to develop efficient algorithm. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

DETAILED SYLLABUS

1 ERROR ANALYSIS

Significant figures, accuracy and precision, error definitions, round of errors, truncation errors, error propagation, Taylor series, total numerical errors, formulation errors and data uncertainty

2 ROOTS OF EQUATIONS

Roots of equations, bracketing methods–graphical, bisection and false position methods, Open methods–Newton Raphson methods, Secant methods, Computing methods for roots of polynomials

3 ALGEBRIC EQUATIONS

Numerical solutions of Linear algebraic equations by Gauss elimination method, Numerical solution of nonlinear equations by Gauss Jordan method

4 MATRICES AND EIGEN VALUE IDENTIFICATION

LU Decomposition and matrix inversion, special matrices, Cholesky decomposition, Gauss Seidel method, Jacobi method

5 CURVE FITTING

Linear regression, Polynomial regression, Nonlinear regression

6 INTERPOLATION

Newton's forward and backward difference interpolation, Lagrange interpolation, Hermite interpolation, Inverse interpolation, Spline interpolation

7 NUMERICAL DIFFERENTIATION, NUMERICAL INTEGRATION AND SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Overview of Numerical differentiation and integration methods, Overview of solution methods of Ordinary differential equations, boundary value problems, eigen value problems

8 PARTIAL DIFFERENTIAL EQUATIONS

Finite difference methods for elliptic equations, parabolic equations & hyperbolic

equations

9 STATISTICAL TECHNIQUES

LEARNING OUTCOMES

- At the end of the course, Students would be acquainted with basic concept of numerical method and application to real life problem as follow:
- Mathematical modelling and engineering problem solution, Error analysis, Roots of equations, Solution of system of linear equation, Curve fittings, Numerical differential and integration, Ordinary and partial differential equations. MATLAB programming for engineering problem solving.

TEXT/ REFERENCE BOOKS

1. Numerical Methods for Engineers, Steven C. Chapra, Raymond P. Canale, Tata McGraw Hill
2. Numerical Methods for Engineers, S. K. Gupta, New Age International Publishers
3. Applied Numerical Analysis, Curtis F. Gerald, Patrick O. Wheatley, Addison Wesley
4. Applied Numerical Methods with MATLAB for Engineers & Scientists, Tata McGraw Hill
5. Numerical Recipes in C–The Art of Scientific Computing, William H. Press, Saul A. Teukoksky, William T. Vetterling, Brian A. Flannery, Cambridge University Press

(AF501) PROFESSIONAL COMMUNICATION - I

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
1	0	2	50	---	---	50	100	1	0	1	2

OBJECTIVES OF THE COURSE

- To develop confidence in the students for communicating at workplace.
- Develop their Listening, Speaking, Reading, and Writing Skills.
- To give exposure of communicating with public.
- How to develop fluency in English Language.
- To prepare students for placement.
- To teach how to be effective at the job.

DETAILED SYLLABUS

1 INTRODUCTION TO PROFESSIONAL COMMUNICATION

Importance, Methods and Manners, Need of Professional Communication, Objectives of Professional Communication, Skills required for Professional Communication, Employers' Expectations

2 COMMUNICATION AND BARRIERS

Introduction, Process, Principles, Components, Types of Communication, Main problems of Communication

Verbal Communication: Oral Communication, Written Communication, Advantages of Verbal Communication, Limitations of Verbal Communication

Nonverbal Communication: Importance of Non-Verbal, Kinesics, Proxemics, Chronemics, Haptics, Oculesics, Paralanguage

Barriers of Communication: Intrapersonal, Inter-Personal, Organizational,

Noises in Channel: Physical, Semantic, Psychological, Physiological

3 LANGUAGE PROFICIENCY

Introduction, Basic Grammar Rule, Vocabulary Building, Language Games

4 FOUR SKILLS (LSRW)

Introduction

Listening: Process, Types of Listening, Six Stages of Listening, Listening Criticism, Characteristics of effective listening

Speaking: Elements of speaking skills, Pronunciation, Speech art

Reading: Skimming, Scanning, Intensive reading, Levels of Comprehension (Literal and Inferential), Techniques of good comprehension, Improving Comprehension Skills

Writing: Developing Basic writing skill, letter & e-mail writing

LEARNING OUTCOMES:

After completion of this course students will be able to understand:

- Communication Process and framework
- Obstacles in Communication
- Possible remedies to barriers of communication
- Effective Listening, Reading, Writing and speaking skills
- Implementation of Non-Verbal features in the presentation
- Ways and manners Presentations, Speech, Group talk and Interview
- Competence in writing and reading

TEXT/ REFERENCE BOOKS

1. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma, Oxford University press: New Delhi
2. Business Communication, Meenakshi Raman and Prakash Singh, 2nd Edition, Oxford University press: New Delhi
3. Embark: English for Undergraduates, Steve Hart, Arvind R. Nair and Veena Bhambhani, Cambridge University Press, New Delhi
4. Communication Skills for Technical Students, T M Farhathullah, Orient Longman Private Ltd. Chennai

(MH508) INTERNAL COMBUSTION ENGINES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To make the students understand the basic as well as latest technical knowledge of IC engines.
- To make the students understand various systems of IC engines and to evaluate the performance parameters of engine.
- To make students aware of the environmental effects of IC engines and the necessary technical remedies for it.
- To understand the need for alternative fuels

DETAILED SYLLABUS

1 INTRODUCTION

Introduction, Assumptions, Stirling cycle, Ericsson cycle, Lenoir cycle, Atkinson cycle, Joule or Brayton cycle, Dual combustion cycle, Comparison between Otto, Dual and Diesel cycles, non-conventional IC engines, applications of IC engines

2 FUEL-AIR AND ACTUAL CYCLES

Valve/Port timing Diagram for four-stroke/two- stroke SI/CI engine, Fuel-air cycles and their significance, Factors affecting the fuel air cycle, Difference between actual cycles and fuel- air cycles

3 COMBUSTION IN IC ENGINES

Introduction, Homogeneous and Heterogeneous mixtures, Ignition limits, Stages of combustion in SI engine, effect of engine variables on ignition lag, effect of engine variables on flame propagation, abnormal combustion: Detonation or knocking in SI engines, effect of engine variables on knock or detonation. Control of detonation, stages of combustion in CI engine, delay period and factors affecting delay period, diesel knock, Comparison of Knock in SI and CI engines, CI Engine Combustion Chambers, Cold Starting of CI Engines

4 FUEL SUPPLY SYSTEM IN SI AND CI ENGINES

Carburetion, Factors affecting carburetion, Air- fuel mixture requirement for different conditions, Simple Carburettor: Essential Parts and its working, Analysis of Single Jet Carburettor, Multipoint Fuel Injection System (MPFI), Requirement of Fuel injection system and its classification, Jerk type Fuel Injection Pump, Fuel Injectors, Nozzle and its type

5 CONVENTIONAL AND ALTERNATIVE FUELS FOR ENGINES

Fuels for SI engines: Desirable properties, Volatility and its effects on engine performance, Rating of S.I. engine fuels: HUCR, Octane Number, Performance Number and Triptane Rating.

Fuels for CI engines: Desirable properties, Rating of C.I. engine fuels: Cetane Number, Diesel Index, Aniline point, API gravity and Specific gravity

Alternative Fuels: CNG, LNG, LPG, alcohol, biodiesel and hydrogen

6 ENGINE FRICTION

Introduction, Sources of Losses, Factors affecting mechanical friction

7 IC ENGINE SYSTEMS

Lubrication System-Function of Lubrication, Lubrication of Engine Components, Lubrication System, Properties of Lubricants, Additives for Lubricants, SAE Rating of Lubricants

Ignition System-Function of Ignition System, Requirements of Ignition System, Battery Ignition System, Magneto Ignition System, Electronic Ignition System, Ignition advance and methods of advancing, Firing order of the engine cylinders.

Cooling System-Need for Cooling System, Types of Cooling System: Air (Direct) Cooling System, Liquid (Indirect) Cooling System

Governing System-Function of Governor, Methods of governing: Hit and miss method, Quality governing and Quantity governing

8 SUPERCHARGING

Introduction, Objective of supercharging, Thermodynamics Cycle with supercharging, Types of superchargers, Effects of supercharging, Methods of supercharging, Supercharging limitations in SI and CI engines, Turbo Charging and its different methods

9 ENGINE EMISSIONS

Emission of pollutants from SI & CI engines, Control of emissions from SI and CI engines, Measurement of pollutants in exhaust gases, Emission norms

10 MEASUREMENT AND TESTING

Introduction, Performance parameters, Measurement of speed, Measurement of fuel consumption, Measurement of air consumption: Air box method, Measurement of brake power: (a) Absorption Dynamometer: Rope brake Dynamometer, Prony brake Dynamometer, Hydraulic Dynamometer and Electrical Dynamometer, (b) Transmission Dynamometer; Measurement of frictional power: Willan's line method, Motoring Test, Retardation Test; Measurement of indicated power of Multi cylinder engine by Morse test

LEARNING OUTCOMES

After learning the course, the students should be able to:

- Perform thermodynamic analysis of various cycles used in IC engines.
- Understand various IC engine systems
- Measure the performance parameters on test rig.
- Understand the generation of exhaust emissions and various techniques to reduce them.

- Understand the technological and environmental impacts of alternative fuels.
- Develop awareness of recent research areas in I.C. engines

TEXT/ REFERENCE BOOKS

1. A course in internal combustion engines, V.M. Domkundwar, Dhanpatrai& Co
2. Internal combustion engines, Mathur& Sharma, Dhanpatrai& sons
3. Internal combustion engines, V. Ganeshan (Tata Mc Grawhill Pub. co. ltd
4. Internal combustion engines, Ramalingam, Scitech publications
5. Internal combustion engines, H. N. Gupta, PHI Learning, New Delhi
6. Internal combustion engines, B. L. Singhal, Tech-max publications
7. Internal combustion engines, S. S. Thipse, Jaico Publishing house
8. Fundamental of I.C. Engines, John Heywood, McGraw Hill Publication

(MH509) MANUFACTURING TECHNOLOGY - II

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	3	60	40	25	25	150	3	0	1.5	4.5

OBJECTIVES OF THE COURSE

Objective of this course is to;

- Understand basics of metal joining processes and metal forming process.
- Understand principle of various types of welding processes
- Interpret the various factors affecting metal forming & welding quality.
- Perform practice jobs related to metal forming and various types of welding processes

DETAILED SYLLABUS

1 INTRODUCTION

Fundamentals of welding system, Advantages & Disadvantages of welding, Classification of welding processes

2 ARC WELDING PROCESSES

Fundamentals of arc welding, Arc Welding Processes: Carbon Arc welding , Manual Metal Arc Welding, Tungsten Inert Gas welding, Metal Inert Gas welding, Metal Argon gas welding & Submerged arc welding.

Welding Consumables: Welding Electrode and fluxes, Selection of electrodes, Electrode coating, Care & storage of welding electrode, Classification and coding of electrodes as per IS system.

Welding equipment and its specification: Arc welding power sources (AC and DC type), other accessories for arc welding

3 RESISTANCE WELDING PROCESSES

Fundamentals of Electric Resistance welding, Spot welding, Projection welding, Seam welding

4 GAS WELDING:

Oxyfuel Gas welding Processes, Oxyacetylene welding: Principle, Methods, Applications Other Joining Processes, Gas cutting**,** Principles of gas cutting, equipment used in gas welding, different types of gas welding torches

5 SOLDERING AND BRAZING

Soldering, Brazing, Adhesive Bonding and application

6 WELDING DEFETS

Various types of welding defects, Causes and remedies, introduction to Inspection and

Testing of welds

7 ADVANCED WELDING PROCESSES

Introduction to Electron Beam welding, Electroslag welding, underwater welding, and Narrow gap welding.

8 HOT WORKING AND COLD WORKING OF METALS

Plastic Deformation, Rolling, Extrusion, Pipe & tube manufacture, Merits and demerits of the hot working and cold working process, Wire drawing, Metal spinning, Rolling and Extrusion

9 PRESS WORKING

Presses & drive mechanism for presses, Feed mechanism, Clearance and its importance, Press tool operations, Shearing, cutting off, parting, blanking, piercing, notching, slitting, slitting, Nibbling Trimming, Lancing, Bending & forming types of dies, die materials, stock layout, compound and progressive dies and punches, construction details of die set, auxiliary equipment, safety devices

10 SUPER FINISHING OPERATIONS

Introduction to: Grinding, Lapping, Horning, Buffing, Burnishing

LEARNING OUTCOMES

After the completion of this course students will be able to

- Understand about the various metal joining processes and metal forming processes
- Understand about the various types of power sources used for arc welding
- Perform welding operation for the different types of welding processes
- Know about the various types of welding defects and causes and remedies for defects

TEXT/ REFERENCE BOOKS

1. Welding Technology, O. P. Khanna, Dhanpat Rai Publications
2. Welding processes and technology, R. S. Parmar, Khanna publishers
3. Production Technology vol-I, O. P. Khanna
4. Manufacturing Technology- Foundry, Forming and Welding, P. N. Rao, Tata McGraw Hill
5. Workshop Technology, Vol.1, 2, and 3, W. A. J. Chapman
6. Introduction to Manufacturing Processes, Schey J., Tata McGraw Hill
7. Production technology, R.K. Jain, Khanna publishers
8. Welding Technology, Richard Little
9. Manufacturing Engg. And Technology, S. Kalpakajain, PHI/Pearson
10. Materials and Processes in Manufacturing, DeGarmo E. P., Black J. T. and Kohser R. Prentice Hall India

(MH510) MACHINE DESIGN - I

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To develop basic understanding about design engineering and design skills.
- Student shall gain design knowledge of the different types of elements used in the machine design process, for e.g. levers, temporary and permanent fasteners, shafts, keys, couplings, springs, clutches, brakes etc. and will be able to design these elements for each application.
- Student shall understand the use statistical considerations in mechanical design.
- Student shall understand the importance of codes and standards used in design of mechanical parts.

DETAILED SYLLABUS

1 INTRODUCTION

Design engineering, design engineering phases, basic requirements and procedure of design, design synthesis, use of standards in design, selection of preferred sizes, aesthetic and ergonomic considerations in design, concurrent engineering

2 DESIGN CONSIDERATIONS

Design considerations for manufacture and assembly of casting, forging, machining and welding

3 DESIGN AGAINST STATIC LOAD

Design parts subjected to tension, compression, shear, bending, torsion, combined and eccentric axial static loads such as such as cotter joint, knuckle joint, levers

4 THREADED FASTENERS

Basic design concepts of threaded fasteners, eccentrically loaded threaded joint in shear, eccentric load perpendicular and parallel to axis of threaded fastener, design of turn buckle

5 POWER SCREW

Design of power screw, simple screw jack, toggle jack and C-clamp

6 RIVETED JOINTS

Basic design concepts of riveted joints, design of longitudinal and circumferential riveted joints for boiler shell, Eccentrically loaded riveted joints

7 SHAFTS, KEYS AND COUPLINGS

Types of shaft, material for shaft, shaft design based on strength and rigidity, A.S.M.E. code for shaft design, types of keys, design of sunk, saddle and Kennedy key, design of

splines, types of couplings, design of flanged and bush-pin flexible couplings

8 MECHANICAL SPRINGS

Types, applications and materials for springs, stress and deflection equations for closely coiled helical compression springs, Wahl's factor and its use in spring design, end conditions, concentric springs, design of helical torsion, spiral and leaf springs

9 STATISTICAL CONSIDERATIONS IN DESIGN

Statistics in design, Variance, standard deviation and standardized variables, normal distribution, confidence intervals, population combinations, design and natural tolerances, mechanical reliability, statistical considerations for factor of safety

10 DESIGN OF CLUTCHES AND BRAKES

Function, classification and material selection, design of single plate, multiple plate, cone and centrifugal clutches, classification of brakes, design of band brake, External and internal shoe brakes, Internal expanding shoe brakes, calliper discbrake

LEARNING OUTCOMES

On successful completion of the course, student will be able to;

- understand design engineering philosophy
- to design shafts, keys and coupling for industrial applications
- design Power Screws for various applications
- design fasteners and welded joints subjected to different loading conditions
- design various types of springs industrial applications
- design basic types of clutches and brakes used in mechanical applications
- incorporate statistical consideration in design
- use design standards and codes

TEXT/ REFERENCE BOOKS

1. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd
2. Machine Design – I & II, Farazdak Haideri, Nirali Prakashan
3. Mechanical System Design, Farazdak Haideri, Nirali Prakashan
4. Machine Design, An integral approach - Robert L. Norton, Pearson Education Inc
5. Mechanical Engineering Design, J. E. Shigley, C. R. Mischke, McGraw-Hill Publishing Co. Ltd
6. A text book of Machine Design, P. C. Sharma, D. K. Aggarwal, S. K. Kataria & Sons
7. Engineering Design, George E. Dieter, McGraw-Hill Publishing Co. Ltd
8. Design Data (PSG College of Engg. & Tech.), DVP Printers

(MH511) POWER PLANT ENGINEERING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

Objective of this course is to;

- To understand the basic thermodynamics cycles of thermal power plant.
- To introduce the students about the various system of thermal power plant and their working.
- To make familiarize the student about economics of power generation and various tariff methods.

DETAILED SYLLABUS

1 INTRODUCTION

Introduction to various power plants, General layout of thermal power plant, Criteria for Site selection, Rankine Cycle and its modification (Super heating, Reheating, Regeneration), Brayton Cycle and its modification (Reheating, Regeneration, intercooling), types of fuels

2 STEAM GENERATOR

Heat balance sheet for Boiler, High pressure boilers, Supercritical boiler, Supercharged boiler, Boiler Mountings: Safety Valve, Water level indicator, Pressure gauge, Steam stop valve, Feed check valve, Blow off cock, Fusible plug, Attachment for inspector's test gauge, man hole; Boiler Accessories: Super-heaters, Economizers, Air pre-heaters; Methods of superheat temperature control

3 MATERIAL HANDLING SYSTEM IN POWER PLANT

Coal Handling Systems- Introduction, conveyor systems, Out-plant handling of the coal, Storage of coal at plant site, In-plant handling of the coal, Pulverized fuel handling systems (Unit and central systems)

Fuel Burning Equipment-Introduction, Stoker firing, Types of stokers their working, Pulverized mills, Pulverized coal burners, Oil burners, Fluidized bed combustion systems

Ash Handling Systems-Introduction, Layout of Ash handling system, Different types of ash handling systems (Mechanical, Hydraulic, Pneumatic and steam-jet), Basics of dust collection, Mechanical dust collector and Electrostatic precipitator (ESP)

4 DRAUGHT SYSTEM

Introduction, losses in air-gas loop system, Natural draught and design of chimney, Maximum discharge condition, Artificial draught (Forced, Induced and balanced), Power

requirement by fans

5 CONDENSERS AND COOLING TOWERS

Necessity of condenser in power plant, Elements of steam condensing plant, Types of condensers, Selection of condenser, Sources of air in condenser, Effects of air leakage in condenser, Methods for obtaining maximum vacuum in condenser, Vacuum efficiency, Condenser efficiency, Dalton's law of partial pressure used for condenser analysis, Determination of mass of cooling water required in condenser, Necessity of cooling ponds and cooling towers, Condenser water cooling systems, Types of cooling towers, Cooling ponds

6 FEED WATER TREATMENT

Introduction, Necessity of feed water treatment, Effect of impurities, Internal & external water treatment system

7 NUCLEAR POWER PLANT

Nuclear fusion and fission, Chain reaction, Nuclear fuels, Components of nuclear reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal

8 ECONOMICS OF POWER GENERATION

Load curves, Load duration curves, Base load and peak load power plants, Connected load, Demand, Maximum demand/ Peak load, Demand factor, Load factor, Plant capacity factor, Plant use factor, Diversity factor, Cost of power plant, Performance and operating characteristics of power plant, Tariff for electric energy

9 POLLUTION AND ITS CONTROL

Effect of different pollutants on human health and vegetation, Air pollution by thermal power plants and its control, Water pollution by thermal power plants and its control, Thermal pollution, Acid rain

LEARNING OUTCOMES

After learning the course, the students should be able to;

- Understand and analyse the basic thermodynamic cycles of thermal power plant.
- Understand and identify the various systems and their components, their working and significance.
- Understand economics of power generation.
- Use various tariff methods.
- Understand environmental impact of thermal power plant.

TEXT/ REFERENCE BOOKS

1. Power Plant Engineering, Arora, S.C. and Domkundwar, S., Dhanpat Rai & Co. Delhi.
2. Power Plant Engineering, R.K. Rajput, Laxmi Publication, Delhi
3. Power Plant Engineering, P.K. Nag, Tata McGraw-Hill Co., Delhi
4. Power Plant Technology, Wakil M. M., McGraw Hill, 1985.

5. Power Plant Engineering, .F. T. Morse, Affiliated East-West Press Pvt. Ltd; New Delhi

(MH512) MECHANICAL MEASUREMENT AND METROLOGY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

Objective of this course is to:

- To introduce the students about various mechanical measuring devices used in the industries
- Train them to use devices, so that they know how to incorporate these devices effectively in practice.

DETAILED SYLLABUS

MECHANICAL MEASUREMENTS

1 BASIC CONCEPT OF MEASUREMENT

Introduction, Methods of measurement, Standards, Calibration, General measurement system. Operational description of a measurement system, Accuracy and Precision, Types of errors, Sources of errors, Statistical analysis of data

2 PERFORMANCE CHARACTERISTICS OF MEASURING INSTRUMENTS

Introduction, Static performance characteristics, Dynamic performance characteristics, Input types, Instruments types, Transducers

3 PRESSURE MEASUREMENT

Introduction, Methods of measuring pressure, Dead weight gauge tester, McLeod gauge, Pressure measurement with elastic transducers, Electrical methods, Manometers, Measurement of Vacuum

4 TEMPERATURE MEASUREMENT

Introduction, Expression of Temperature, Expansion of thermometer, Change of state thermometer, Electrical methods, Pyrometry, Optical pyrometer, Calibration of temperature measuring instruments

5 FLOW MEASUREMENT

Introduction, Types of flow measuring instruments, Quantity meter, Obstruction meters, Ultrasonic flow meter, Flow measurement by drag effect (Rotameter), Pitot tube, Hot wire anemometers, Special methods, Flow visualization methods

6 MISCELLANEOUS MESUREMENTS

Basic methods of force measurements, Torque measurement on rotating shaft, Prony brake and eddy current dynamometers, Stress and strain measurements, Types of strain gauges, Electrical resistant strain gauges, Wheatstone bridge, Gauge factor of strain

gauge, Rosettes, Speedometer and stroboscope, Ballast circuit, Vibration measurement using accelerometer

METROLOGY

7 LINEAR AND ANGULAR MEASUREMENT

Introduction, Standards of Measurements, Line graduated measuring instruments, Steel Rule, Calipers, Surface plate, Angel plate, V block, Planner gauges, Radius gauges, Feeler gauges, Angel gauges, Vernier Caliper, Micrometers, Slip gauges, Vernier and Optical Bevel Protector, Sine Principle and Sine Bars, Dial gauges

8 LIMITS, FITS AND GAUGE DESIGN

Introduction, Tolerances, Interchangeability, Selection of fits, Tolerances and Geometry, Positional tolerance, Types of gauges, Taylor's principle of gauge design, Gauge tolerance, Allocation of gauge tolerance, Wear allowance

9 COMPARATORS

Introduction, Characteristics of comparators, Uses of comparators, Advantages & Disadvantages of various types of comparators, Mechanical Optical Comparators, Pneumatic Comparators, Fluid Displacement Comparators, Optical Projector

10 STRAIGHTNESS, FLATNESS, SQUARENESS, PARALLELISM, CIRCULARITY AND ROTATION

Straightness, Test for straightness by using Spirit level and Auto- collimator, Flatness Testing, Mathematical treatment of determination of straightness and flatness of surface, Parallelism, Equidistance, Coincidence, Squareness, Measurement of circularity, Test for checking Rotation, Profile Measurement, Surface roughness measurement

11 METROLOGY OF GEAR AND SCREW THREAD

Introduction, Screw thread terminology, Effect of pitch error, Measurement of various element of thread, Different types of gears, Basic elements of gear, Involute function, Relations between different gear elements of spur and helical gears, Virtual number of teeth, Methods of measuring the gear tooth thickness

LEARNING OUTCOMES

After successful completion of the course, student should be able to:

- Understand basic concepts of mechanical measurement and errors in measurements.
- Recognise appropriate temperature, pressure and flow measuring device for various applications
- Apply methods of measurement for various quantities like force, torque, power, displacement, speed and acceleration measurement.
- Learn methodology for linear and angular measuring instruments in any mechanical system.
- Design various gauges and selection of fits based on appropriate limits and tolerances

TEXT/ REFERENCE BOOKS

1. Mechanical Measurements and Control, D. S. Kumar, Metropolitan
2. Mechanical Measurements and Instrumentation and Control, A. K. Sawhney&Puneet
3. Sawhney, Dhanpat Rai & Co.
4. Metrology, M. Mahajan, Dhanpat Rai & Co.
5. Engineering Metrology, R. K. Jain, Khanna publisher
6. Measurement Systems: Application and Design, E.O. Doeblein, McGraw Hill
7. Mechanical Measurement, R. S. Sirohi& H C Raha Krishna, Wiley Eastern Limited.
8. Engineering Metrology, K. J. Humc, MacDonald and Co.
9. The Metrology Hand Book, Jay L. Bucher, American society for quality
10. Engineering Metrology, D. M. Anthony, Pergamon Press India

(MH513) FLUID MACHINES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

The objectives of the course proposed are to;

- provide insight of energy transfer by fluid in various machines
- study the practical applications of Hydraulic Machines and Compressible Turbo Machines

DETAILED SYLLABUS

1 HYDRO POWER PLANT

Introduction, Major applications of hydropower plant, Classification of hydropower plant, Mini-micro hydro power plant, Elements of hydropower plant, Advantages and disadvantages

of hydropower plant, selection of site for a hydropower plant

2 IMPACT OF JET

Introduction, Force exerted by jet on stationary plate - vertical, inclined and curved plate, Force exerted by jet on hinge plate, Force exerted by jet on moving plate – Vertical, Inclined and curved, Force exerted by jet on unsymmetrical moving curved plate when jet strikes tangentially at one end of tip, Force exerted by jet on series of vanes, Force exerted by jet Radial curved vanes, Jet Propulsion

3 HYDRAULIC TURBINES

Introduction, Classification of Hydraulic Turbines, Head and efficiencies of hydraulic turbine

Pelton Wheel Turbine- Construction and Working, Velocity triangle and work done

for Pelton Wheel turbine, design parameters

Radial Flow Reaction Turbine- Inward radial flow and outward radial flow turbine, Construction and Working of Francis turbine, Velocity triangle and work done for Francis turbine.

Axial Flow Reaction turbine- Construction and Working of Kaplan Turbine, Design parameters

Draft tube- Types, Theory and efficiency of draft tube

Specific speed of Hydraulic turbines, Unit quantities and characteristics curves of Hydraulic Turbines. Governing of Hydraulic turbines

4 HYDRAULIC PUMPS

Introduction, Classification of pumps

Centrifugal Pump- Introduction, main parts of centrifugal pump, Work done by centrifugal pump, Definition of Heads and efficiencies of centrifugal pump, Minimum Starting speed of Centrifugal pump, Multistage centrifugal pumps, Specific speed of centrifugal pump, Model testing of Centrifugal pump, Priming, characteristics curves of Centrifugal pump, Cavitation, Maximum suction lift Centrifugal pump, NPSH

Reciprocating Pump- Introduction, Construction and working, Indicator diagram, Air vessels, Comparison of Centrifugal pump and Reciprocating Pump

5 AIR COMPRESSORS

Introduction, Classification of compressor

reciprocating compressor- Terminology, classification, single stage reciprocating air compressor without clearance- work done, Power required to compress air, condition for minimum work, single stage reciprocating air compressor with clearance- work done, volumetric efficiency, FAD, Multistage compression- Work done Two stage compressor with intercooler without clearance, Condition for minimum work, Work done Two stage compressor with intercooler with clearance, Optimum intermediate pressure in two stage compressor with incomplete intercooling, Actual p-v for reciprocating compressor, mean effective pressure and indicated power, compressor efficiency, Heat rejected in compressor and intercooler

Centrifugal compressor-Introduction, Principle of operation, components of centrifugal compressor, static and stagnation properties, Work done by the impeller, pressure rise and temperature rise, Degree of reaction, Power input factor, slip factor, Stodola formula, Enthalpy- entropy diagram, isentropic efficiency, Pre-whirl, influence of impeller blade shapes on performance, surging and chocking of compressor, rotating stall, losses in compressor

Axial Flow Compressor- Introduction, Principle of operation, stage velocity triangles, work done, work done factor, Enthalpy- entropy diagram, static pressure rise, stage loading and flow co-efficient, Degree of reaction, velocity triangles for different value of DOR, Aerofoil Blading, Comparison between centrifugal compressor and reciprocating compressor

6 MISCELLANEOUS FLUID MACHINES

Introduction, Hydraulic accumulator, Hydraulic intensifier, Hydraulic Ram, Hydraulic Lift, Hydraulic Crane, Hydraulic Coupling, Hydraulic Torque converter, Airlift Pump, Gear Pump

LEARNING OUTCOMES

At the end of course students will be able to:

- 1. Understand the importance of hydro Power plant in energy generation.
- 2. Understand fundamentals of impact of jet and Jet Propulsion.
- 3. Understand the basics of energy transfer by fluid in various applications.
- 4. Understand application of different hydraulic machines.
- 5. Understand the fundamental of compressible turbo machines.

TEXT/ REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Prakashan
2. Fluid Mechanics and Hydraulic Machines, R.K. Rajput, S. Chand & Co
3. Fluid Power Engineering, R.N. Patel and V.L. Patel, Mahajan Publication
4. Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw hill
5. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S.K. Kataria & Sons
6. Turbines, Compressors and Fans, S. M. Yahya., TMH Publishers
7. Fundamental of Turbo machinery, B. K. Venkanna, PHI

(AF601) PROFESSIONAL COMMUNICATION - II

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
1	0	2	50	---	---	50	100	1	0	1	2

OBJECTIVES OF THE COURSE

- To develop confidence in the students for communicating at workplace.
- Develop their Listening, Speaking, Reading, and Writing Skills.
- To give exposure of communicating with public.
- How to develop fluency in English Language.
- To prepare students for placement.
- To teach how to be effective at the job.

DETAILED SYLLABUS

1 COMMUNICATION SKILLS

Intrapersonal Communication, Interpersonal Communication, Importance of Empathy in Communication, Psychological Dealings in Communication, Positive Attitude

2 TEAM BUILDING

Introduction, Meaning and importance of team, Skills and qualities of a team member, Techniques to be a good team member, working in Groups, Leadership Qualities, Negotiation Skills, Adjustment level and Flexibility,Understanding Team mates

3 EFFECTIVE SELF PRESENTATION THROUGH LSRW

Listening: Active Listening

Speaking: Indianisms, Presentation

Reading: Speed Reading, Reading Practice, Levels of Comprehension (Evaluative and Applied), Comprehension Practice

Writing: minutes, notice, proposal, report writing

LEARNING OUTCOMES

After completion of this course students will be able to understand:

- Psychological aspects in communication
- Developing Positive Attitude and empathy
- Importance of team and how to work in a team
- Effective Listening, Reading, Writing and speaking skills
- Corporate Communication

- Writing Minutes, Notice, Proposal and Report
- Competence in writing and reading

TEXT/ REFERENCE BOOKS

1. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma, Oxford University press: New Delhi
2. Business Communication, Meenakshi Raman and Prakash Singh, 2nd Edition, Oxford University press: New Delhi
3. Embark: English for Undergraduates, Steve Hart, Arvind R. Nair and Veena Bhambhani, Cambridge University Press, New Delhi
4. Communication Skills for Technical Students, T M Farhathullah, Orient Longman Private Ltd.,Chennai

(MH610) CAD-CAM

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

Objective of this course is to

- Understand the basic fundamentals of computer aided design and manufacturing.
- To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
- To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
- To learn the part programming for CNC machine, importance of group technology, computer aided process planning, computer aided quality control.
- To learn solid modeling with the help of solid modeling software
- To learn part programming through software

DETAILED SYLLABUS

1 INTRODUCTION

Introduction, Reasons for implementing CAD system, Conventional design vs CAD. Advantages of CAD, Architecture of CAD workstation with technical specifications, CAD hardware: working principles of various input, output and memory devices. CAD software: Elements of computer programming, computer languages, CAD programming, Modules of CAD software, ICG system: Desirable features, Functions

2 ALGORITHMS AND GEOMETRIC TRANSFORMATIONS

Scan conversion, DDA algorithm of line and circle, Bresenham's algorithm of line. Geometric transformations: Scaling, Translation, Rotation, Reflection, Shear, Homogeneous coordinate system

3 GEOMETRIC MODELING

Introduction, Types of geometric modeling: wireframe, surface and solid modelling, Curves used in wireframe modeling, Non Parametric and Parametric representation of curves, Analytic curves: line and circle,

Synthetic curves: Hermite cubic spline, Bezier curve, B- spline curve.

Surface modelling: Types of surfaces, analytical surfaces, synthetic surfaces such as Hermite cubic, Bezier, B-spline and coons patch.

Solid modelling: introduction, geometry and topology, solid modelling representation schemes such as pure primitive instancing, generalized sweeps, hierarchical, octree and cellular decomposition, B-rep, CSG etc. Feature based modelling, Parametric modelling

4 CADSTANDARDS

Standards for graphics programming, GKS and its features, Need of CAD data exchange, CAD standards such as DXF, IGES, STEP, PDES

5 COMPUTER AIDEDMANUFACTURING

Introduction, historical background, role of computers in manufacturing, automation, Types of automation

6 FUNDAMENTALS OF NC AND CNC MACHINES

Numerical Controls, types, evolution of controllers, components of NC/CNC system, specification of CNC system, classification of NC/CNC machines, transducers used, salient features, constructional details of CNC machines, axis designation, NC/CNC tooling

7 PART PROGRAMMING FOR CNC MACHINES

Fundamentals of manual part programming, types of format, word address format manual part Programming for drilling, lathe and milling machine operations, subroutines, doloops, canned Cycles

Computer Assisted Part Programming– APT language, types of statement, command and programming

8 ADVANCES IN CAM

Group Technology and Cellular manufacturing: Introduction, Part families, parts classification and coding, production flow analysis, machine cell design

Computer aided process planning(CAPP):Types of process planning system introduction of flexible manufacturing system and computer aided quality control

LEARNING OUTCOMES

After completion of this course, the students will be able to;

- Describe the fundamental theory and concepts of the CAD/CAM.
- Develop the concepts and underlying theory of modeling and the usage of models in different engineering applications
- Compare the different types of modeling techniques
- Understand construction and working of CNC machines
- Write a part programme for CNC Turning centres and CNC machining centres
- Prepare part model, assembly of given components in solid modeling software
- Generate part programme for turning and milling operations by using part programming software

TEXT/ REFERENCE BOOKS

1. CAD-CAM and Automation, Farazdak Haideri, Nirali Prakashan
2. Computer Aided Manufacturing, Rao, Tewari, Kundra, McGraw Hill
3. CNC Machines, Pabla B.S. &Adinathan, New Age publishers
4. Mastering CAD/CAM, Ibrahim Zeid, Mc Graw Hill international

5. Mathematical Elements of Computer Graphics, Roger and Adams, McGraw Hill
6. Computer Aided Design and Manufacturing, Sadhu Singh, Khanna Pub.
7. CAD/CAM, Zimmer & Groover P., Prentice Hall of India
8. CNC Programming, Sinha S. K., Galgotia Publications

(MH611) CONTROL ENGINEERING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To improve knowledge of students about Mathematical modelling of various physical system
- To improve knowledge of students about time response analysis of 1st order & 2nd order systems
- To enhance ability of student to calculate steady state error & understand various controller action
- To know about various methods for finding stability of the system
- To enhance knowledge of student about microcontroller & Arduino

DETAILED SYLLABUS

1 BASIC CONTROL SYSTEM

System differential equation of electrical, mechanical, thermal, hydraulic and electromechanical network, analogy

2 THEORY OF AUTOMATIC CONTROL

Concept of feedback referred to linear control systems in general, e.g. displacement and speed control, process control, definition and terminology, open loop and closed loop systems and its advantages. Block diagrams and signal flow graph representation of a physical system, block diagram algebra, transfer function from a block diagram. Basic control actions and controllers – on – off. Proportional, derivative and integral controllers, steady – state analysis. Transient response of first order and second order systems to step, ramp and sinusoidal input, steady state errors, Applications of Laplace transform methods, Routh's stability criteria and root locus methods improving system performance.

3 HYDRAULIC CONTROL

Characteristic of hydraulic components control valves, sources of hydraulic power hydraulic meters, pistons and transmission, elements of circuit design, Accumulation control circuit such as position control and speed control circuit

4 PNEUMATIC CONTROL

Pneumatic power supply, Amplifiers with different controlling actions, Pneumatic valves and cylinders, theory of four way and pilot valves.

5 ELECTRICAL CONTROL SYSTEMS

Speed control of D.C. motors, Remote control positional servo mechanism (including effect of gearing between motor and load).

6 MICROCONTROLLER BASED DIGITAL CONTROL

Microcontrollers & microprocessors, 8051 architecture, 8051 assembly language programming, Jump Loop & call instructions, Counters & timers, 8051 addressing modes, arithmetic logic instructions & programs

7 ARDUINO AND MOTION LOGIC DRIVE BASED DIGITAL CONTROL

Introduction of hardware & software, Basics of Arduino, Functional block diagram of Arduino, Functions of each pin of Arduino, Arduino development board diagram (including different blocks): IDE, I/O functions, looping techniques, decision making techniques, Programming of an Arduino, basic circuit for Arduino, basic interfacing & i/o concept, interfacing LED, switch and seven segment LED & its code. Introduction to motion logic drive (Hardware & software), Programming in motion logic drive

LEARNING OUTCOMES

After learning the course, the students should be able to;

- Make mathematical model as well as should be able to find transfer function of various physical system.
- Understand basics of Microcontroller & Arduino
- Get knowledge about various methods to find stability.
- Find stability of the system.
- Understand use of motion logic drive

TEXT/ REFERENCE BOOKS

1. Control Systems Engineering, Nagrath & Gopal, New Age International Publishers
2. Modern Control Engineering, Ogata K, Pearson Education
3. Exploring Arduino: Tools and Techniques for Engineering Wizardry, Jeremy blum, Willey Publication
4. The 8051 microcontrollers and embedded systems, Muhammad Ali Mazidi, Janice Gillispie Mazidi & Rolin D. Mckinlay, Pearson Education
5. Automatic Control System, Kuo, Benjamin.C, Prentice Hall
6. Control Systems Engineering, Nise, Norman S John Wiley & Sons, New York
7. Control Systems Engineering, S. K. Bhattacharya, Pearson Education
8. Control Engineering, D. Ganesh Rao, K. Chennavenkatesh Pearson Education

(MH612) HEAT AND MASS TRANSFER

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To understand the fundamentals of heat transfer mechanism, their applications in various heat transfer equipment in industries.
- To develop methodologies for solving a wide variety of practical engineering problems related to heat transfer.

DETAILED SYLLABUS

1 INTRODUCTION

Thermodynamics vs. Heat transfer, Modes of Heat transfer, basic laws of heat transfer, steady and unsteady state of heat transfer

2 HEAT CONDUCTION

Fourier's law, Thermal resistance, thermal conductivity of material, general heat conduction equation in Cartesian, cylindrical and spherical coordinate system

Steady state one dimension heat conduction- Heat conduction through plane and composite wall, heat flow between surface and surroundings, overall heat transfer coefficient, heat conduction through hollow and composite cylinders, heat conduction through hollow and composite spheres, Shape Factor, effect of variable conductivity, critical thickness of insulation

Heat transfer from extended surfaces- heat flow through rectangular fin, heat dissipation from an infinitely long fin, a fin insulated at the tip and fin loosing heat at the tip, Fin performance

Unsteady state heat conduction-Transient conduction in solid with infinite thermal conductivity, Time constant and response of thermocouple, Transient conduction in solid with finite conduction and convection resistance

3 HEAT CONVECTION

Basic law of heat convection, Free and Force convection

Dimensional analysis-Dimensional homogeneity, Methods of dimensional analysis, Dimensional analysis applied to force and free convection, Dimensional numbers and their physical significance

Empirical relation for free convection and forced convection- Bulk temperature and mean film temperature, Local and average convection coefficient, Correlations for force convection, Correlations for free convection

Force convection-Hydrodynamic Boundary layer, thicknesses of boundary layer, continuity, momentum and energy equations for force convection, Blasius solution for

laminar boundary layer, General solution of Von- Karman integral momentum equation

Free convection-characteristic parameters, momentum and energy equations for laminar free convection heat transfer on vertical plate

4 HEAT RADIATION

Thermal Radiation Basic relations-Surface emission properties, absorptivity, reflectivity and transitivity, black, white and grey body, emissive power and emissivity, important laws of radiation, intensity of radiation and solid angle

Radiation heat exchange between surfaces-black bodies, shape factor, heat exchange between non-black bodies- infinite parallel planes and infinite long concentric cylinder, small grey surfaces, small body in large enclosure, Electrical network approach for radiation heat exchange. Radiation shield, error in temperature measurement due to radiation

5 HEAT EXCHANGER

Classification of heat exchanger, performance analysis, overall heat transfer coefficient, LMTD, Correction factor for multi-pass arrangement, effectiveness and NTU, Limiting value of capacity ratio

6 CONDENSATION AND BOILING

Condensation-Laminar film condensation on vertical plate, turbulence film condensation, convective coefficient for film condensation on tube

Boiling-Boiling regimes, Bubble growth and nucleate boiling, boiling correlation

7 MASS TRANSFER

Classification, Concentration, velocity and fluxes. Fick's law, General equation of mass diffusion, Steady state diffusion, Mass transfer coefficient

LEARNING OUTCOMES

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

- Understand the basic laws of heat transfer.
- Analyze problems involving steady state heat conduction
- Develop solutions for transient heat conduction.
- Apply empirical correlations for forced and free convection to determine values for the convection heat transfer coefficient which is calculate heat transfer rates.
- Analyze heat exchanger performance by using the LMTD method and NTU method
- Calculate radiation heat transfer between black body surfaces and gray body surfaces.
- Understand boiling and condensation process.

TEXT/ REFERENCE BOOKS

1. Heat and Mass Transfer, R.K. Rajput, S.Chand Publication
2. Heat and Mass Transfer, D.S.Kumar, S.K Kataria and sons
3. Heat Transfer – A Practical Approach, Cengel Y A, McGraw Hill

4. A text book on heat transfer, S.P. Sukhatme, University Press
5. Fundamentals of Heat and Mass Transfer, D.P. Incropera, P.P. and Dewitt, Wiley Eastern
6. Convective Heat Transfer, Adrian Bejan, Wiley India.
7. Heat Transfer, J. P. Holman, McGraw Hill
8. Heat and Mass Transfer, Domkudawararora, Dhanapt rai & CO.
9. Heat and Mass Transfer, P.K .Nag, McGraw Hill

(MH613) MACHINE DESIGN - II

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- Primary objective is to present the fundamental of fatigue and surface failure phenomenon.
- To learn the design of various components subjected to fluctuating load like gears, gear box.
- To learn about design of sliding and rolling contact bearings.
- To understand the importance of tribological principle to improve design and service life of tribo-elements.

DETAILED SYLLABUS

1 DESIGN AGAINST VARYING LOAD

Stress concentration – causes and remedies, stress concentration factors, fluctuating stresses, fatigue failure, S-N curve, endurance limit, notch sensitivity, design for finite and infinite life, Soderberg and Goodman lines, modified Goodman diagrams, Gerber equation, fatigue design under combine stresses, impact stresses

2 SURFACE FAILURE

Introduction, surface geometry, mating surfaces, friction, effect of roughness on friction, effect of velocity on friction, rolling friction, effect of lubrication on friction, adhesive wear, abrasive wear, corrosive wear, surface fatigue, spherical contact, cylindrical contact, general contact, surface fatigue failure models, surface fatigue strength

3 BEARINGS

Introduction, types of rolling contact bearings, comparison of rolling and sliding contact bearings, selection of rolling bearing type, static and dynamic load carrying capacity, equivalent bearing load, bearing life, load factor, design for cyclic loads and speeds, probability of survival, bearing mounting, failure of rolling contact bearing, causes and remedies, lubricants, viscosity, basic modes of lubrication, material combination in sliding bearings, hydrodynamic lubrication theory, design of hydrodynamic journal bearings, journal bearing failure causes and remedies, viscous flow through rectangular slot, design of hydrostatic bearing

4 GEARS

Overview of gear drive terminology, standard systems of gear tooth, gear material selection, force analysis of spur gear, minimum no. of teeth, estimation of module based on beam and wear strength for gears, design of spur gears, virtual number of teeth, force analysis of helical gears, design of helical gears,bevel gear geometry, force analysis of bevel gears, design of bevel gears, worm set geometry, force analysis of worm set, design

of worm set, lubrication of gearing

5 DESIGN OF GEAR BOXES

Basic considerations in design of drives, determination of variable speed range, preliminary steps in the design of multi speed gear box, structure diagram, graphical representation of ray and speed diagram, rules and guidelines for layout

6 TRIBOLOGY ASPECTS OF MACHINE ELEMENTS

Introduction, Friction and wear of gears and bearings, contact stresses, lubrication of spur gears, surface failures, offline monitoring of gears, online monitoring of gears

LEARNING OUTCOMES

- By completing this course student will be able to apply fundamental principles of fatigue and stress concentration while designing various components.
- Student will be able to design various types of gears, gear box and bearings.
- Student will also be able to understand the basic tribological principle for optimum design and to improve service life of tribo-elements.

TEXT/ REFERENCE BOOKS

1. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd.
2. Machine Design- An Integrated Approach, Robert L. Norton, Pearson Education, Inc.
3. Machine Tool Design and Numerical Control, N. K. Mehta, Tata McGraw-Hill Education Pvt. Ltd.
4. Mechanical Engineering Design, Shigley J.E. and Mischke C.R., McGraw Hill Publ. Co. Ltd.
5. Fundamental of Engineering Tribology with Application, Harish Hirani, Cambridge University Press.
6. Design of Machine Elements, M. F. Spott, T. E. Shoup, L. E. Hornberger, S. R. Jayram& C. V. Venkatesh, Pearson Education Inc.
7. Machine Design, Black P.H. and O. Eugene Adams, McGraw Hill Book Co.Ltd.
8. Design Data (PSG College of Engg. & Tech.), DPV Printers.
9. Mechanical Design Data Book, V. S. Konnur& A. A. Memon, New Popular Prakashan, Surat.

(MH614) STEAM AND GAS TURBINES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

The objective of the course work is to introduce students with:

- Basic concepts of Compressible flow, Steam and Gas Turbine cycles.
- Thermodynamics of steam flow through nozzle.
- Types of Steam and Gas Turbines with their variants.
- Basics of combustion phenomenon in Gas turbine.
- Construction and requirements of Gas Turbine components.
- Principle of Propulsion, different types of propulsion systems and their performance parameters.

DETAILED SYLLABUS

1 POWER GENERATION CYCLES

Rankine cycle:Thermodynamics of Rankine cycle, Effect of increasing maximum pressure, Effect of reducing exhaust pressure, Modifications (Super heating, Reheat, Regenerative, water extraction, Binary vapour power cycle), ideal working fluid for vapour power cycle, Brayton cycle**:** Open and closed cycle arrangement, Modifications in ideal and actual cycle (Reheat, Regeneration, Intercooling and their combinations), combined cycle power plant.

2 COMPRESSIBLE FLOW

Stagnation properties, Speed of sound and Mach number, One dimensional isentropic flow, Variation of fluid velocity and fluid pressure with area, Introduction to Shock waves

3 NOZZLE

Introduction, Types of nozzle and diffuser, Critical pressure ration and chocked flow, Flow in steam nozzle, Nozzle efficiency, Effect of back pressure in convergent divergent nozzle, Super saturated flow in nozzle

4 STEAM TURBINE

Working principle of steam turbine, Types of steam turbine, Impulse and Reaction turbine (Velocity diagram, Diagram work, Diagram efficiency, Compounding of turbine, Effect of blade friction, optimum velocity ratio and maximum work done), Effectiveness of moving row in velocity compounding, Degree of reaction in reaction turbine, steam turbine governing, Energy losses in turbine, Back pressure and Pass out turbine, design of turbine blades in different stages, casing design and other design aspects.

5 GAS TURBINE

Combustion chamber: Combustion theory applied gas turbine, Factors affecting combustion chamber design and their performance, Requirements of combustion chamber, Process of combustion in Gas turbine, Combustion chamber geometry and its arrangement.

Turbine rotor: Rotor blade material and its selection, Blade fixing, Problems of high temperature operation, Blade cooling

Pollution control in gas turbine plants, materials for gas turbine plants, different fuels used.

6 INTRODUCTION OF JET PROPULSION

Principal of Jet propulsion, Types of propulsion systems (Ram jet, Pulsejet, Turbo prop, Turbo jet, Turbofan), Thrust and thrust power, Propulsive power and efficiency, thermal and overall efficiency of jet, Specific fuel consumption.

LEARNING OUTCOMES

After successful completion of the course, student should be able to:

- Understand basic concepts of compressible flow, Steam and Gas Turbines.
- Analyse thermodynamic cycles of Steam Turbine with different variants of it.
- Analyse thermodynamic cycles of Gas Turbine with different variants of it.
- Understand combustion phenomenon in Gas Turbine.
- Understand the construction of Turbine components.
- Understand the concepts of Jet Propulsion systems.

TEXT/ REFERENCE BOOKS

1. Power Plant Engineering, P.K. Nag, Tata McGraw Hill Publication.
2. Gas Turbines, V. Ganeshan, McGraw Hill Publication.
3. Steam Turbine, R. Yadav, Khanna Publications.
4. Thermodynamics - An Engineering Approach, Yunus A. Cengel, McGraw Hill Publication
5. Fundamentals of Compressible Flow, S. M. Yahya, New Age International Publishers
6. Gas Turbine Theory,Cohn H. Rogers, GFC and H. I. H. Saravanamutto, Pearson Education Ltd
7. Gas Dynamics and Space Propulsion, M.C. Ramaswamy, Jaico Publishing House
8. Gas Dynamics, Rathakrishnan, Prentice Hall India
9. Steam Turbine Theory and Practice, William J. Kearton, CBS Publication

(MH615) OPTIMIZATION TECHNIQUES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

- To provide students the knowledge of optimization techniques and approaches.
- To enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.
- To teach students about networking, inventory, queuing, decision and replacement models.
- To introduce students to research methods and current trends in Operations Research.

DETAILED SYLLABUS

1 INTRODUCTION

Definition and concept of Operation Research (OR), History of OR, Methodology of OR, Applications of OR, Techniques used in OR, non-traditional optimization techniques

2 LINEAR PROGRAMMING

Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Primal and Dual Problems, Economic Interpretation, Sensitivity analysis

3 TRANSPORTATION TECHNIQUES

Transportation problems definition, Solution methods: North-west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, stepping stone method, Modified Distribution method, Un-balanced problems and profit maximization problems, Transshipment Problems

4 ASSIGNMENT TECHNIQUES

Assignment problems definition, Hungarian method for solution, variation of assignment problem-non square matrix, restriction on assignments, maximization problem, travelling salesman problem

5 QUEUING THEORY

Terms used in queuing theory, Kendall's notation, classification of queuing models- model 1 single server unlimited queue (M/M/1) : (α/FCFS), model 2 (M/M/1) : (N/FCFS)

6 CPM AND PERT

Terms used in network analysis, Network or arrow diagram, Fulkerson's rule, Project evaluation and review technique (PERT), Critical path method (CPM), Crashing of

network

7 INVENTORY CONTROL

Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis

8 GAMES THEORY

Introduction, Characteristics of Game Theory, Two Person-Zero sum games, Pure strategy, Mixed strategies (2x2, mx2, 2xn), Arithmetic, Dominance theory, Sub game, Algebraic and graphical methods, Linear programming method to solve game

9 REPLACEMENT MODELS

Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy

LEARNING OUTCOMES

After successful completion of the course, student will be able to;

- Apply operations research techniques like L.P.P, Dynamic programming, network analysis in industrial optimization problems.
- Solve transportation problems using various OR methods.
- Illustrate the use of OR tools in a wide range of applications in industries.
- Analyze various OR models like Inventory, Queuing, Replacement, Decision etc. and apply them for optimization.
- Gain knowledge on current topics and advanced techniques of Operations Research for industrial solutions.

TEXT/ REFERENCE BOOKS

1. Operation Research, Gupta P. &Hira D.S., S. Chand & Company Ltd.
2. Quantitative Techniques in Management, N D Vohra, Tata McGrawHill
3. Operations Research: An Introduction, Hamdy Taha, Pearson
4. Operations Research, R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
5. Quantitative Techniques for Managerial Decisions, J. K. Sharma, MacMillan India Ltd.
6. Optimization Methods for Engineers, N.V.S. Raju- PHI Publication

ALTERNATIVE ENERGY SOURCES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

- To understand the need for alternative energy sources.
- To make the students understand the basic as well as latest technical knowledge of alternative energy sources.
- To make the students understand various applications of alternative energy sources

DETAILED SYLLABUS

1 INTRODUCTION

Present energy scenario in India, need of the non- conventional energy sources, various conventional & non-conventional energy sources and their comparison

2 SOLAR ENERGY

Sun-Earth geometry, characteristics & estimation of solar radiation, instruments for solar radiation measurements. Types of solar collector – flat plate & concentrating. Energy calculations for flat plate type parabolic concentrator type collector, collector efficiency calculation, Selective paints & surfaces for collectors

3 SOLAR APPLICATIONS

Heating of air & water for building and other uses. Active & passive systems, solar pumps, solar refrigeration & air conditioning solar cookers, solar furnaces, photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and limitations, Thermal Storages and Solar ponds – principle & its uses

4 WIND ENERGY

power in wind, power coefficient,different types of wind turbines, design criteria and material selection and economics, site selection, advantages and disadvantages, applications, wind energy development in India

5 BIOMASS CONVERSION

Photosynthesis & generation of bio-gas, digester and their design, selection of material, feed of digester, gasification, types and application of gasifiers

6 TIDAL ENERGY

Site selection, different method of using tidal power, single basin, double basin, advantages and imitation **Ocean Thermal Energy Conversion**-Principle of utilization, open cycle OTEC system, closed cycle, hybrid cycle

7 MAGNETO HYDRO DYNAMIC POWER PLANT

Introduction, Principle of MHD power generation, open cycle plant, closed cycle plant, liquid metal system, advantages and limitations **Thermo Electric Power Plants-**Principle of power generation, materials used, advantages and limitations

8 GEO-THERMAL ENERGY

Sites, potentiality, resources, different conversion systems and other uses of geo-thermal sources, advantages and limitations. Prospects of geothermal energy in India

9 FUEL CELLS

Principle of operation, free energy change and cell potentials; effects of temperature and pressure on cell potential; energy conversion efficiency; factors affecting conversion efficiency; polarization losses, types of fuel cells: Alkaline fuel cell, Proton Exchange Membrane fuel cell, Phosphoric acid fuel cell, Molten carbonate fuel cell, solid oxide fuel cell. Applications of fuel cells

LEARNING OUTCOMES

After learning the subject; students will be able to:

- Understand the need for alternative sources of energy.
- Know various alternative sources and their energy conversion techniques, applications, comparison.
- Select and develop commercially feasible systems for various regions.

TEXT/ REFERENCE BOOKS

1. Renewable Energy Sources and Emerging Technologies by: Kothari D. P., Singal K. C., Ranjan Rakesh, Publisher: PHI ISBN No.: 9788120344709
2. Non-conventional Energy Sources – G.D. Rai, Publisher: Khanna publisher
3. Solar Energy - Principles of thermal collection and storage, S. P. Sukhatme, Publisher: Tata McGraw-Hill
4. Solar Energy, Garg and Prakash
5. Solar Energy Utilization, G.D. Rai

ENERGY CONSERVATION AND MANAGEMENT

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	0	60	40	---	---	100	4	0	0	4

OBJECTIVES OF THE COURSE

- To provide detailed understanding of energy conservation and management, 3Es (Energy, Economics and Environment) and their interaction, energy audit and financial management.

DETAILED SYLLABUS

1 ENERGY SCENARIO

Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future

ENERGY CONSERVATION ACT 2001 AND RELATED POLICIES

Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction

2 FINANCIAL MANAGEMENT AND ENERGY MONITORING AND TARGETING

Investment-need, appraisal and criteria, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs)

ENERGY MONITORING AND TARGETING

Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS)

3 ENERGY MANAGEMENT & AUDIT

Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering

4 ENERGY EFFICIENCY IN THERMAL UTILITIES AND SYSTEMS:

Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation, Thermic fluid heaters, super critical boilers

Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance assessment more details, installation, thermo-compressor, steam pipe insulation, condensate pumping, steam dryers

Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery. Forging furnace heat balance, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace, hot air generators.

Insulation and Refractories: Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss. Cold insulation.

Heat Exchangers: Types, networking, pinch analysis, multiple effect evaporators, condensers, distillation column, etc.

Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential.

Cogeneration: Definition, need, application, advantages, classification, saving potentials. Heat balance, steam turbine efficiency, tri-generation, micro turbine.

Heating, ventilation, air conditioning (HVAC) and Refrigeration System: Factors affecting Refrigeration and Air conditioning system performance and savings Opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system and saving potential, heat pumps and their applications, section on ventilation system, ice bank system, and performance assessment of window and split room air conditioners, Star labeled pumps, cold storage refrigeration, and humidification system

5 ENERGY AND ENVIRONMENT, AIR POLLUTION, CLIMATE CHANGE:

United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM – Bachat Lamp Yojna and industry; Prototype Carbon Fund (PCF).

LEARNING OUTCOMES

- Understand the basic knowledge of different terms & principles of energy conservation, audit and management.
- Evaluate the energy saving & conservation in different mechanical utilities.
- Understand efficient heat & electricity utilization, saving and recovery in different thermal and electrical system.

- Prepare energy audit report for different energy conservation instances.

REFERENCE BOOKS

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4
4. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing
6. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill

(MH616) AUTOMOBILE SYSTEMS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- To study basic and advance automotive transmission system.
- To study working of different automotive systems and subsystems.
- To study different vehicle layouts.
- To have basic idea about how automotive systems are developed.

DETAILED SYLLABUS

1 VEHICLE CLASSIFICATION AND LAYOUTS

Study various vehicle layouts as front engine and front wheel drive, front engine & rear wheel drive, rear engine & rear wheel drive, Components of transmission system, Four wheel drives

2 CHASSIS FRAMES AND BODY

Types of Chassis frames & body, Material, Frameless construction

3 PERFORMANCE OF VEHICLE

Vehicle motion, Resistances during motion, Power required for acceleration and constant velocity motions, Tractive efforts and draw bar pull, Power required and engine characteristics, Gear ratio requirement

4 CLUTCH

Functions, Type of clutches, Single, Multiple, Centrifugal, Electromagnetic and hydraulic clutches, Lining material, Release mechanism, Fluid flywheel

5 GEAR BOX

Types of gear boxes, Sliding mesh, Constant mesh, Synchromesh, Epicyclic gear boxes, Gear ratios, Transfer case, Semi-automatic transmission system

6 AUTOMATIC TRANSMISSION

Requirements, types, Torque converter, Epicyclic gearbox, Continuously variable transmission, Overdrive

7 DRIVE LINE AND AXLES

Propellers shaft, Types of drive as torque tube and hotch kiss drive, Final drive types, Bevel, Hypoid, Worm and worm wheel, Type of drive axles & differential, Fully or semi floating and three quarter floating

8 STEERING AND FRONT AXLE

Steering requirements, Steering system and linkages, Steering gears, Steering geometry, Ackermann linkages, Wheel alignment, Toe-in, Toe out, Caster, Camber, king-pin inclination, Under steer and over steer conditions, Power steering

9 SUSPENSION SYSTEM

Purpose, Types of suspension system, Front and rear suspension, Coil spring, Leaf spring, Torsion bars, Shock absorbers, Air and rubber suspension, Plastic suspensions, Independent suspension, Antiroll bar or stabilizer

10 BRAKES

Function, Internal expanding brakes, Brake lining material, Properties, Hydraulic braking system, Brake oil, Bleeding of brakes, Pneumatic braking system, Vacuum brakes, Antilock braking system, Parking brake and braking efficiency

11 WHEELS AND TYRES

Types of wheel rims, Types of tyres, Cross ply, Radial & tubeless tyres, Specifications of tyres, wheel balancing

12 BATTERY AND SAFETY SYSTEM

Battery:Construction, working, methods of rating, charging methods, test, generator and cranking motor with drive purpose,

Modern technique, Safety provisions,like air bags/ safety belts, Traction control system

13 HYBRID AND ELECTRIC VEHICLE DRIVETRAIN

Introduction to Hybrid Electric Vehicles, Architecture of hybrid and electric vehicles, Working of parallel, series parallel and complex drive trains and power flow in each case, Regenerative braking, Control system for hybrid and electric vehicles

LEARNING OUTCOMES

- Upon completion of this course, the students can practically identify different automotive systems and subsystems, practically identify different automotive components. Illustrate working and functions of various automotive components.

TEXT/ REFERENCE BOOKS

1. Vehicle and Engine Technology, Heinz Heisler, Arnold, London
2. Automobile Engineering Vol- I & II, Dr. Kirpal Singh, Standard Pub & Dist1.Automobile Mechanics, Crause, W.H., Tata McGraw Hill
3. Automobile Engineering, R. B. Gupta, Satya Prakashan
4. Automobile Technology, Dr. N. K. Giri, Khanna Publishers
5. Automobile Engineering, Narang G.B.S., Khanna Publishers

(MH617) QUALITY MANAGEMENT AND RELIABILITY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- The aim of this course is to provide students with a basic understanding of the approaches and techniques to assess and improve process and/or product quality and reliability.
- The objectives are to introduce the principles and techniques of Total Quality Management and their practical uses in product and/or process design and monitoring.
- To understand techniques of reliability engineering tools.

DETAILED SYLLABUS

1 INTRODUCTION

Quality – Concept, Different Definitions and Dimensions, Inspection, Quality Control, Quality Assurance and Quality Management, Quality as Wining Strategy, Definition of SQC, benefits and limitation of SQC, Views of different Quality Gurus

2 Total Quality Management (TQM)

Introduction, Definitions and Principles of Operation, Tools and Techniques, such as,Quality Circles, Total Quality Control (TQC), Total Employee Involvement (TEI), 7QC Tools, PDCA Cycle, 7 New Quality Improvement Tools, TQM Implementation and Limitations

3 Quality Systems

Need for ISO 9000, ISO 9000-2000 Quality System – Elements, Documentation, ISO 14000 – Concepts, Requirements and Benefits, Case studies of TQM implementation in manufacturing and service sectors

4 Recent trends in quality management

5s, Poka-Yoke, Kaizen, Lean manufacturing, Agile Manufacturing, World Class Manufacturing, Six Sigma, JIT, Kanban, Cost of Quality, TPM, OEE, Single Piece Flow, Andon system, SMED, Advantages and Limitation of all as applicable

5 DESIGN FOR QUALITY

Introduction to Concurrent Engineering, Quality Function Deployment (QFD), Failure Mode and Effect Analysis (FMEA) – Concept, Methodology and Application

6 Introduction to Design of Experiments

Introduction, Methods, Taguchi approach, Achieving robust design, Steps in experimental design

7 Introduction to Probability Theory

Fundamental laws of probability, Random variables; Probability distribution function;

Discrete and continuous distribution; Histogram and Normal distribution curve, Mean variance and standard deviation of a distribution function

8 RELIABILITY CONCEPTS

Reliability Engineering Fundamentals, Basic Elements of Reliability, Measurement of Reliability, Maintenance and Reliability, Quality and Reliability, System Reliability

LEARNING OUTCOMES

After successful completion of the course, student will be able to;

- Understand basic techniques for quality control, improvement and management.
- Understand the modern practices in quality management.
- Understand the concept of design for quality.
- Acquire fundamental knowledge of statistics and probability.
- Understand Reliability concepts

TEXT/ REFERENCE BOOKS

1. Statistical Quality Control, M. Mahajan, Dhanpat Rai Publication
2. Total Quality Management, P. M. Charantimath, Pearson Education
3. Total Quality Management, S. Ramasamy, Tata McGraw Hill
4. Quality Management: A process improvement approach,M. A. Fryman, Cengage Learning
5. Total Quality Management, P. N. Mukherjee, Prentice-Hall of India
6. Total Quality Management- Principles and Practices, Tools and Techniques, K. Suri, Katson Books Publication
7. Taguchi Techniques for Quality Engineering, P. J. Ross, Tata McGraw Hill

DESIGN OF PRESSURE VESSELS AND PIPING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- The course aims to impart basic knowledge of design of pressure vessels and piping system.
- It is also aimed to introduce use of various standards used for the pressure vessel design.
- It is aimed to develop understanding of basic membrane stress and deflection analysis of axisymmetric vessels and its applications amongst students.

DETAILED SYLLABUS

1 STRESSES IN VESSELS

General theory of membrane stresses in vessel under internal pressure and its application to shells (cylindrical, conical and spherical) and end closures, bending of circular plates and determination of stresses in simply supported and clamped circular plate, thermal stresses, stress concentration in plate having circular hole due to bi-axial loading, excessive elastic deformation, plastic instability, brittle, rupture and creep, theory of reinforced opening and reinforcement limits

2 DESIGN OF VESSELS USING CODES

Introduction to ASME cods for pressure vessel design, pressure vessel and related components' design using ASME codes, supports for short vertical vessels, stress concentration at a variable thickness transition section in a cylindrical vessel, design of nozzles

3 SUPPORTS FOR VERTICAL AND HORIZONTAL VESSELS

Design of base plate and support lugs, types of anchor bolt, its material and allowable stresses, design of saddle supports

4 OTHER DESIGN CONSIDERATIONS

Buckling phenomenon, elastic buckling of circular ring and cylinders under external pressure, collapse of thick walled cylinders or tubes under external pressure, effect of supports on elastic buckling of cylinders, design of circumferential stiffeners, buckling under combined external pressure and axial loading, Fatigue, shock, high pressure, high temperature, irradiation, corrosion, and other hostile environments, high strength, lightweight pressure vessels, vessels resistant to external high pressures found in undersea exploration, offshore drilling, and mineral mining

5 PIPING ANALYSIS

Flow diagram, piping layout and piping stress analysis, flexibility factor and stress intensification factor; design of piping system as per B31.1 piping code, piping

components: bends, tees, bellows and valves, types of piping supports and their behaviour; Introduction to piping Codes and Standards

LEARNING OUTCOMES

Upon completion of this course, the student will be able to;

- select material required for the pressure vessel design and different terms associated with it.
- analyze different stresses in pressure vessels for shells and closures.
- design shells, end closures and nozzles of pressure vessels using ASME codes
- design pressure vessels according to ASME code specifications
- analyze stress concentration effects in pressure vessels and avoid fracture growth.
- analyse piping systems

TEXT/ REFERENCE BOOKS

1. Mechanical System Design, Farazdak Haideri, Nirali Prakashan
2. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd
3. Fundamentals of Machine Components Design, Juvinal R.C, Wiley, India
4. Pressure vessel design, Harvey J F, CBS publication
5. Process equipment design, Brownell L. E & Young. E. D, Wiley Eastern Ltd., India
6. ASME Pressure Vessel and Boiler code, Section VIII Div 1, 2, and 3.
7. American standard code for pressure piping, B 31.1
8. Pressure vessel Design Hand book, Henry H Bednar, CBS publishers and distributors
9. Design Data (PSG College of Engg. & Tech.), DVP Printers

TRIBOLOGY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
4	0	2	60	40	25	25	150	4	0	1	5

OBJECTIVES OF THE COURSE

- India is one of the fastest developing nation around the globe. Addition to that population of country is increases every day. In order to satisfy basic necessities and amenities in future generation large amount of infrastructure is required. To meet this challenge large amount of machinery will be required in future. Currently we are importing various machinery around the globe which creates dependency on other nation. Concept of tribology basically helps engineers to develop machines with long life and improved performance. So, in order to develop such machinery with updated technology in India, basic knowledge of tribology can helpful young engineer to develop various in house machinery.

DETAILED SYLLABUS

1 INTRODUCTION

Introduction to tribology, Introduction to bearings, properties of lubricants, viscosity index, effect of pressure and temperature on viscosity

2 FRICTION AND WEAR

Introduction, Concept of tribo-system, Laws of friction, Theory of Friction, Types of friction, Friction properties of metallic and non-metallic materials, effects of friction, COF, friction reducing measures, Wear, causes of wear, types of wear, wear of different materials, effect of wear, steps of wear prevention

3 LUBRICATION AND LUBRICANTS

Importance of lubrication, boundary lubrication, mixed lubrication, hydrodynamic lubrication, hydrostatic lubrication, Elastohydrodynamic lubrication, Types & Properties of Lubricants, lubricant additives, SAE classification, smart lubricants

4 HYDRODYNAMIC THEORY OF LUBRICATION

Introduction, Various theories of lubrication, Petroffs equation, Reynold's equation, mechanism of pressure development, plane-slider bearing, idealized journal bearing, step bearing, analysis of finite bearing

5 HYDROSTATIC LUBRICATION

Principle of hydrostatic lubrication, fixed restrictor, hydrostatic step bearing, rectangular thrust bearing, multirecess journal bearing

6 ELASTO-HYDRODYNAMIC LUBRICATION

Principles and application, Hertz theory, Pressure-viscosity term in Reynold's equation, Ertel-Grubin equation, Rolling element bearings, EHL of Gear teeth contact

7 TRIBO MEASUREMENT

Friction and wear measurements, Bearings performance measurements, Rolling element bearing endurance test, Material characterization techniques

LEARNING OUTCOMES

By completing this course student will be able

- To understand fundamentals of machinery or equipment based on system theory.
- To develop methodology to design any machinery.
- To learn multidisciplinary approach to solve problems related to maintenance as interdisciplinary knowledge is basics of Tribology.

TEXT/ REFERENCE BOOKS

1. Introduction to tribology of bearings, Majumdar B. C., S. Chand & Company Ltd.,2010.
2. Fundamentals of engineering Tribology with applications, Harish Hirani, Cambridge University Press, Delhi.
3. Basic Lubrication Theory, Cameron A., Ellis Horwood Ltd., UK, 1981Introduction to Physical Metallurgy by Sidney Avner
4. Engineering Tribology, Williams, J.A., Oxford Univ. Press, 1994.
5. Tribology Hand Book, Neale, M.J., Butterworth Heinemann, 1995.
6. Tribology in Machine Design, Stolarski, T.A., Industrial Press, 1990.
7. Tribology in industries, Sushil Kumar Srivastava, Chand & Company Ltd., 2011.
8. Tribology a system approach to the science and technology of friction, lubrication and wear by Horst Czichos, Elsevier scientific publishing company, New York. 1978

(MH710) MECHANICAL VIBRATIONS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- To understand the importance of vibrations in mechanical machineries and to develop the mathematical model for them. And also to learn the solution methods to obtain their responses.
- To understand the working principle and applications of various vibration measuring instruments.

DETAILED SYLLABUS

1 FUNDAMENTALS OF VIBRATION

Introduction, Basic Terminologies, Simple harmonic motion, Degrees of Freedom

2 UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS

Introduction, Derivations of differential equations, Solution of differential equation, Rayleigh's energy method, Torsional vibrations, Equivalent stiffness of spring combinations: spring in series, spring in parallel, inclined springs

3 DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS

Introduction, Different types of damping, over-damped system, critically-damped system, under-damped system, logarithmic decrement, Viscous dampers: Fluid Dashpot, Eddy current damping, Dry friction damping, Solid damping, Slip damping

4 FORCED VIBRATIONS OF SINGLE DEGREE OF SYSTEMS

Introduction, Forced vibration with constant harmonic excitation, Force vibration with rotating and reciprocating unbalance, Forced vibrations due to excitation of support, Absolute amplitude, Relative amplitude, Energy dissipated by damping, Vibration isolation and transmissibility, Force transmissibility, Motion transmissibility

5 TWO DEGREE OF FREEDOM SYSTEMS

Introduction, Principle modes of vibration, Two masses fixed on a tightly stretched string, Double pendulum, Torsional system, Systems with damping, Undamped forced vibration with harmonic excitation, Generalized coordinates and co-ordinate coupling, vibration absorbers, vibration isolation, Introduction to multi-degree of freedom systems

6 CRITICAL SPEED OF SHAFTS

Introduction, Critical speed of a single disc with and without damping, Secondary critical speed, Lateral vibrations

7 VIBRATION MEASURING INSTRUMENTS

Vibrometer, velocity pick-ups, accelerometer and frequency measuring instruments, Introduction to proximeter

LEARNING OUTCOMES

Upon completion of this course the student will be able to:

- Develop and analyze the mathematical model of a free vibration.
- Model the un-damped and damped harmonically excited vibratory systems.
- Measure the response like displacement, velocity, acceleration and frequency of the mechanical system using vibration measuring instruments.

TEXT/ REFERENCE BOOKS

1. Mechanical Vibrations, Grover, G.K., 8th Ed., Nem Chand and Brothers, 2003
2. Mechanical Vibrations, Singh, V.P., Dhanpat Rai & Co
3. Mechanical Vibration, Singiresu S. Rao, 5th Ed., Pearson Publication
4. Mechanical Vibrations, ShrikantBhave, Pearson Publication
5. Theory of Vibration with Applications, Thomson W. T., 5th Ed., Pearson Publication
6. Principles of Vibration, Benson H. Tongue, Oxford University Press
7. Theory of Machines & Mechanisms, P. L. Ballaney, Khanna Publishers, Delhi

(MH711) PRODUCTION PLANNING & CONTROL

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	0	60	40	0	0	100	3	0	0	3

OBJECTIVES OF THE COURSE

- To learn various concepts and methods of Production Planning and Control (PPC) to increase effectiveness of the production function in a business.

DETAILED SYLLABUS

1 INTRODUCTION

Types of Production System; Introduction of Production Planning & Control (PPC) – Definition, Objectives and Functions of PPC;

2 LOCATION SELECTION AND PLANT LAYOUT

Importance of Plant Location; Choice of site for selection; Introduction to Plant Layout – Definitions, Principles and Objectives; Types of Plant Layout – Product, Process, Fixed Position and Cellular.

3 FORECASTING MODELS

Nature and use of forecast, Different forecasting methods: Qualitative and Quantitative.

4 AGGREGATE PLANNING

Introduction, Nature of aggregate planning decisions, Aggregate planning strategies, Aggregate planning methods, Master production plan

5 PROCESS PLANNING AND MATERIAL PLANNING

Introduction of Process Planning – objectives, types, Route sheet; Master Production Schedule (MPS); Materials Requirement Planning (MRP); Lot sizing in MRP Systems

6 PRODUCTION SCHEDULING

Techniques of Scheduling: Gantt Chart, Sequencing, Single Machine Scheduling, Flow Shop Scheduling, Job Shop Scheduling

7 LINE BALANCING

Concept of mass production system, Objective of assembly line balancing, Rank positional weight method

8 WORK STUDY

Method Study: Objectives and procedure for methods analysis, Recording techniques, Micro motion and macro-motion study; Principles of motion economy, Work Measurement: Objectives, Work measurement – time study, Determination of time standards: Observed time, basic time, normal time, rating factors, allowances, and

standard time.

9 STATISTICAL QUALITY CONTROL

SQC Concept, variable and attributes, normal distribution curves and its property charts for variable and attributes and their applications and interpretation (analysis) process capability, Acceptance sampling, sampling plans, OC curves and AOQ curves.

LEARNING OUTCOMES

After successful completion of the course, student will be able to;

- Understand types of Production systems, types of Plant Layout and scheduling techniques.
- Use various recording techniques for improvement in present working method.
- Use SQC techniques for quality control of product/service being delivered.

TEXT/ REFERENCE BOOKS

1. Industrial Engineering and Production Management, M. Mahajan, Dhanpat Rai Publication
2. Industrial Engineering and Production Management, MartandTelsang, S. Chand Publication
3. Industrial Engineering, L. C. Jhamb, Everest Publishing House
4. Production and Operation Management, R. Paneerselvam, PHI Publication
5. Industrial Engineering, V. Deshpande, M. Gor and J. Ravalji, Ria Publishing House
6. Modern Production Management, Buffa, John Willey Publication
7. Theory and Problems in Production and Operation Management, S. N. Chary, Tata-McGraw Hill Publication

(MH712) PRODUCTION TECHNOLOGY

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- To understand about theory of metal cutting and relevant parameters which are related to it and to differentiate the various gear and thread manufacturing processes.
- To know about various types of jigs and fixture devices, types of automats and drive control for machine tools
- To learn introductory concepts of various unconventional machining processes

DETAILED SYLLABUS

1 THEORY OF METAL CUTTING

Principles of metal machining, cutting tools and tool materials, tool signature, mechanics of chip removal, cutting forces and parameters effecting it, cutting fluids, tool wear, tool life, economics of machining. Multi point cutting tools, temperature measurement at tool-work interface and its effects

2 GEAR AND THREAD MANUFACTURING

Different types of Threads manufacturing methods, and tools involved, Different gear forming and generating methods with their special features, Gears finishing processes

3 JIGS & FIXTURES

Definition, its usefulness in mass production, design principles, locating systems and types of locators & clamps, jig bushes, design of jigs and fixtures for various machining operations

4 UNCONVENTIONAL MACHININIG

Process principle**,** process equipment for various un- conventional machining processes like - EDM, wire cut EDM, ECM, ECG, CM, AJM, USM, PAM,IBM, LBM

5 DRIVE AND CONTROLS IN MACHINE TOOLS

Introduction to drives in machine tools, classification of machine tool drives, selection of maximum and minimum speeds and feeds, stepped regulators and stepless regulators for spindle drive

6 SEMI AUTOMATS AND AUTOMATS:

Classification of automats, specifications, Capstan and turret lathes, tooling equipment, bar stock feeding methods, tool layout for turret, capstan and automats, single spindle and multi spindle automats, bar type and chucking type machines their principles of working constructional details and tool setting, transfer machines

LEARNING OUTCOMES

After the successful completion of course student will be able to

- Apply basics of metal machining processes very well with the detailed signature of tools
- Understand forces acting while metal cutting and can draw merchant circle diagram and also able to apply knowledge to economic metal cutting.
- Grasp distinctive knowledge of gear and thread forming and its generating methods. They will also able to understand importance of various non-conventional machining methods.
- Understand various types of jigs and fixtures used in manufacturing industries.

TEXT/ REFERENCE BOOKS

1. Production Technology, HMT
2. Production engineering and science, P. C. Pandey and Singh, Standard Publishers Distributors
3. Jigs and Fixtures by P. H. Joshi, Tata McGraw Hill
4. A Textbook of Production Engineering, P. C.Sharma , S. Chand & Company
5. A Textbook of Production Technology, P. C.Sharma , S. Chand & Company
6. Modern Machining Processes, P. C. Pandey and H. S. Shan, by Tata McGraw Hill
7. Manufacturing Science, A. Ghosh and A. KMallik, East West Press
8. Metal Cutting principles,M C Shaw, Oxford University press

(MH713) REFRIGERATION & AIR CONDITIONING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

A. OBJECTIVES OF THE COURSE:

- To make the students understand various systems of refrigeration and air-conditioning and to evaluate the performance of various systems.

DETAILED SYLLABUS:

1 FUNDAMENTALS OF REFRIGERATION

Reversed Carnot cycle, maximum coefficient of performance, methods of producing cooling effect

2 VAPOUR COMPRESSION SYSTEM

Factors affecting the performance of the system, actual cycle considering different losses, methods of improving COP.

Single load system: single evaporator with multi expansion valves & flash chambers, compound compression system with flash intercooler with single expansion valve

concept of Variable Refrigerant Flow/Volume(VRF or VRV) technology

3 VAPOR ABSORPTION REFRIGERATION SYSTEM

Aqua-ammonia system and its analysis, (Li-Br)-Water system, advantages of absorption system over compression refrigeration system, electrolux refrigerator

4 THERMAL INSULATION AND REFRIGERANTS

Insulations: Desired properties and classification, thickness of insulation,

Refrigerants: thermodynamic, chemical & physical requirements, different types of refrigerants, including eco-friendly refrigerants, Refrigerant mixtures

5 PSYCHROMETRY & AIR-CONDITIONING

Psychrometric properties, Adiabatic saturation and Thermodynamics wet bulb temperature, psychrometric chart, psychrometer, application of first law to psychrometric process, mixing process, working substance in air-conditioning, basic process in conditioning of air, psychrometric process in air conditioning equipment, sensible heat factor (SHF) and its use, Grand sensible heat factor (GSHF) and apparatus dew point (ADP), Effective sensible heat factor (ESHF), Cooling towers, Indoor air quality

6 TRANSMISSION AND DISTRIBUTION OF AIR

Introduction, pressure drop in ducts, pressure drop by graphical method, Economic duct dimensions, methods of duct design

7 AIR-CONDITIONING SYSTEMS

Classification, All year air-conditioning system, Winter air-conditioning, residential, commercial and industrial applications.

8 AIR-REFRIGERATION SYSTEM

Bell-Coleman refrigeration cycle and its analysis, aircraft refrigeration system and its classification, advantages of air cycle for aircraft refrigeration, DART

LEARNING OUTCOMES

After learning the course, the students should be able to:

- Understand and perform analysis of various refrigeration and air-conditioning systems
- Measure the performance parameters on test rig.
- Develop awareness of recent research areas in refrigeration and air-conditioning

TEXT/ REFERENCE BOOKS

1. Refrigeration and Air Conditioning, C.P. Arora, Tata McGraw-Hill New Delhi
2. A course in Refrigeration and Air-Conditioning, S.C. Arora & S. Domkundwar, Dhanpat Rai & Co.
3. Refrigeration and Air Conditioning, Manohar Prasad, Wiley Eastern Ltd.
4. Refrigeration and Air Conditioning, W.F.Stocker and J.W.Jones, McGraw-Hill
5. Principles of Refrigeration, Roy.J Dossat, Pearson Education
6. Refrigeration & air conditioning technology, Whitman, W. C., Johnson, W. M., &Tomczyk, J. Delmar

(MH714) PROJECT

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
0	0	2	---	---	100	---	100	0	0	1	1

- The students are required to prepare term project on given topic.
- The students will undertake project work for the period of full semester. They may opt for design/develop &
- Fabricate small innovative product. They are supposed to prepare and submit a project report as a part of their term work and give presentation on their work. The faculty should monitor the students for their project work regularly every week. They are to be examined based on viva and/or demonstration.

(MH715) ADVANCED MANUFACTURING PROCESSES

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- To understand need of advanced manufacturing processes and to learn about various advanced metal removal processes
- To analyze the welding process behavior for common and newer welding and forming techniques
- To understand basics of rapid manufacturing and rapid tooling

DETAILED SYLLABUS

1 ADVANCED MANUFACTURING PROCESSES

Introduction and need of advance manufacturing processes, classification of unconventional machining processes, merits and demerits

2 ADVANCED METAL REMOVAL PROCESSES

Process principle, metal removal mechanism, parametric analysis and application of various non-conventional machining processes like mechanical energy based processes, chemical and electro-chemical energy based processes, thermal energy based processes, Introduction of hybrid machining processes

3 ADVANCED WELDING PROCESSES

Physics of welding, solid state welding processes, radiant energy welding processes, Estimation of welding cost, Introduction to welding automation

4 ADVANCED METAL FORMING PROESSES

Introduction of metal forming processes, introduction of High Energy Rate Forming processes, merits and demerits of HERF processes, various HERF processes like electromagnetic forming, explosive forming, electro hydraulic forming, stretch forming.

5 ADDITIVE MANUFACTURING

Introduction, rapid product development, classification of rapid prototyping processes, types of rapid prototyping processes, rapid tooling and manufacturing

LEARNING OUTCOMES

- Students will be able to understand various unconventional machining methods
- Students able to understand advanced welding and forming processes and able to estimate cost for welding joints
- Students can able to grasp brief knowledge of additive manufacturing and rapid tooling

TEXT/ REFERENCE BOOKS

1. Materials and Processes in Manufacturing" (8th Edition), E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi
2. Manufacturing Science" A. Ghosh, and A. K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi
3. Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York
4. Rapid Prototyping: Principles and Applications in Manufacturing by Rafiq Noorani, John Wiley & Sons
5. Modern Machining Processes by P. C. Pandey and H. S. Shan, by Tata McGraw Hill
6. Manufacturing Processes for Engineering Materials by S. Kalpakjian and S. Schmid, Prentice Hall
7. Welding Processes and Technology by R. S. Parmar, Khanna Publisher
8. Rapid Tooling: Technologies and Industrial Applications by P.D. Hilton, and P.F Jacobs, CRC press

(MH716) THERMAL SYSTEM DESIGN

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVE OF THE COURSE

- Ability to design and analyse problems in thermal engineering world, including those in real-life contexts with better accuracy.

DETAILED SYLLABUS

1 BASIC CONSIDERATION IN DESIGN

Engineering Design, Formulation of the Design Problem, Steps in the Design Process, Conceptual Design

2 DESIGN OF HEAT EXCHANGER

Review of heat exchanger basics, Basic design methodologies - Number of Transfer Units (NTU) method and Logarithmic Mean Temperature Deference (LMTD) method, Design of double pipe heat exchangers, Shell & tube type heat exchangers, Plate type Heat exchangers, Compact heat exchangers, classification and design methods for Condensers and Evaporators

3 DESIGN OF REFRIGERATION AND AIR CONDITIONING

Review of basics of Refrigeration and air conditioning, Choice of inside design condition, Outside conditions and supply air condition, load calculation and applied Psychrometric, Selection of compressor, condenser, expansion device and evaporator for refrigeration system design, Design of air-conditioning system, Indoor air quality

LEARNING OUTCOMES

- This course builds the foundation for preparing students to work in the area of thermal systems.
- A fundamental understanding of the steps in design consideration.
- An ability to design different types heat exchangers, condenser and evaporators.
- An ability to choose design conditions and able to calculate the load.
- An able to select different parts of refrigeration systems.

TEXT/ REFERENCE BOOKS

1. Thermodynamics: An Engineering approach; Y. A. Cengel; TMH publication
2. Design and optimization of Thermal system; Yogesh Jaluriya; CRC Press
3. Heat Exchanger: Selection, Rating and thermal design; S. Kakac; CRC press

4. Solar Energy; S. P. Sukhatme& J. K. Nayak; TMH Publication
5. Refrigeration and Air-conditioning; Manohar Prasad; New Age international publication
6. Design of thermal system; W. F. Stoecker; Mc Graw Hill Publication
7. Fundamental of heat exchanger design; R. K. Shah; John Wiley & Sons Inc.
8. Fundamental of Engineering Thermodynamics; M. J. Moran & H. N. Shapiro
9. Principle of refrigeration; R. J. Dossat; Pearson publication

HYDRAULIC AND PNEUMATIC SYSTEMS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- Students shall be able to understand fluid power technologies, working principles of hydraulic pumps along with performance, different types of actuators and control valves used in hydraulic and pneumatic, purpose and operation of air filters, regulators, lubricators, dryers etc… and various methods of controlling of pneumatic cylinders

DETAILED SYLLABUS

1 FLUID POWER SYSTEM

Introduction, methods of power transmission, advantages of fluid power, applications of fluid power, types of fluid power systems

2 BASIC PRINCIPLES OF HYDRAULICS

Basic terms and definitions in hydraulics, Pascal's law application,continuity equation, Reynold number, laminar and turbulent flow, Darcy-Weisback equation, losses in pipe and pipe fittings

3 HYDRAULIC FLUIDS

Introduction, Fluid properties, requirements of hydraulic fluids, types and selection of hydraulic fluids

4 HYDRAULIC PUMPS

Introduction, basic elements of hydraulic system, pump classification, gear pump, vane pump, piston pump, pump performance, comparison of various hydraulic pumps

5 HYDRAULIC ACTUATORS

LINEAR ACTUATORS: Introduction, linear actuator classification, cylinder mounting methods, cylinder cushioning, cylinder force, velocity and power, cylinder dynamics, checklist for cylinder design

ROTARY ACTUATORS: Hydraulic motors, gear motor, vane motor, piston motor, motor performance

6 HYDRAULIC CONTROL VALVES

DIRECTION CONTROL VALVES: Introduction and classification, ports and position, valve symbol, valve actuation methods, poppet valves, rotary spool valves, sliding spool valves, two and three position valves, centre conditions, check valve, shuttle valve

PRESSURE CONTROL VALVES: Introduction, pressure relief valve - simple and compound type, pressure reducing valve - simple and compound type, Unloading valve, sequence valve, counterbalance valve, brake valve

FLOW CONTROL VALVE: Introduction, classification, fixed type flow control valve, adjustable type flow control valves, non-pressure compensated type and pressure compensated type flow control valve, speed control of a cylinder using flow control valve

7 HYDRAULIC ACCUMULATOR

Introduction and classification of hydraulic accumulators, dead weight type accumulator, spring loaded type accumulator, separator and non-separator type gas loaded accumulators, accumulator application circuits

8 HYDRAULIC CIRCUIT DESIGN AND MAINTENANCE

Design information required, selection of hydraulic cylinders, selection of hydraulic motors, selection of hydraulic control valves, selection of hydraulic filters, selection of hydraulic conduits, pump selection, reservoir, trouble shooting, maintenance and safety considerations in hydraulic circuits

9 INTRODUCTION TO PNEUMATIC CONTROL

Introduction, characteristics of compressed air, selection criteria for Pneumatic control system, Advantages and disadvantages of Pneumatic control, Basic structure of Pneumatic control system

10 COMPRESSED AIR PREPARATION

Various types of compressors for air preparation, Different types of air filters, Compressed air regulator, Compressed air lubricator

11 PNEUMATIC ACTUATORS

Single acting actuators, Various double acting actuators like actuators with cushion, Tandem actuators, Rod less actuators, Rotary actuators, cylinder seals

12 PNEUMATIC CONTROL VALVES

Use of directional control valves in Pneumatics, Symbolic representation of DCV, Types of DCV, Constructional details of DCV, Selection criteria of DCV, Flow control valves, Quick exhaust valve, shuttle valve, Two pressure valve, Time delay valve

13 CONTROLLING OF PNEUMATIC CYLINDERS

Direct control of single acting cylinders, Indirect control of single acting cylinders, Methods of checking end positions, speed control of cylinders, coordinated motion control

LEARNING OUTCOMES

On successful completion of the course, student will be able to;

- understand fluid power technologies, basic principles of fluid power and identify different applications, fluids and their important properties
- understand working principles of various types of hydraulic pumps and hydraulic and pneumatic actuators
- understand various type of control valves used in hydraulic and pneumatic and able to understand and prepare various hydraulic and pneumatic circuits

TEXT/ REFERENCE BOOKS

1. Fluid Power with Applications, Anthony Esposito, Pearson Education
2. Hydraulic and Pneumatic controls, Srinivasan R., Vijay Nicole Imprints Pvt. Ltd
3. Industrial Fluid Power, D. S. Pavaskar, P. D. Sonawane, P. M. Chanegaonkar, R. V. Shetty, Nishant Prakashan
4. Pneumatics Systems- Principles and Maintenance, Majumdar S.R., Tata McGraw-Hill1. Oil Hydraulics Systems- Principles and Maintenance, Majumdar S.R., Tata McGraw-Hill
5. 2. Hydraulics and Pneumatics, Andrew Parr, Jaico Publishing House
6. Hydraulic and Pneumatic controls, Shanmugasundaram.K, S. Chand & Co

(MH717) FINITE ELEMENT METHODS

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- To provide in-depth knowledge about the Finite element methods used to analyse complex structural problems. To provide basics of finite element analysis. Ability to analyse and solve problems in both familiar and unfamiliar situations including those in real-life contexts with better accuracy.

DETAILED SYLLABUS

1 INTRODUCTION

Introduction and basic concept of finite element method, General steps for finite element method, application of FEM, advantage of FEM, shape function, Types of elements, Potential energy approach, Rayleigh-Ritz method, principle of virtual work, stiffness matrix, stiffness matrix for spring element, direct stiffness method, boundary conditions

2 1D STRUCTURAL PROBLEM

Natural and global co-ordinate systems, linear shape function, stress-strain and displacement relationship, stiffness matrix for bar element, load vector, Boundary condition, elimination approach and penalty approach, structural problems: Axial bar elements, Thermal effects in axial bar elements, Quadratic shape function, displacement, stress and strain for quadratic element, element stiffness matrix for quadratic element

3 2D STRUCTURAL PROBLEM

Principles for 2D problems- plane stress and plane strain, Constant Strain Triangular element – shape function, element stiffness matrix and equation, plane stress problem, Isoparametric formulation of quadrilateral element- shape function, element stiffness matrix, numerical integration method, examples

4 DEVELOPMENT OF TRUSS EQUATION

Transformation of vectors in two dimensions, Global stiffness matrix for bar arbitrarily oriented in the plane, stresses in truss element, truss element problems

5 DEVELOPMENT OF BEAM EQUATION

Beam stiffness matrix on Euler Bernoulli's beam theory, distributed loading, work equivalence method, Beam element with nodal hinge, beam element problems

6 DEVELOPMENT OF FRAME EQUATION

Rigid plane frame, element stiffness matrix of frame element, plane frame examples

7 SCALER FIELD PROBLEMES

Steady state heat transfer, one dimensional heat conduction, and one dimensional heat

transfer in thin fin element

LEARNING OUTCOMES

- Ability to analyse and solve structural problems
- Able to understand application of analysis software, e.g. Ansys
- Able to obtain solution of complex problems of engineering involve in real life situation.

TEXT/ REFERENCE BOOKS

1. Introduction to Finite Elements in Engineering, Tirupathi K. Chandrupatla and Ashok D. Belegundu Prentice Hall of India Private Ltd.
2. A First Course in the Finite Element Method, D. L. Logan, Cengage Learning, Mc Graw Hill
3. CAD / CAM and Automation, Farazdak Haidery, Nirali Prakashan
4. Finite Element Analysis, P. Seshu
5. Finite Element Procedures in engineering analysis, K.J Bathe
6. An Introduction to Finite Element Methods, J. N. Reddy, Mc Graw Hill.
7. The finite element methods in Engineering, S.S. Rao, Pergamon, New York
8. The Finite Element Method in Engineering science, O.C. Zienkowicz, Mc Graw Hill

MACHINE TOOL DESIGN

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- Study of various machine internal parts
- Dynamics of machining by varying parameters

DETAILED SYLLABUS

1 MACHINE TOOLS

General classification of machine tools, working and auxiliary motions, Hydraulics transmission and its elements, Mechanical transmission and its elements, General requirements of machine tools

2 KINEMATICS OF MACHINE TOOLS

Stepped and step less drive, Basic considerations in the design of drives, Variable speed range in machine tools, Graphical representation of speed, structure diagram, selection of optimum ray diagram, Design of speed and feed gear boxes, step-less regulation of speed and feed rates

3 MACHINE TOOL STRUCTURES

Design criteria, materials, static and dynamic stiffness, Basic dynamic stiffness, Basic design procedure, design of beds and columns, Model technique in design of machine tool structures

4 GUIDEWAYS AND POWER SCREWS

Classification of guideways, material and Lubrication, design criteria and calculations for guideways, designs of guides under hydrostatic lubrication, Aerostatic slideways, Antifriction guideways, Combination guideways, classification of power screws, Design principles of power screws, Recirculating power screws assemblies, Elimination of backlash

5 MACHINE TOOL SPINDLES AND ITS BEARINGS

Materials of spindles, Effect of machine tool compliance on machining accuracy, Design principles of spindles, Anti-friction and sliding bearings

6 CONTROLLING SYSTEMS IN MACHINE TOOLS

Classification, Control systems for changing speeds and feeds, Ergonomic considerations applied to design of control members, principles of automatic and adaptive control

7 VIBRATION IN MACHINE TOOLS

Forced Vibration, self-excited vibration, stick-slip vibration and its minimization, vibration isolation

LEARNING OUTCOMES

- Identify various parts of machine tools.
- Apply various design aspects of spindles and bearings.
- Reduce vibration and chatter developing on machine tools.

TEXT/ REFERENCE BOOKS/REFERENCE BOOKS

1. Machine Tools Design, N. K. Meheta, TMH.
2. Design of Machine Tools, S. K. Basu, D. K. Pal, OIBH
3. Metal Cutting Theory and Practice, A. Bhattachary, New Central Book Agency (P) Ltd.
4. Machining and Machine Tools, A. B. Chattopadhyay, Wiley-India Publication.
5. Principles of Machine Tools, G. C. Sen, Bhattacharya, New Central Book Agency.

ROBOTICS AND AUTOMATION

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	Tut	Prac	Theory	Sess.	TW	Prac	Total	Lect	Tut	Prac	Total
3	0	2	60	40	25	25	150	3	0	1	4

OBJECTIVES OF THE COURSE

- To learn about automation, strategies of automation & understand robot control system component motion analysis
- To learn about various robot configurations and application of its in industry with various types of grippers & design of end effectors.

DETAILED SYLLABUS

1 INTRODUCTION TO AUTOMATION

Concept and scope of automation, Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Levels of Automations

2 INTRODUCTION TO ROBOTICS

Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement

Application of Robotics: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection

3 CONTROL SYSTEM AND COMPONENTS

Basic concept, Linear and rotary actuators and control valves, power transmission system, DC motors, Dynamics of Single axis drive system, Pulse width modulation & its switching characteristics

4 MOTION ANALYSIS AND CONTROL

Manipulator kinematics, position representation forward transformation, homogeneous transformation

5 END EFFECTORS

Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design

6 ROBOT IMAGE PROCESSING

Robotic vision system, Image grabbing, Image processing and analysis, Image segmentation, Pattern recognition, Training of vision system

7 ROBOT CELL DESGIN AND CONTROL

Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, safety in robotics, Work and control, Inter locks, Error detection, Work cell controller.

LEARNING OUTCOMES

- Students will be able to understand basics of automation and control system of robotics
- Students will be able to understand different types of robot configuration and elements of robotic system
- Students will be able to understand different types of end effector and design for the same.

TEXT/ REFERENCE BOOKS

1. Introduction to Robotics Analysis, Systems, Applications, Saeed B Niku, PHI
2. A Robot Engineering text book, Moshen Shahinpoor, Harper and Row Publishers, NY.
3. Industrial Robotics, Mikell Groover, McGraw Hill Publications
4. Fundamentals of Robotics – Analysis and Control, Robert J Schilling, PHI.
5. Industrial Robots, Ganesh S Hegde – Laxmi Publications.
6. Robotic technology, Principles and practice – Werner G Holz book – Van Nostrand Reinhold Co.NY.
7. Automation, Production Systems and Computer Integrated Manufacturing, Third Edition Pearson Educational Publication
8. Robotic Engineering–An Integrated Approach, Richard D Klaffer, Thomas A Chmielewski, Michael Negin – PHI
9. Intro to Robotics, Mechanics and Control, John J Craig, Pearson Education

(AF801) PROJECT / INDUSTRIAL TRAINING

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Sess.**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
0	0	28	---	---	100	300	400	0	0	14	14

- The students are required to undergo industrial training for the whole semester.
- The students will undertake project work/assigned work by the company for the period of full semester. They may opt for design/develop & fabricate assigned project work. They are supposed to prepare and submit a project report as a part of their term work and give presentation on their work progress on weekly basis. The faculty should monitor the students for their project work regularly every week. Students are to be examined based on external viva at the end of semester.

(AF802) SEMINAR

Teaching Scheme (Hours)			Examination Scheme					Credit Structure			
Lect	**Tut**	**Prac**	**Theory**	**Seminar**	**TW**	**Prac**	**Total**	**Lect**	**Tut**	**Prac**	**Total**
0	4	0	---	100	---	---	100	0	4	0	4

- The students are required to prepare presentations showing their progress of industrial training on regular weekly basis. The students will undertake Seminar work for the period of full semester.
- The faculty should monitor the students for their seminar report and presentation work regularly every week. Students are to be examined as a part of term work and shall be evaluated for overall performance at the end of semester.