Industrial Engineering

SEMESTER III

S. No.	Code No.	Subject	Teaching Periods			Credit Points
			L	T	P	
1.	03IIE101	Mechanics of Solids	3	0	0	3
2.	03IIE102	Material Science & Engineering.	3	0	0	3
3.	03IIE103	Engineering. Thermodynamics	3	0	0	3
4.	03IIE104	Manufacturing .Process	3	0	0	3
5.	03IIE105	Object oriented programming in c++	3	0	0	3
6.	03IIE106	Advance Engineering Mathematics	3	0	0	3
7.	03IIE201	Strength of Material Lab	0	0	2	1
8.	03IIE202	Material Sc. Lab	0	0	2	1
9.	03IIE203	Thermal Engineering Lab	0	0	2	1
10.	03IIE204	Prod. Engineering. Practice	0	0	3	2
11.	03IIE205	Computer Programming Lab	0	0	3	2
12	03IIE206	Machine Drawing	0	0	3	2
13.	03IIE301	Discipline & Co curricular Activities	0	0	4	1
		Total	18	0	19	28

SEMESTER IV

S. No.	Code No.	Subject	Teaching Periods			Credit Points
			P	T	P	
1.	04IIE101	DYNAMICS OF MACHINE ELEMENTS I	3	0	0	3
2.	04IIE102	AUTOMOBILE ENGINEERING	3	0	0	3
3.	04IIE103	FLUID MECHANICS	3	1	0	4
4.	04IIE104	MACHINING&M/C TOOLS	3	0	0	3
5.	04IIE105	KINEMATICS OF M/C	3	1	0	4
6.	04IIE106	MECHANICAL MEASUREMENT & CONTROL	3	0	0	3
1.	04IIE201	DYNAMICS OF MACHINES ELEMENT LAB I	0	0	2	1
2.	04IIE202	FLUID MECHANICS LAB	0	0	2	1
3.	04IIE203	THERMAL ENGINEERING LAB	0	0	3	2
4.	04IIE204	MECHANICAL MEASUREMENTS & CONTROL	0		2	1
5.	04IIE205	MACHINE DESIGN LAB I	0	0	3	2
13.	04IIE301	DISCIPLINE & CO CURRICULAR ACTIVITIES	0	0	4	1
		Total	18	2	16	28

SEMESTER V

S. No.	Code No.	Subject	Teaching Periods			Credit Points
			P	T	. P	
1.	05IIE101	ADVANCED MECHANICS OF SOLID	3	1	0	4
2.	05IIE102	DYNAMICS OF MACHINE	3	1	0	4
3.	05IIE103	FUNDAMENTAL OF AERODYNAMICS	3	0	0	3
4.	05IIE104	HEAT AND MASS TRANSFER	3	0	0	3
5.	05IIE105	INDUSTRIAL ENGINEERING I	3	0	0	3
6.	05IIE106	PRINCIPLE OF TURBO MACHINE	3	0	0	3
1.	05IIE201	PRODUCTION ENGG. LAB I	0	0	3	2
2.	05IIE202	AUTOMOBILE ENGG LAB	0	0	3	2
3.	05IIE203	DYNAMICS OF MACHINES LAB II	0	0	3	2
4.	05IIE204	MAT LAB &COMPUTER GRAPHICS	0	0	3	2
5.	05IIE301	DISCIPLINE & CO CURRICULAR ACTIVITIES	0	0	4	1
		Total	18	2	16	29

SEMESTER VI

S. No.	Code No.	Subject	Teaching Periods			Credit Points
			P	T	. P	
1.	06IIE101	DESIGN OF MACHINE ELEMENTS–II	3	1	0	4
2.	06IIE102	MANUFACTURING SCIENCE & TECHNOLOGY	3	1	0	4
3.	06IIE103	NOISE VIBRATION & HARSHNESS	3	1	0	4
4.	06IIE104	I.C ENGINE & DIESEL POWER PLANT	3	0	0	3
5.	06IIE105	HYDRAULIC MACHINE &HYDROELECTRIC POWER PLANT	3	0	0	3
6.	06IIE106	NUMERICAL METHODS & APPLIED STATISTICS'	3	0	0	3
1.	06IIE201	MACHINE DESIGN LAB II	0	0	3	2
2.	06IIE202	HEAT & MASS TRANSFER LAB	0	0	3	2
3.	06IIE203	TURBO MACHINERY LAB	0	0	2	1
4.	06IIE204	COMPUTER ORIENTED NUMERICAL METHODS LAB	0	0	3	2
5.	06IIE301	DISCIPLINE & CO CURRICULAR ACTIVITIES	0	0	4	1
		Total	18	3	15	29

SEMESTER VII

S. No.	Code No.	Subject	Teaching Periods			Credit Points
			L	T	. P	
1.	07IIE101	COMPUTER AIDED DESIGN	3	1	0	4
2.	07IIE102	REFRIGERATION &AIR CONDITIONING	3	1	0	4
3	07IIE103	STEAM TURBINES &STEAM POWER PLANT	3	1	0	4
4.	07IIE104	PRODUCT DEVELOPMENT & LAUNCHING	3	0	0	3
5.	07IIE105	MECHATRONIC	3	0	0	3
6	07IIE106	QUANTITATIVE METHODS AND OPERATIONS RESEARCH	3	0	0	3
7.	07IPIE107	RESEARCH METHODOLOGY	3	0	0	3
8.	07IIE201	LAB I	0	0	2	1
9.	07IIE202	MECHANICAL VIBRATION LAB	0	0	2	1
10	07IIE203	I.C ENGINE LAB	0	0	2	1
11	07IIE204	PRACTICAL TRAINING & INDUSTRIAL VISIT	0	0	2	1
12.	07IIE301	DISCIPLINE & EXTRA CURRICULAR ACTIVITIES	0	0	4	1
			21	3	12	29

SEMESTER VIII

S. No.	Code No.	Subject	Teaching Periods			Credit Points
			P	T	P	
1.	08IIE 101	RENEWABLE ENERGY TECHNOLOGY	3	0	0	3
32.	08IIE102	OPERATIONS MANAGEMENT	3	1	0	3
3.	08IIE103	GAS TURBINE & GAS POWER PLANT	3	1	0	3
4.	08IIE104	ELECTIVE –II I- RELIABILITY & MAINTENCE ENGG. II- COMPUTATIONAL FLUID FLOW & HEAT TRNSFER III- FINITE ELEMENT METHODS	3	0	0	3
5.	08IIE105	SUPPLY CHAIN MANAGEMENT	3	1	0	3
6	08IIE106	PRODUCTION AND INVENTORY CONTROL	3	1	0	4
7	08IIE107	SAFETY ENGINEERING	3	0	0	3
8	08IIE201	CAD LAB (PRO E/UNIGRAPHICS/AUTO CAD INVENTOR)	0	0	2	1
9	08IIE202	CAM & ROBOTICS LAB	0	0	2	1
10	08IIE203	INDUSTRIAL ENGG. LAB	0	0	2	1
11	08IIE204	LAB II	0	0	2	1
		DISCIPLINE & EXTRA CURRICULAR ACTIVITIES	21	0	4	1
			21	4	12	30

SEMESTER IX

S. No.	Code No.	Subject	Teaching Periods			Credit Points
			L	T	P	
1.	09IIE101	Simulation of Industrial Systems	3	1	0	4
2.	09IIE102	Methods Engineering and Ergonomics	3	1	0	4
3.	09IIE103	Industrial Psychology	3	1	0	4
4.	09IIE104	Materials Management	3	1	0	4
5.	09IIE105	Management Information System	3	1	0	4
6.	09IIE106	Value Engineering	3	1	0	4
8	09IIE201	PRACTICAL TRAINING & INDUSTRIAL VISIT	0	0	3	2
9	09IIE202	SEMINAR	0	0	2	1
10	09IIE203	PROJECT	0	0	3	2
11	09IIE301	DISCIPLINE & EXTRA CURRICULAR ACTIVITIES	0	0	4	1
		TOTAL	18	6	12	30

SEMESTER X

Subject code	Name of Subject	TEACHING PERIODS			Credit Points
		L	T	P	
10IIE 201	Dissertation a) Continuous Evaluation b) Project Report c) Viva Voice	5 6 6			5 6 6

10IIE 301	Discipline & Extra Curricular Activities			4	1
	Total	17		4	18

SEMESTER III

MECHANICS OF SOLID

Course/Paper 03IIE 101

IIE semester III

Unit – 1

Stress & strain: Tension, compression, shearing stress & strain; Poisson's ratio: Stress-strain

Relationship, Hooke's law; equations of static = w for 2D & 3D cars Elastic constants and their relations for a isotropic hookean material, anisotropy & orthotropic, thermal stresses, composite bars; simple Elastic, plastic & visco-elastic behavior of common materials in tension and compression test, stress-strain curves. Concept of factor of safety & permissible stress. Conditions for equilibrium. Concept of free body diagram; Introduction to mechanics of deformable bodies.

Unit – 2

Members subjected to flexural loads: Theory of simple bending, bending moment and shear force

diagrams for different types of static loading and support conditions on beams. Bending stresses,

Section modulus and transverse shear stress distribution in circular, hollow circular, I, Box, T, angle sections etc.

Unit – 3

Principal planes, stresses & strains: Members subjected to combined axial, bending & Torsional loads, maximum normal & shear stresses; Concept of equivalent bending & equivalent twisting moments: Mohr's circle of stress & strain. Theories of Elastic Failures: The necessity for a theory, different theories, significance and comparison, applications.

Unit – 4

Torsion: Torsional shear stress in solid, hollow and stepped circular shafts, angular deflection and

power transmission capacity. Stability of equilibrium: Instability & elastic stability. Long & short columns, ideal strut, Euler's formula for crippling load for columns of different ends, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations.

Unit – 5

Transverse deflection of beams: Relation between deflection, bending moment, shear force and load, Transverse deflection of beams and shaft under static loading, area moment method, direct integration method: method of superposition and conjugate beam method. Variational approach to determine deflection and stresses in beam. Elastic strain energy: Strain energy due to axial, bending and Torsional loads; stresses due to suddenly applied loads; use of energy theorems to determine deflections of beams and twist of shafts. Castigliano's theorem. Maxwell's theorem of reciprocal deflections

Reference

1. MECHANICS OF SOLID: S. H CRANDALL, N.C DAHI & T.J LARDNER. MCGRAW HILL INTERNATIONAL EDITION.
2. STRENGTH OF MATERIALS: G.H RYDER. ELBS PUBLICATIONS CO., LONDON
3. ELEMENTS OF STRENGTH OF MATERIALS. J.P TINNOSHNKO & G.H YOUNG, AFFILIATED EAST WEST PRESS, NEW DELHI
4. SOLID MECHANICS. G.M.A KAZMI. TATA MCGRAW HILL PUBLISHING CO. LTD.. NEW DELHI
5. STRENGTH OF MATERIALS: S. RAMAMRUTHAM. DHANPAT RAI AND PUBLICATIONS, NEW DELHI.

MATERIAL SCIENCE AND ENGG.

Course/Paper 03IIE 102

IIE semester III

UNIT 1

Atomic structure of Metals: Crystal structure, crystal lattice of (i) Body centred cubic (ii) Face centred cubic (iii) Closed packed hexagonal, crystallographic Notation of atomic planes and Directions (Miller Indices), polymorphism and allotropy, Crystal imperfection.

UNIT 2

Theories of plastic deformation. Phenomenon of slip, twinning and dislocation. Identification of

crystallographic possible slip planes and direction in FCC, BCC, HCP. Recovery and recrystallization, preferred orientation causes and effects on the property of metals.

UNIT3

Classification of engineering materials. Solidification of metals and of some typical alloys: Mechanism of crystallization (I) nuclear formation (ii) crystal growth. General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagram of binary system having complete Mutual solubility in liquid state and limited solubility in solid state, Binary isomorphism alloy system, Hume-Rothery rule, Binary system with limited solid solubility of terminal phase and in which solubility decreases with temperature and also alloy with a peristaltic transformation. Equilibrium diagram of a system whose components are subject to allotropic change. Iron carbon Equilibrium diagram, phase transformation in the iron carbon diagram (I) Formation of Austenite (ii) Transformation of Austenite into partite (iii) Marten site transformation in steel, TTT curves.

UNIT 4

Engineering properties and their measurements. Principles and applications of annealing, normalizing, hardening, tempering. Recovery and recrystallization. Harden ability - its measures, variables, effecting Harden ability, methods, for determination of Harden ability. Over-heated and Burnt steel, its causes and remedies. Temper brittleness - its causes and remedies. Basic principles involved in heat treatment of plain carbon steel, alloy steels, cast iron and Non-ferrous metals and their alloys. Chemical Heat treatment of steels: Physical principles involved in chemical heat treatment procedure for carburizing, Nitrating, Cyaniding, carbo-nitriding of steel.

UNIT 5

Effects produced by Alloying element on the structures and properties of steel Distribution of alloying Elements (Si, Mn, Ni, Cr, Mo, Co, Wr, Ti, Al) in steel, structural classes of steel. Classification of steels, BIS Standards. Fibre reinforced plastic composites: Various fibres and matrix materials, basic Composite manufacturing methods, applications of composite materials.

Reference

1. MATERIAL SCIENCE & ENGINEERING BY V. RAGHAVAN. PUB PHI
2. ENGINEERING MATERIALS BY B. K. AGARWAL. PUB. TMH
3. MATERIAL SCIENCE & PROCESS BY S.K. HAZRA: CHOWDHARY , MEDIA PROMOTERS & PUBLICATIONS PVT. LTD. BOMBAY
4. ENGG. METALLURGY. PART – I BY RAYMOND A. HIGGINS. ELBS
5. HEAT TREATMENT PRINCIPLES AND TECHNOLOGIES BY T.V RAJAN, O.P. SHARMA & ASHOK SHARMA

ENGG. THERMODYNAMICS

Course/Paper 03IIE 103

IIE semester III

UNIT 1

Basic Concepts of Thermodynamics :Thermodynamics system, control volume, Properties, state,

processes and cycle, equality of temperature, Zeroth Law of thermodynamics, temperature scale, laws of perfect gas, Pure substances, vapour-Liquid –solid-phase equibrium in a pure substances, thermodynamic surfaces

UNIT 2

Work and heat, Law of conservation of mass and energy, First law of thermodynamics, steady state Processes, Second law of thermodynamics, Heat engine, Carnot cycle, thermodynamic temperature scale, entropy, change of entropy for different processes, equivalence of Kelvin plank and clausius statements, clausius inequality.

UNIT 3

Available and unavailable energy, availability of a non flow and steady flow system, Helmbeltz and Gibb's functions, Thermodynamic Relations: Important mathematical relations, Maxwell relations, Tds Relations, Joule- Thomson coefficient, Clayperon relation.

UNIT 4

Air – standard power cycle, Brayton cycle, Otto cycle, diesel cycle, Dual cycle, Stirling cycle, Ericssion cycle and Atkinson cycle, Mean effective pressure and efficiencies, Four stroke petrol and diesel engine, Two stroke Petrol and diesel engine.

UNIT 5

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Properties of steam, phase change process, use of steam table & molier char. Rankine cycle, Reheat cycle, Regenerative cycle, cogeneration vapour compression refrigeration cycle.

Reference

1. ENGINEERING THERMODYNAMICS, P.K NAG TATA MCGRAW HILLS
2. ENGINEERING THERMODYNAMICS, C.P GUPTA, RAJENDRA PRAKASH NEMI CHAND & BROS.
3. ENGINEERING THERMODYNAMICS, R.S KHURMI, J.K GUPTA PUBLISHER S. CHAND
4. PRINCIPLES OF THERMAL ENGG., NARMAN E. HARRIS, TATA MCGRAW HILL.

MANUFACTURING PROCESS

Course/Paper 03IIE 104

IIE semester III

UNIT 1

Importance of manufacturing, economic and technological definition of manufacturing, survey of

manufacturing processes.

Foundry Technology: Patterns practices: Types of patterns, allowances and material used for

patterns, moulding materials, moulding sands, Moulding sands; properties and sand testing; grain

fineness; moisture content, clay content and permeability test, core materials and core making, core print; core boxes, chaplets, gating system design. Moulding practices**:** Green, dry and loam sand moulding, pit and floor moulding; shell moulding; permanent moulding; carbon dioxide moulding.

Casting practices: Fundamental of metal casting, sand casting, Shell-Mould casting, mold casting

(plaster and ceramic), investment casting, vacuum casting, Permanent mould casting, slush casting,

pressure casting, die casting, centrifugal casting, continuous casting, squeeze casting, casting alloys,

casting defects, design of casting, gating system design, and riser design. Melting furnaces-rotary, pit

electric, tilting and cupola.

UNIT 2

Metal Joining Processes: Principle of welding, soldering, brazing and adhesive bonding. Survey of welding and allied processes. Arc welding: power sources and consumables. Gas welding and cutting: Processes and equipments. Resistance welding: principle and equipments. Spot, projection and seam welding process. Atomic hydrogen, ultrasonic, plasma and laser beam welding, electron beam welding, and special welding processes e.g. TIG, MIG, friction and explosive welding, welding of C.I. and Al, welding defects. Electrodes and Electrode Coatings

UNIT 3

Forming and Shaping Processes: Metal working, elastic and plastic deformation, concept of strain hardening, hot and cold working, rolling, principle and operations, roll pass sequence, forging, forging operations, extrusion, wire and tube drawing processes. Forging: Method of forging, forging hammers and presses, principle of forging tool design, cold working processes- Shearing, drawing, squeezing, blanking, piercing, deep drawing, coining and embossing, metal working defects, cold heading, riveting, thread rolling bending and forming operation.

UNIT 4

Powder Metallurgy: Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of P/M.

Rapid Prototyping Operations: Introduction, subtractive processes, additive processes, Virtual

Prototyping and applications

UNIT 5

Plastic Technology: Introduction, Classification of Plastics, Ingredients of Moulding compounds,

General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, transfer moulding, injection moulding, extrusion moulding, blow moulding, calendaring, thermoforming, slush moulding, laminating

Reference

1. PRODUCTION TECHNOLOGIES BY P.C SHARMA BY S.CHAND AND CO. LTD.
2. MANUFACTURING PROCESS BY BEGEMAN
3. MANUFACTURING PROCESSES AND MATERIAL: I. E DOYLE, CARL KAYSER, SCHRADE LEECH.
4. MANUFACTURING PROCESS. SCHEY
5. PRODUCTION TECHNOLOGIES: ASHISH DUTT SHARMA, CBC

OBJECT ORIENTED PROGRAMMING IN C++

Course/Paper 03IIE 105

IIE semester III

UNIT 1

Introduction to Object Oriented Programming: Basic concepts: Class, Object, Method, Message

passing, Inheritance, Encapsulation, Abstraction, Polymorphism.

UNIT 2

Basics of C++ Environment: Variables; Operators; Functions; user defined, passing by reference,

passing an array to the function, inline function, scope, overloading; Pointers: objects and lvalue,

arrays and pointers, the new and delete operators, dynamic arrays, arrays of pointers and pointers to arrays, pointers to pointers and functions; Strings: String I/O, character functions in ctype.h, string functions in string.h.

UNIT3

Object oriented concepts using C++: Classes: Member functions, Friend functions, Constructors,

Access functions, Private member functions, class destructor, static data and function members;

Overloading: inline functions, this operator, overloading various types of operators, conversion

operators; the String Class; Composition and Inheritance: Hierarchy and types of inheritance,

protected class members, private versus protected access, virtual functions and polymorphism, virtual destructors, abstract base classes.

UNIT 4

Templates and Iterators: function and class templates, container classes, subclass templates, iterator classes; Libraries: standard C++ library, contents of a standard C headers, string streams, file processing: Files and streams classes, text files, binary files, classification of files, the standard template library.

UNIT 5

Data Structures Using C++: Linked lists – Singly linked list, Doubly linked lists, Circular lists, Stacks and Queues priority Queues, Stacks, Queues.

Reference

1. PROGRAMMING IN C: C. GOTTFRIED, SCHAUM SERIES.
2. PROGRAMMING IN C: E. BALAGRUSWAMY.
3. OBJECT ORIENTED PROGRAMMING IN C++: E. BALAGRUSWAMY

ADVANCE ENGINEERING MATHEMATICS

Course/Paper 03IIE 106

IIE semester III

UNIT 1

Fourier series: Fourier series, Half-range series, Harmonic analysis.

Integral Transforms: Fourier integral theorem, Fourier transforms, Convolution theorems, Inversion theorem for Fourier and Laplace transforms, Simple applications of these transforms to onedimensional problems.

UNIT 2

Method of separation of variables - applications to the solution of wave equation in one dimension, laplace's equation in two dimensions, Diffusion equation in one dimension.

Transform calculus : Laplace transform with its simple properties, applications to the solutions of

ordinary and partial differential equations having constant co-efficient with special reference to wave and diffusion equation.

UNIT 3

Complex Variable: Functions of a complex variable; Exponential, trigonometric, hyperbolic and

logarithmic functions; Differentiation, Analytic functions, Cauchy-Riemann equations, conjugate

functions; Application to two dimensional potential problems; Conformal transformations, Schwartz-Christoffel transformation; Cauchy's Integral theorem. Taylor's and Laurent's expansions; Branch

points, zeros, poles and residues; Simple problems on contour integration

UNIT 4

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Boundary Value Problems: Equations for vibrations of strings, heat flow and electrical transmission lines; Laplace's equation in Cartesian, cylindrical polar and spherical polar coordinates; Solution by separation of variables. Solution in Series: Differentiation and integration of infinite series, Series solution of differential equations; Bessel and Legendre equations, their series solution, elementary properties of Bessel functions and Legendre polynomials

UNIT 5

Numerical Methods: Difference operators: forward, backward, central shift and average operators and relations between them. Newton Backward and Interpolation; Lagrange's interpolation and the error formula for interpolation. Numerical differentiation and integration. Trapezoidal rule and Simpson's one-third rule including error formula.

Reference

1. MATHEMATICS STATISTICS BY J. N KAPUR & H.C SAXENA, S. CHAND & CO., NEW DELHI

2. MATHEMATICAL STATISTICS, M RAY & H.S. SHARMA, RAM PRASAD & SONS , AGRA

3. MATHEMATICAL STATISTICS, JOHN E. FREUND, PRENTICE HALL OF INDIA, NEW DELHI

4. ADVANCED MATHEMATICS FOR ENGINEERS, CHANDRIKA PRASAD, PRASAD MUDRANALAYA

STRENGTH OF MATERIALS LAB

03IIE201:

1. Izod Impact testing.

2. Rockwell Hardness Testing.

3. Spring Testing

4. Column Testing for buckling

5. Torsion Testing

6. Tensile Testing

7. Compression Testing

8. Shear Testing

9. Brinell Hardness Testing

10. Bending Test on UTM.

11. Study of Fatigue Testing Machine.

MATERIAL SCIENCE AND HEAT TREATMENT LAB

03IIE202

1. Study of Engineering Materials and crystals structures. Study of models BCC, FCC, HCP and stacking sequence, tetrahedral and octahedral voids.

2. To calculate the effective number of atoms, co-ordination number, packing factors, c/a ratio for HCP structure.

3. Study of brittle and ductile fracture.

4. To prepare metallic samples for metallographic examination and to study the principle and construction of the Metallurgical Microscope.

5. Study of the following Micro structures: Hypo, Hyper and Eutectoid Steel, Grey, White, Nodular and Malleable Cast Iron.

6. Annealing of Steel - Effect of annealing temperatures and time on hardness.

7. Study of Microstructure and hardness of steel at different rates of cooling. Microstructure examination of white cast iron.

8. Hardening of steel, effect of quenching medium on hardness.

9. Effect of Carbon percentage on the hardness of Steel.

10. Study of various crystal structures and dislocations through models.

11. Study of Iron-Carbon Equilibrium Diagram and sketch the various structures present at room temperature.

THERMAL ENGINEERING LAB 1

03IIE203:

1. Comparative study of four stroke diesel and petrol engines.

2. Comparative study of two stroke petrol and diesel engines.

3. Studies of fuel supply systems of diesel and petrol engines.

4. Study of cooling, lubrication and ignition system in diesel and petrol engines.

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5. To study various types of Boilers and to study Boiler mounting and accessories.

6. To study various types of Dynamometers.

7. To study Multi Stage Air Compressors.

8. To find the BHP, Thermal efficiency of four stroke diesel engine.

9. Study of Brakes, Clutches, and Transmission System.

10. To prepare a comparison sheet of various automobiles (4 Wheeler and 2 Wheeler).

PRODUCTION PRACTICE I

03IIE204

1. Study of lathe machine, lathe tools cutting speed, feed and depth of cut.

2. To perform step turning, knurling and chamfering on lathe machine as per drawing.

3. Taper turning by tailstock offset method as per drawing.

4. To cut metric thread as per drawing.

5. To perform square threading, drilling and taper turning by compound rest as per drawing.

6. To study shaper machine, its mechanism and calculate quick return ratio.

Foundry Shop

1. To prepare mould of a given pattern requiring core and to cast it in aluminium.

2. Moisture test and clay content test.

3. Strength Test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and

Hardness Test (Mould and Core).

4. Permeability Test.

5. A.F.S. Sieve analysis Test.

COMPUTER PROGRAMMING LAB I

03IIE205:

List of programs in C:

1. Program for revising control statements, arrays and functions.

2. Program using string handling and various functions described in string.h, ctype.h.

3. Program using structures and sorting algorithm (Insertion, Selection, Quick, Heap sort) and

functions described in math.h.

4. Program using file handling and related functions defined in stdio.h, io.h.

5. Program using pointers, array and pointers, pointers to structures, dynamic memory allocation.

List of Programs in C++

6. Program using basic I/O and control statements.

7. Program using class, objects, objects as function parameters.

8. Program using functions and passing reference to a function, inline functions. Program using

Inheritance and virtual base class.

9. Program using pointers, arrays, dynamic arrays. Program using functions defined in ctype.h and string.h.

10. Program using constructors, destructors. Program using function and operator over loading

List of program in C++ implementing Data Structures

11. Creating and managing (add, delete, print, insert) nodes of a Linked list.

12. Creating and managing (create, pop, push etc.) stacks and queues.

Note: Students should submit and present a minor project at the end of the lab.

MACHINE DRAWING

03IIE206:

Detail drawings:

Couplings: Pin-type flexible coupling etc,

IC. Engine parts: connecting rod, crank shaft, etc,

Boiler Mountings: Steam stop valve/ feed check-valve/ safety valve /three way stop valve blow offcock.

Bearings: Swivel bearing

Machine Tool Parts: Shaper tool head, Lathe Tail Stock, Turret Tool Post, Turret Bar feeding

Mechanism / Universal Dividing Head, Swivel machine vice.

Miscellaneous: Screw jack and drill-press vice.

Free Hand Sketches: Pipes and Pipe fittings, clutches, bearings, bearing puller, valve gear

mechanisms, machine arbor and cutter, universal dividing head, jigs and fixtures, Step less drive ,

sliding gear box.

SEMESTER IV

DESIGN OF MACHINE ELEMENTS

Course/Paper 04IIE 101

IIE semester IV

UNIT - 1

Materials: Properties and IS coding of various materials, Selection of material from

properties and economic aspects. Manufacturing aspects in Design : Selection of manufacturing processes on the basis of design and economy, Influence of rate of production, standard size, Influence of limits, fits tolerances and surface finish. Change in the shape of the designed element to facilitate its production, Design of castings, working drawing.

UNIT - 2

Design for strength: Allowable stresses, detailed discussion on factor of safety (factor of

ignorance): Stress concentration. Causes & mitigation. Introduction of various design

considerations like strength, stiffness, weight, cost, space etc. Concept of fatigue failures.

Design of machine elements subjected to direct stress, Pin, cotter and keyed joints, Design of

screw fastening.

UNIT - 3

Design of members in Bending: Beams, levers and laminated springs.

UNIT - 4

Design of members in torsion : Shafts and shaft couplings.

UNIT - 5

Design of shafts, brackets under combined stresses, Calculation of transverse & torsional

Deflections. Screw fasteners subjected to eccentric loading.

Reference

1. ELEMENTS OF MACHINE DESIGN: N.C PANDEY, C.S SHAH CHAROTAR BOOK STALL AND
2. DESIGN OF MACHINE ELEMENT: V. B BHANDARI TATA MCGRAW HILL PUB CO. LTD.
3. MECHANICAL MACHINE DESIGN: R.C BAHL, V.K GOEL, STANDARD PUB. DISTRIBUTERS DELHI.
4. MECHANICAL ENGINEERING DESIGN: J.E SHIGLEY MCGRAW HILL CO.
5. MACHINE DESIGN : K K PUJARA, B I JUNEGA, DHANPAT RAI PUBLICATIONS.

AUTOMOBILE ENGINEERING

Course/Paper 04IIE 102

IIE semester IV

UNIT - 1

FRAME & BODY: Layout of chassis, types of chassis frames and bodies, their constructional

features and materials. TRANSMISSION SYSTEM**:** Clutch; single plate, multiplate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydrautic clutches. Fluid coupling.

UNIT - 2

Gear boxes, Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic

transmission sytem; Hydraulic torque converter; overdrive, propeller shaft, universal joints,

front wheel drive, differential; Rear axle drives. Hotchkiss and torque tube drives; rear axle

types; Two wheel and four wheel drive.

UNIT - 3

RUNNING GEAR: Types or wheels and tyres. Tyre construction; tyre inflation pressure, tyre

wear and their causes; re-treading of the tyre, Steering system, steering gear boxes, Steering

linkages, steering mechanism, under and over steering. Steering Geometry, effect of camber,

caster, king pin inclination, toe in and toe out; power steering; integral and linkage types

suspension system; objects and requirements, suspension spring, front and rear suspension

systems, Independent suspension system shock absorber. BRAKES ; Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.

UNIT - 4

AUTOMOTIVE ELECTRICAL SYSTEM: Battery construction, Charging and testing,

battery types,

Starting and Battery Charging System : Starter motor construction, types of drive, Alternator

construction, regulation and rectification.

Ignition System : magneto and coil ignition systems, System components and requirements,

Automotive lighting : Wiring systems Electrical instruments; head lamp, electric horn, fuel

level indicator.

UNIT - 5

AUTOMOTIVE AIR CONDITIONING: Introduction, Loads, Air conditioning system

Components, Refrigerants, Fault Diagnosis. AUTOMOTIVE SAFETY: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System) etc.

Reference

1. AUTOMOBILE ENGINEERING BY R K SHARMA
2. AUTOMOBILE ENGINEERING BY KIRPAL SINGH
3. VEHICAL ENGINE AND TECHNOLOGY BY HEISLER ELBS
4. AUTOMATIC TRANSMISSION BY MATHIAS F. BREJCHA, PRENTICE HALL
5. AUTO MECHANICS WEBSTER J. GLENWNE PUBLISHING CO.

FLUID MECHANICS

Course/Paper 04IIE 102

IIE semester IV

UNIT - 1

Basic Definitions and Fluid Properties ; Definition of Fluid, Incompressible and compressible

fluids, Fluid as a continuum, Mass, Density, specific weight, relative density, specific

volume, Bulk modulus, velocity of sound Ideal fluid Viscosity. Newtonian and Non -

Newtonian fluid, Kinematic viscosity, Effect of temperature and pressure on viscosity, surface tension capillarity, vapour pressure and cavitation. Fluid Statics : General differential equation, Hydrostatics Manometry, Fluid forces on suIIErged surfaces. Curved surfaces, Aerostatics, Isothermal atmosphere, polytropic atmosphere. The international standard atmosphere, static stability The international standard atmosphere suIIErged bodies. Floating bodies.

UNIT - 2

Kinematics and conservation of Mass : Flow classifications. Fluid velocity and acceleration,

streamlines and the stream function. Pathlines and streak lines. Deformation of a fluid

element, verticity and circulation. Irrotational and Rotational flow. Flownet, Laplace

equation. Conservation of mass and the continuity equation for three dimensions.

Fluid Momentum : The Momentum theorem Applications of the momentum theorem

Equation of motion, Euler's equation of motion Integration of Euler's equation of motion.

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Bernoulli's equation. Applications of Bernoulli's Pitot tube, Equation of motion for Viscous

fluid, Navier Stoke's equation.

UNIT - 3

Orifice discharging free, Jet, vena contracts, co-efficient of contraction, velocity and

discharge, coefficient of resistance. Orifices and mouthpieces Nozzles and weires.

Flow Through Pipes : Reynold's experiment Darcy's Weisback equation. Loss of head due to

sudden enlargements, contraction, entrance, exit obstruction, bend, pipe fittings. Total and

Hydraulic grandient lines, Flow through pipe line. Pipes in series, parallel Transmission of

power through pipes.

UNIT - 4

Laminar Flow: Simple solution of Navier Stokes equations. Hagen – Poiseuille flow. Plans

Poiseuille flow and coutte flow. Turbulent Flow; Variation of friction factor with Reynold's number. The Prandt Mixing length hypothesis applied to pipe flow, velocity distribution in smooth pipes, sough pipes.

The Universal pipe friction laws, Colebrook. White formula. Dimensional Analysis: Buckingham variables, Model Similitude, Force ratio, Reynolds, Froude's Mach, Weber and Euler numbers and their applications. Undistorted model distorted model scale effect.

UNIT - 5

The Boundary Layer: Description of the boundary layer. Boundary Layer thickness boundary

layer separation and control. The Prandtl boundary layer equation. Solution for cominar

boundary layer. The momentum equation for the boundary layer. The flat plate in uniform

free stream with no pressures gradients. Approximate momentum analysis laminar boundary

Aerofoils Theory. Flow round a body ; Drag skin friction drag, pressure drag, combined skin friction & pressure drag (Profile drag) wave drag, lift induced drag. Flow past sphere & Cylinder.

Reference

1. ENGINEERING FLUUID MECHANICS: K L KUMAR, EURESIA PUBLISHING HOUSE
2. FLUID MECHANICS AND MACHINES: F M WHITE, JOHN WILLY AND SONS
3. FLUID MECHANICS : R.K.RAJPUT S. CHAND COMPANY LTD
4. FLUID MECHANICS VM STREETER MCGRAW HILL
5. ENGINEERING FLUID MECHANICS BY D S KUMAR

MACHINING AND MACHINE TOOLS

Course/Paper 04IIE 104

IIE semester IV

UNIT 1

Classification of metal removal process and machines

Mechanics of metal cutting: Geometry of single point cutting tool and tool angles. Tool

nomenclature in ASA, ORS, NRS and interrelationship. Mechanism of chip formation and

types of chips, chip breakers. Orthogonal and oblique cutting, cutting forces and power

required, theories of metal cutting. Thermal aspects of machining and measurement of chip

tool interface temperature. Friction in metal cutting.

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UNIT 2

Machinability: Concept and evaluation of machinability, tool life, mechanisms of tool failure,

tool life and cutting parameters, machinability index, factors affecting machinability. Cutting

fluids: Types, properties, selection and application methods

General Purpose Machine Tools: Classification and constructional details of lathe, drilling, milling, shaping and planning machines. Tooling, attachments and operations performed, selection of cutting parameters, calculation of forces and time for machining. Broaching operation.

UNIT 3

Special Purpose Machine Tools: Automatic lathes, capstan and turret lathe machines. Swiss automatic, operational planning and turret tool layout, sequence of operations. Tracer attachment in Machine Tools: mechanical-copying machines; Hydraulic Tracing Devices; Electric Tracing systems; Automatic tracing.

Abrasive processes: Abrasives; natural and synthetic, manufacturing, nomenclature. Selection of grinding wheels, wheel mounting and dressing, characteristic terms used in grinding. Machines for surface and cylindrical grinding, their constructional details and processes.

Surface finishing: Honing, lapping, superfinishing, polishing and buffing processes.

UNIT 4

Thread Manufacturing: casting; thread chasing; thread cutting on lathe; thread rolling, die threading and tapping; thread milling; thread grinding.

Gear Manufacturing Processes: hot rolling; stamping; powder metallurgy; extruding etc. Gear generating processes: gear hobbling, gear shaping. Gear finishing processes: shaving, grinding, lapping, shot blasting, phosphate coating, Gear testing.

UNIT 5

High Velocity Forming Methods: (High-energy rate forming processes) Definition; Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming.

Industrial Safety: Human factor in machine equipment safety; reducing industrial noise; precautions to be taken by operators for safe working on different machine tools.

Reference

1. PRODUCTOIN ENGINEERING SCIENCES BY PC PANDEY & C K SINGH STD PUB & DIST.
2. PRODUCTION ENGINEERING BY P C SHARMA BY S CHAND & CO.
3. IFUNDAMENTALS OF TOOL DESIGN: F W WILSON

KINEMATICS OF MACHINES

Course/Paper 04IIE 105

IIE semester IV

UNIT - 1

Kinematics: Elements, pairs , mechanisms, four bar chain and its inversions, velocity and

acceleration, Klein's construction, coriolis component, instantaneous center method, synthesis

UNIT - 2

Automotive vehicle mechanisms: Overhead valve mechanism, Davis and Ackerman steering mechanism, Trifler suspension and Hookes joint.

Power transmission: Belts and ropes, effect of centrifugal force, creep, chain drive

UNIT - 3

Friction: Laws of static, dynamic and rolling friction, dry and viscous friction, inclined plane

and screw jack, ,pivots and friction axis, bearing, Clutches. Theory of film lubrication.

UNIT - 4

Brakes and dynamometers: Band, block and band & block brakes, braking action, absorption

and transmission type dynamometers, prony, rope and hydraulic dynamometers braking

system of automobiles.

UNIT - 5

Cams: Type of cams, displacement, velocity and acceleration curves for different cam

followers, consideration of pressure angle and wear, analysis of motion of followers for cams

with specified contours.

Reference

1. KINETICS & DYNAMICS OF MACHINES : G.H.MARTIN M CGRAWHILL PUBLISHING CO LTD
2. ELEMENTS OF M/C DESIGN: N.C. PANDYA & C.S SHAH CHAROTAR BOOK STALL ANAND
3. DESIGN OF M/C ELEMENTS: V.B. BHANDARI,TATA MC-GRAW HILL PUBLISHING LTD.,NEW DELHI M CGRAWHILL PUBLISHING CO LTD
4. MECHANICAL ENGG DESIGN : J.E. SHIGLEY, M C GRAW HILL PUBLISHING CO LTD
5. FUNDAMENTAL OF MACHINE COMPONENT DESIGN : R.C.JUVINALL&K.M. MARSHEK,JOHN VILAY & SONS
6. THEORY & PROBLMS OF MACHINE DESIGN ,HALTETSCHAUM"S OUTLINE SERIES, M CGRAWHILL PUBLISHING CO LTD
7. "DESIGN DATA" PSG COLLEGE OF TECHNOLOGY/S DPV PRINTERS
8. MACHINE DESIGN ,RAJENDRA KARVA

MECHANICAL MEASURMENTS & CONTROL

Course/Paper 04IIE 106

IIE semester IV

UNIT - 1

System configuration, basic characteristic, calibration, classification and performance

characteristics of a instrumentation system, Specification and testing of dynamic response.

Strain Measurement : Electric Strain Gauges - Types ; Selection and Installation, Strain gauge

circuits; temperature compensation and calibration; Use of Strain Gauges on Rotating Shafts,

Load Cells, Mechanical and Optical Strain Gauges.

UNIT - 2

Various Mechanical, Electro- Mechanical & Photoelectrical Sensors for sensing of

Displacement, Velocity, Acceleration, Torque, Force, Temperature from Low to High Range,

flow, level of fluid , pressure, angular speed, voltage, frequency and current.

UNIT - 3

Introduction to Multi-Channel Data-Acquisition System, Measurement Pods, Interface

Hardware, Data Analysis Software, Interfacing.

Concepts and examples of automatic control systems, systems by differential equations,

transfer function, block diagram, open and feed back control systems, signal flow graphs &

its constructions. Control System components, error sensing devices and servo motors.

UNIT - 4

Control for mechanical systems & processes ; speed control system for steam/gas turbines. A

constant tension ;reeling system, Electro-mechanical systems. Thermal systems, Pneumatic

systems; Mathematical Models of physical systems, Feed back characteristics of Control

Systems. Time response analysis; transient response analysis, time response specifications, steady
state-error.

UNIT - 5

Concepts of stability, Routh-Hurwiz stability criterion, relative stability. The root locus

technique, use of construction rules without any derivation.

Frequency response analysis, Polar plots; stability in frequency domain, Bode / Logrithmic

plots. Nyquist stability criterion.

Reference

1. MECHANICAL MESUREMENTS, T THOMAS G. BACKWITH, N LEWIS BUCK, ROY, NAROSA PUBLISHING HOUSE.
2. MECHANICAL MEASUEMENTS AND INSTRUMENTATIONS , A K SAWHNEY , DHANPAT RAI AND CO.
3. INDUSTRIAL INSTRUMENTATION AND CONTROL. S K SINGH, TATA McGRAW HILL

DYNAMICS OF MACHINES LAB.

04IIE201:

1. To study inversion of four bar chain

2. Coupling Rod

3. Beam Engine

4. Steering Mechanism

(a) Study of quick return mechanism.(Crank and Slotted lever mech.)

(b) To draw velocity and acceleration diagram for Crank and slotted lever mechanism.

5. Study of inversion of Double slider chain

Oldhan Coupling

Scotch Yoke

Elleptical Trammel

6. To plot displacement v/s $\square$ $\square$ curve for various cams

7. Study of various cam- follower arrangements.

8. To determine co-efficient of friction.

9. Study of various types of dynamometers, Brakes and Clutches.

10. To determine moment of inertia of the given object using of Trifler suspension.

FLUID MECHANICS LAB.

04IIE202:

NAME OF EXPERIMENTS

1. Determine Metacentric height of a given body.

2. Determine Cd, Cv & Cc for given orifice.

3. Determine flow rate of water by V-notch.

4. Determine velocity of water by pitot tube.

5. Verify Bernoulli's theorem.

6. Determine flow rate of air by Venturi meter

7. Determine flow rate of air by orifice meter

8. Determine head loss of given length of pipe.

9. Determine flow rate of air by nozzle meter.

10. Study of Pelton, Kaplan Turbine models.

THERMAL ENGINEERING LAB. – II

04IIE203:

1. Disassembling and assembling of multi-cylinder petrol and diesel engines and study

of their parts.

2. To disassemble and assemble a 2-stroke petrol engine.

3. To disassemble and assemble a 4-stroke motor cycle engine and study of various

engine parts.

4. Load test on a single cylinder 4-stroke diesel engine using a rope brake dynamometer

and calculate volumetric and thermal efficiency and draw a heat balance-sheet.

5. Study of carburettors and MPFI system and disassembling and assembling of their

parts.

6. To calculate valve timing of a multi-cylinder petrol engine and valve tappets

adjustment.

7. Disassemble all the parts of a fuel injection pump and its parts study.

8. To disassemble the governor and study its various parts

MECHANICAL MEASURMENTS & CONTROL LAB.

INSTRUMENTATION LAB. SESSIONAL

04IIE204:

1. Displacement Measurement using Capacitive Pick - up System

2. Displacement Measurement Using Inductive Pick-up System

3. Displacement Measurement Using Light Dependent Register Set up

(i) Displacement v/s Registance at Constant Voltage

(ii) Voltage v/s Registance at Constant Displacement

4. Study of Speed Measurement System

(i) Magnetic Pick-up

(ii) Strobometer

5. Study of Load Measurement System

Load Cell + Load Indicator

6. Calibration of Thermocouple Wire.

MACHINE DESIGN LAB - I

04IIE205:

1. Selection of material & IS coding

2. Selecting fit & assigning tolerances

3. Examples of Production considerations.

Problems on

1. Knuckle & Cotter joints

2. Torque : Keyed joints & shaft couplings

3. Design of screw fastening

4. Bending: Beams, Levers etc.

5. Combined stresses : Shafts, brackets, eccentric loading.

6. Design for rigidity (Transverse / Torsional)

SEMESTER V

ADVANCED MECHANICS OF SOLIDS

Course/Paper 05IIE 101

IIE semester V

UNIT 1:-

Analysis of stress in 3-Dimensions: Body force, surface force and stress vectors, state of stress at a point, normal shear stress components, stress component on arbitrary plane, principal stresses in 3-Dimentions, stress invariants, decomposition of stress matrix into hydrostatic and pure shear states, Lame's stress ellipsoid, differential equations of equilibrium.

UNIT 2:-

Analysis of strain in 3-Dimensions: introduction, deformation in neighborhood of a point, change of length of linear element, state of strain at a point, principal axes of strain and principal strains, compatibility conditions.

UNIT 3:-

Stress strain relations for linearity elastic bodies, generalized Hooke's law, stress-strain relations for anisotropic, orthotropic and isotropic materials.

UNIT 4:-

Bending of curved beams (Winkler-Bach formula); unsymmetrical bending of beams, shear centre.

UNIT 5:-

Stresses in thick cylinders, shrink fit stresses, stresses in rotating discs.

Reference

1. MECHANICS OF SOLIDS BY S H CRANDALL. N C DAHI McGRAW HILLS INTERNATIONAL EDITION
2. STRENGTH OF MATERIALS: G.H RYDER. ELBS PUBLICATIONS CO., LONDON
3. ELEMENTS OF STRENGTH OF MATERIALS. J.P TINNOSHNKO & G.H YOUNG, AFFILIATED EAST WEST PRESS, NEW DELHI
4. SOLID MECHANICS. G.M.A KAZMI. TATA MCGRAW HILL PUBLISHING CO. LTD.. NEW DELHI
5. STRENGTH OF MATERIALS: S. RAMAMRUTHAM. DHANPAT RAI AND PUBLICATIONS, NEW DELHI.

HEAT TRANSFER

Course/Paper 05IIE 102

IIE semester V

UNIT 1:-

Introduction to heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling, definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient.

Conduction : General 3-Dimensoinal conduction equation in Cartesian , cylindrical and spherical coordinates; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; electrical analogy; heat conduction through composite walls; critical thickness of insulation.

UNIT 2:-

Heat transfer from finned surfaces; fin efficiency and effectiveness, two dimensional steady state heat conduction using analytical and numerical methods, periodic heat conduction.

Convection: review of Navier – Stokes and energy equation, hydrodynamic and thermal boundary layers; laminar boundary layer equations; forced convection appropriate non dimensional members; effect of Prandtl number; empirical relations for flow over a flat plate and flow through pipes.

UNIT 3:-

Natural convection: Dimensional analysis, Granhoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations.

Heat transfer with change of phase: nature of vaporization phenomena; different regimes of boiling heat transfer; correlations for saturated liquid vaporization; condensation on flat plates; correlation of experimental results, drop wise condensation.

UNIT4:-

Heat exchanger: Different types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method, fouling factor.

Constructional and manufacturing aspects of Heat Exchangers.

UNIT 5:-

Thermal Radiation: Plank distribution law, Krichoff's law; radiation properties, diffuse

radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies

heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating

surfaces heat transfer in presence of reradiating surfaces.

Reference

1. FUNDAMENTALS OF HEAT AND MASS TRANSFER, R C SACHDEVA, NEW AGE PUBLICATION
2. FUNDAMENTALS OF HEAT AND MASS TRANSFER, C P KOTHANDARAMAN, NEW AGE PUBLICATION
3. HEAT TRANSFER , J.P.HOLMAN
4. HEAT AND MASS TRANSFER, KERN, TMH
5. FUNDAMENTALS OF HEAT AND MASS TRANSFER, Dr. D.S. KUMAR

FUNDAMENTALS OF AERODYNAMICS

Course/Paper 05IIE 103

IIE semester V

UNIT 1:-

Aerodynamic forces and moments over the body surface, concept of lift and drag,

dimensionless force and moment coefficient, centre of pressure of an aerofoil,

nomenclature of aerofoil, angle of attack, circulation and lift over an-aerofoil, Kutta

condition, Kelvin's circulation theorem.

UNIT 2:-

Blade theory; Symmetrical and non-symmetrical aerofoil. Energy transfer in terms of lift

and drag, cascade nomenclature, turbine cascade nomenclature, cascade lift and drag

coefficient.

UNIT3:-

Isentroic Flow: Velocity of sound; Mach angle; Mach number, steady isentropic flow

through ducts; use of isentropic tables; condition for maximum discharge; choked flow;

flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle.

UNIT 4:-

Adiabatic flow and flow with Heat Transfer: Adiabatic flow; Fanno line tables; entropy

change; choking due to friction; flow through long ducts; Diabatic flow ; Rayleigh line;

use of tables; change in entropy; effect of change in stagnation temperature.

UNIT 5:-

Normal Shock: Plane stationary normal shock; Ranking-Hugoniot relations; increase in

entropy; Prandtl's relations; change in stagnation pressure across the shock.

Reference

1. FUNDAMENTALS OF AERODYNAMICS BY ASHISH DUTT SHARMA, S. CHAND & CO.
2. AERODYNAMICS BY R.K.RAJPUT DHANPAT RAI & PUBLICATION

INDUSTRIAL ENGINEERING

Course/Paper 05IIE 104

IIE semester V

UNIT I:-

Management Theory and Functions: Evolution of management, scientific management,

Contribution to scientific management: Reactions and criticisms of Taylor, Fayol, Mayo,

Levels of 'Management Administration and Management, functions of management.

Decision-making.

UNIT 2:-

Business Forms and Organization:

Forms of Business:(i)Single proprietorship (ii) Partnership (iii) Joint stock company (iv)

Private Ltd- Companies and public limited companies

Forming Joint Stock Companies (a) Registration (b) issue of Prospectus

(c) Commencement Certificate (iv) co-operative Society choice of Business forms

(v) State undertaking. Organization meaning. Types of organization; (i) Line organization

(ii) Functional Organization (iii) Line Staff organization (iv) Line Staff Committee

organization, span of control.

UNIT 3:-

Finance & Financial Statements: Introduction, Needs of Finance, Kinds of Capital

Sources of fixed capital, Shares - (i) Ordinary Shares (ii) Preference Shares. Borrow

capital. Surplus profits.

Sources of Working capital. Management of working capital. Financial Institutions.

Profit & Loss Statement, Balance Sheet, Financial ratio: Liquidity ratio, Profits

investment ratio, equity ratio, inventory ratio.

UNIT4:-

Interest and Depreciation: interest meaning, Compound interest. Annuities capital

recovery Annuity present worth annuity sinking funds annuity compound Amount

Annuity Nominal and effective rate of interest. Depreciation Meaning and causes. Need

of Depreciation calculation, Methods of Depreciation. Straight line Methods. Sinking

funds methods. Declining Balance Method, sum of years digits method (Syd Method).

UNIT 5:-

Labour relations and legislation: Profit sharing, fringe benefits etc.Trade Unions.

Methods of setting disputes (i) Collective bargaining (ii) Conciliation (iii) Mediation

(iv) Arbitration industrial disputes in India, Machinery for setting disputes. Trade

Disputes Acts. The factory Act 1944, payment of wages act. Workman's compensation

act.

Reference

1. PRODUCTION AND OPERATIONS MANAGEMENT, EWS BUFFA AND S KAPOOR
2. INDUSTRIAL ORGANISATION AND MANAGEMENT, BETHEL ATWATER, SMITH McGRAW HILL
3. INDUSTRIAL ENGG. BY M MAHAJAN, DHANTPAT RAI PUB.
4. PRINCIPLES OF INDUSTRIAL MANAGEMENT, ALFORD, RONALD PRESS

DYNAMICS OF MACHINES

Course/Paper 05IIE 105

IIE semester V

UNIT I:-

Governors: Watt, Porter, Proell, Hartnell and spring controlled governors, governor

effort, power, stability, inertia effects.

UNIT 2:-

Gyroscope: Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal

force on vehicle taking a turn, stabilization of sea vessels.

Inertia force analysis: Velocity and acceleration of slider crank and four bar mechanism,

inertia force, piston thrust and forces on connecting rod, turning moment diagram,

flywheel.

UNIT 3:-

Gears: Law of gearing, terminology, tooth form, standard interchangeable tooth profile,

minimum number of teeth on pinion in contact with gear or rack, interference and

undercutting, bevel, helical and spiral gears.

UNIT 4:-

Gear trains: Simple, compound, reverted and epicyclic gear trains, analytical, tabular,

graphical and vector methods for velocity ratio, gear boxes- sliding and constant mesh for

automobiles.

UNIT 5:- Balancing: Balancing of rotating masses, balancing of reciprocating

masses, locomotives, IC engines, balancing machines.

Reference

1. THE THEORY OF MACHINES ,THOMAN BEVAN ,CS PUBLISHERS& DISTRIBUTERS DELHI
2. THEORY OF MECHANISM & MACHINES: JAGDISH LAL METROPOLITAN BOOK CO.LTD NEW DELHI
3. THEORY OF MACHINES : P.L. BALLANEY ,KHANNA PUBLISHERS DELHI
4. THEORY OF MECHANISM & MACHINES, A.KGOSH & A.K MALIK
5. ,AFFILATED WAST WEST PRESS PVT LTD NEW DELHI
6. THEORY OF MACHINES & MECHANISMS : J.E.SHINGHLEY & J.J UICKER,MC GRAW HILL INTERNATIONAL EDITION
7. KINETICS & DYNAMICS OF MACHINES: G. H MARTIN MC GRAW HILL

PRINCIPLES OF TURBOMACHINES

Course/Paper 05IIE 106

IIE semester V

Unit 1:-

Basic concepts of turbomachines: Definition of Turbomachine, classification; Basic laws and governing equations; continuity equation, steady flow energy equation(1sl law of thermodynamics),2nci law of thermodynamics applied to turbomachines, Newton's 2nd law of motion applied to turbomachines - Euler's pump equation and Euler's turbine equation, dimensional analysis applied to hydraulic machines, power coefficient, flow coefficient, head coefficient, non-dimensional specific speed; Range of 'specific speeds for various turbomachines.

Dimensional analysis applied to compressible flow machines, pressure ratio as a Function of temperature ratio, mass flow rate parameter and speed parameter.

Unit 2:-

Centrifugal pumps: Main parts, work done and velocity triangles, slip and slip factor, pump losses and efficiencies, minimum starting speed, net positive suction head, performance curve.

Unit 3:-

Axial flow pumps; Description, velocity triangles, work done on the fluid, energy transfer, axial pump characteristics, cavitation.

Unit 4:-

Centrifugal compressors and fans: Components and description, velocity diagrams, slip factor, energy transfer, power input factor, stage pressure rise and loading coefficient, pressure coefficient, degree of reaction. Centrifugal compressor characteristic, surging, rotating Stall and Choking.

Unit5:-

Axial flow compressors and fans: Basic constructional features; turbine v/s compressor blades; Advantages of axial flow compressors, working principle, velocity triangle, elementary theory; stage work, work done factor, stage loading, degree of reaction; vortex theory; simple design calculations; introduction to blade design; cascade test;

compressibility effects; operating characteristics.

Reference

1. GAS TURBINE THEORY: H COHAN G.F.C ROGER AND HIH SARAVANAMA LONGMAN SCIENTIFIC AND TECHNICAL PUB.
2. GAS TURBINE AND JET PROPULSION: M L MATHUR AND R P SHARMA, STANDARD PUBLISHER AND DISTRIBTOR
3. GAS TURBINE AND JET PROPULSION: V GANESHAN

PROD. ENGG. LAB. - I

05IIE201:

IIE semester V

Perform any twelve experiments:

1. Study of single point cutting tool geometry & grind the tool as per given tool

geometry.

2. Study the milling machine, milling cutters, indexing heads and indexing methods.

3. Prepare a gear on milling machine.

4. Prepare a hexagonal / octagonal nut using indexing head on milling m/c and to cut

BSW/METRIC internal threads on lathe.

5. To cut multi-start square / metric threads.

6. To cut external metric threads & to meet it with the nut

7. To prepare the job by eccentric turning on lathe machine.

8. To prepare a job on shaper from given MS rod.

9. To study the various crystal structures and dislocations through models.

10. To study the Iron-Iron Carbide Equilibrium Diagram and sketch the various

structures present at room temps.

11. Study of capstan lathe and its tooling and prepare a tool layout & job as per given

drawing.

12. Study the principle & construction of the Metallurgical Microscope.

13. Prepare metallic samples for metallographic examination for study of

Microstructure

14. Study the hardening of steel in different medium and at different cooling rates.

15. Study the effect of Carbon percentage on the hardness of Steel.

AUTOMOBILE ENGG. LAB

05IIE202:

IIE semester V

1. Valve refacing and valve seat grinding and checking for leakage of valves

2. Trouble shooting in cooling system of an automotive vehicle

3. Trouble shooting in the ignition system, setting of contact breaker points and spark

plug gap

4. Demonstration of steering system and measurement of steering geometry angles

and their impact on vehicle performance.

5. Trouble shooting in braking system with specific reference to master cylinder,

brake shoes, overhauling of system and the adjusting of the system and its testing.

6. Fault diagnosis in transmission system including clutches, gear box assembly and

differential.

7. Replacing of ring and studying the method of replacing piston after repair.

DYNAMICS OF MACHINES LAB. - II

05IIE203:

IIE semester V

1. To verify the relation T=Iùùp for gyroscope.

2. To plot force vs. radius and lift vs. speed curves for governors.

3. To plot pressure distribution curves on a journal bearing.

4. To perform wheel balancing.

5. To perform static and dynamic balancing on balancing set up.

6. To determine mass moment of inertia of a flywheel.

1- Study of a lathe gear box.

8. Study of a sliding mesh automobile gear box.

9. Study of a planetary gear box.

MATLAB AND COMPUTER GRAPHICS

05IIE204:

IIE semester V

(A) MATLAB: Use of MATLAB and its application to Mechanical Engineering

problems.

(B) Turbo C Graphics: To make C programs to animate different mechanisms

and system: Such as Slider Crank Mechanism, Quick Return Mechanism,

Cam Follower, Solar system, ball motion in billiard, Rolling of wheel from

inclined plane, Seesaw motion, Projectile moti

on of a wheel, etc.

SEMESTER VI

DESIGN OF MACHINE ELEMENTS- II

Course/Paper 06IIE 101

IIE semester VI

Unit 1

Fatigue Considerations in Design: Variable load, loading pattern, Endurance stresses, influence of

size, surface finish, notch sensitivity & stress concentration. Goodman line, Soderberg, Design of

machine members subjected to combined, steady and alternating stresses. Design for finite life.

Design of Shafts under Variable Stresses.

Unit 2

Pre loading of bolts; effect of initial tension & applied loads, Bolts subjected to variable stresses.

Design of members which are curved like crane hook, body of C-clamp, machine frame etc.

Power screws like lead screw, screw jack.

Unit 3

Design of helical compression, tension, torsional springs. Springs under variable stresses.

Design of belt, rope and pulley drive system, selection of chain & sprocket drive systems.

Unit 4

Design of gear teeth, Lewis and Buckingham equations; wear and dynamic load considerations,

Design and force analysis of spur, helical, bevel and worm gears. Bearing reactions due to gear

tooth forces.

Unit 5

Design of sliding & journal bearing; method of lubrication, hydrodynamic, hydrostatic, boundary

etc. Minimum film thickness and thermal equilibrium.

Selection of anti-friction bearings for different loads and load cycles. Mounting of the bearings.

Method of lubrication, selection of oil seals.

Reference

1. THE THEORY OF MACHINES ,THOMAN BEVAN ,CS PUBLISHERS& DISTRIBUTERS DELHI
2. THEORY OF MECHANISM & MACHINES: JAGDISH LAL METROPOLITAN BOOK CO.LTD NEW DELHI
3. THEORY OF MACHINES : P.L. BALLANEY ,KHANNA PUBLISHERS DELHI
4. THEORY OF MECHANISM & MACHINES, A.KGOSH & A.K MALIK
5. ,AFFILATED WAST WEST PRESS PVT LTD NEW DELHI
6. THEORY OF MACHINES & MECHANISMS : J.E.SHINGHLEY & J.J UICKER,MC GRAW HILL INTERNATIONAL EDITION
7. KINETICS & DYNAMICS OF MACHINES: G. H MARTIN MC GRAW HILL

MANUFACTURING SCIENCE AND TECHNOLOGY

Course/Paper 06IIE 102

IIE semester VI

Unit 1

JIGS AND FIXTURES:- Introduction, definition and difference; usefulness of jigs and fixtures;

design considerations; materials used; principles and methods of location; clamping elements; jig

bushes; drilling jigs; fixtures for milling turning, boring and welding; assembly fixtures; indexing

devices; economics of jigs and fixtures; complete design of a jig and a fixtures; complete design

of a jig and a fixtures.

Unit 2

NEW MACHINING METHODS: Types of machining methods; hot machining; electric discharge machining (E.D.M.) ultrasonic machining (U.S.M.) ; Electron beam machining (E.B.M.) laser beam Machining (L.B.M.); abrasive jet machining (A.J.M.) ; plasma arc machining (PAM); economics of machining! ,

Unit 3

Precision Measurement : Standards of linear measurements; linear and angular measurements; screw thread measurement; measurement of effective diameter, pitch and thread angles; Gear measurement, measurement of tooth profile, tooth thickness and pitch, Measurement of surface roughness. Quantitative methods of roughness measurements, Stylus and profilograph methods.

Precision Measuring Instruments: Comparators types; working principles applications and limitations of various comparators; optical flat; autocollimator indicators, slip gauges, bevel protector.

Unit 4

DESIGN OF SINGLE POINT CUTTING TOOLS: Introduction; functions of various tool angles; design of single point turning too]; parting tool; empirical determination of force components; optimum value of tool angles.

DESIGN OF Multipoint Cutting tool: Introduction; angle of contact; force analysis; approach through dimensional analysis; force and power consumption; tooth forn1 and cutter design.

Unit 5

Design of Machine Tool Element

Design of Lathe bed, Material and construction feature, various bed section, designing for torsional rigidity, use of reinforcing stiffener in lathe bed.

Theoretical aspect of design of guide ways, Material and construction features, Antifriction guide ways.

Reference

1. PRODUCTION ENGINEERING SCIENCES BY P.C.PANDEY & C.K.SINGH, STANDARD PUBLISHERS & DISTRIBUTORS DELHI
2. PRODUCTION ENGINEERING BY P.C.SHARMA, S.CHAND & CO.PVT LTD. NEW DELHI
3. FUNDAMENTALS OF TOOL DESIGN: F.W.WILLSON; ASTME

NOISE, VIBRATION & HARSHNESS

Course/Paper 06IIE 103

IIE semester VI

Unit 1

Sound level and subjective response to sound; Frequency dependent human response to sound, Sound pressure dependent human response. Decibel scale; Decibel addition, subtraction and averaging. Relationship among sound power, sound intensity and sound pressure level. Sound spectra. Octave band analysis. Loudness.

Noise: Effects, Ratings and Regulations; Non-auditory effects of noise on people, Auditory Effects of noise, Noise standards and limits in India.

Major sources of the noise; Industrial noise sources. Industrial noise control-strategies; Noise control at the source, Noise control along the path, Acoustic barriers, Noise control at the receiver.

Unit 2

Scope of vibration, important terminology and classification, Degrees of freedom, Harmonic motion; vectorial representation, complex number representation, addition. Derivation of equation of motion for one dimensional longitudinal, transverse and torsional vibrations without damping using Newton's second law, D' Alembert's principle and Principle of conservation of energy. Compound pendulum and centre of percussion.

Damped vibrations of single degree of freedom systems. Viscous damping; underdamped, critically damped and overdamped systems, Logarithmic decrement. Vibration characteristics of Coulomb damped and Hysteretic damped systems.

Unit 3

Forced vibrations of single degree of freedom systems. Forced vibration with constant harmonic excitation. Steady state and transient parts. Frequency response curves and phase angle plot. Forced vibration due to excitation of support. Vibration Isolation and transmissibility; Force transmissibility, Motion transmissibility. Forced vibration with rotating and reciprocating unbalance. Materials used in vibration isolation.

Unit 4

System with two degrees of freedom; principle mode of vibration, Mode shapes. Undamped

forced vibrations of two degrees of freedom system with harmonic excitation. Vibration

Absorber; Undamped dynamic vibration absorber and centrifugal pendulum absorber.

Many degrees of freedom systems: exact analysis.

Unit 5

Many degrees of freedom systems: approximate methods; Rayleigh's, Dunkerley's, Stodola's and

Holzer's methods.

Vibrations of continuous systems; Transverse vibration of a string, Longitudinal vibration of a

bar, Torsional vibration of a shaft.

Reference

1. MECHANICAL VIBRATION, G K GROVER, NEMI CHAND AND BROS.
2. VIBRATION THEORY AND APPLICATIONS. W T THOMSON
3. VIBRATIONS & NOISE FOR ENGINEERING ; K.K.PUJARA, DHANPAT RAI & SONS,DELHI
4. MECHANICAL VIBRATIONS, DEN HARTOG
5. VIBRATION PROBLEMS IN ENGINEERING , TIMSHENKO

INTERNAL COMBUSTION ENGINES AND DIESEL POWER PLANT

Course/Paper 06IIE 104

IIE semester VI

Unit 1

Introduction : Historical & Modern Development, Nomenclature, Classification & Comparison :

SI & CI, 4 stroke – 2 stroke, First Law analysis, Energy Balance.

Testing & Performance : Performance parameters, Measurement of operating parameters e.g.

speed, fuel & air consumption, Powers IHP, BHP, FHP, Efficiencies Thermal, Mechanical,

Volumetric, Emission Measurement, Numerical problems, India & International standards of

Testing, Emission.

Unit 2

Fuel & Combustion

Combustion in CI & SI engines : Ignition Limits, Stages of combustion, Combustion parameters.

Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion

parameters, Abnormal combustion in CI & SI engines, Detonation & knocking, , Theories of

detonation, Control of abnormal combustion, Combustion chamber Design principles, Types of

combustion chamber.

Fuel:- Conventional : Petroleum, structure, Refusing Fuels for SI & CI engines, Knock rating,

Additives, Fuels for Turbine & Jet Propulsion.

Alternative : Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance

with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio gas.

Unit 3

Engine Systems & Components

Fuel Systems :

SI Engine : Combustion & Injection, process & parameters properties of A/F mixture,

Requirements of A/F per different operating conditions, Carburetion & Carburetors, types,

Aircraft carburetor, comparison of carburetion & injection, F/A ratio calculations, Numerical

problems. CI engine : Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors. Ignition system : Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s

Electronic ignition, Fuel Ignition Energy requirements. Spark galvanic, centrifugal, vacuum

Firing order, spark plugs.

Unit 4

Engine Friction & Lubrication : Determination of friction, Lubrication principles, Types of

lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication,

Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems.

Engine Cooling : Requirements of cooling, Areas of heat flow, High temperature regions of

combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system

components. Supercharging : Objectives, Thermodynamic cycle & performance of super charged SI & CI engines Methods of super charging, Limitations Two stroke engines : Comparison of 4s & 2s engines construction & valve lining scavenging. Process parameters, systems, supercharging of 2 stroke engines.

Unit 5

Dual & Multi fuel engines : Principle, fuels, Combustion, performance Advantages, Modification

in fuel system. Working principles of . Rotary, Stratified charge, Free piston, Variable compression ratio engines. Diesel Power plant: Requirements, capacity, operation, safety, Engine Generator Coupling,

Electrical load, Switching

Reference

1. I.C.ENGINES M.L.MATHUR,R.P.SHARMA, DHANPAT RAI PUBLIATIONS
2. I.C.ENGINE EDWARD F. ORBET , HARPER AND ROW
3. I.C.ENGINES, HEYWOOD

HYDRAULIC MACHINES AND HYDRO ELECTRIC POWER PLANT

Course/Paper 06IIE 105

IIE semester VI

Unit 1

Review of fundamentals

Euler's turbine equation, principles of similarity applied to hydraulic machines, non-dimensional

specific speed. Classification of turbines on the basis of non-dimensional specific speed. Unit and

specific quantities.

Impact of Free Jets

Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged

plate, moving plate and moving curve vanes.

Unit 2

Impulse Turbine

Classification of turbine, impulse turbines, Pelton wheel, Construction, working. Work done,

head, efficiency and design aspects. Governing of impulse turbine.

Unit 3

Reaction Turbine

Radial flow reaction turbine, Francis turbine: construction and working. Work done, efficiency,

design aspects.

Axial flow reaction turbine

Propeller and Kaplan turbine, bulb or tubular turbine- construction and working. Draft tube,

governing of reaction turbine.

Performance characteristics and comparison of all the turbines.

Cavitation Phenomenon in hydraulic machines

Unit 4

Reciprocating Pumps

Classification, component and working, single acting and double acting, discharge, work done

and power required, coefficient of discharge, indicator diagram, slip, effect of friction and

acceleration theory of air vessels.

Fluid system

Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift,

hydraulic Ram, hydraulic coupling, hydraulic torque converter, air lift pump, jet pump.

Unit 5

Hydro Electric power station (HEPP) – Advantages and disadvantages of water power,

selection of site for HEPP, hydrological cycle, hydrographs, essential elements of HEPP. Types

of dams, conduits, spillways, surge tanks.

Classification of HEPP. Major, mini and micro power plants- present scenario in Rajasthan and

India. Selection of turbine.

Reference

1. ENGINEERING FLUID MECHANICS, K.L.KUMAR, EURASIA PUBLISHING HOUSE P.Ltd.
2. FLUID MECHANICS AND FLUID POWER ENGG.: D S KUMAR, S K KATARIA AND SONS.
3. FLUID MECHANICS AND MACHINES: F M WHITE, JOHN WILLY AND SONS
4. FLUID MECHANICS : R.K.RAJPUT S. CHAND COMPANY LTD
5. FLUID MECHANICS VM STREETER McGRAW HILL

NUMERICAL METHODS AND APPLIED STATISTICS

Course/Paper 06IIE 106

IIE semester VI

Unit 1

Errors and significant digits, Roots of algebraic equations Bisection method, secant method,

Newton Raphson method, Graff's root- squaring method, Iterated synthetic division with

quadratic factors method for finding complex roots,

Unit 2

Solutions of systems of equations (Gauss elimination, Gauss Jordan, and Partition method for linear system of equations, power method for partition, method for linear system of equations, power method for finding eigen values), Forward, backward , central and Divided differences, Newton's formula of interpolation for equal and unequal intervals. Lagrange's interpolation formula, Stirling's and Bessell's formula,

Unit 3

Numerical differentiation, Numerical Integration:- Trapezoidal, Simpson's rule and Gaussian integration (only formula applications) Differential equations and their solutions. Numerical methods for ordinary differential equations (Picard method, Taylor series method, Euler's method, Ranga Kutta Method, Predictor- corrector method, Adams- Bashforth method).

Unit 4

Sampling theory: Introduction: Moments, Moment generating functions, Skewness, Kurtosis, Correlation and Regression, Normal sampling distributions; Binomial distribution, Poisson distribution, Normal distribution; Sampling distribution of the means; sampling distribution of the differences of the means; sampling distributions of proportions.

Unit 5

Tests of Significance; t-distributions, chi square distributions, F-distributions.

Regression And Correlation; Linear regression; correlation, multiple correlation & partial correlation Confidence Limits; Large samples, small samples, error bands in regression

Reference

1. MATHEMATICS STATISTICS BY J. N KAPUR & H.C SAXENA, S. CHAND & CO., NEW DELHI

2. MATHEMATICAL STATISTICS, M RAY & H.S. SHARMA, RAM PRASAD & SONS , AGRA

3. MATHEMATICAL STATISTICS, JOHN E. FREUND, PRENTICE HALL OF INDIA, NEW DELHI

4. ADVANCED MATHEMATICS FOR ENGINEERS, CHANDRIKA PRASAD, PRASAD MUDRANALAYA

<u>**MACHINE DESIGN – II SESSIONAL**</u>

Course/Paper 06IIE 201

IIE semester VI

Problems on

1. Fatigue loading

2. Helical compression, tension and torsional springs design

3. Curved Beams

4. Preloaded bolts and bolts subjected to variable stresses

5. Belt, Rope and Chain drive system

6. Gear Design

7. Sliding contact bearing design

8. Anti-friction bearing selection

HEAT TRANSFER LAB

Course/Paper 06IIE 202

IIE semester VI

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)

1. To Determine Thermal Conductivity of Insulating Powders.

2. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).

3. To Measure the thermal Conductivity of Liquid.

4. To determine the transfer Rate & Temperature Distribution for a Pin Fin.

5. To Measure the Emmissivity of the Test plate Surface.

6. To Determine Stefan Boltzman Constant of Radiation Heat Transfer.

7. To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural

Convection.

8. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.

9. To Determine Critical Heat Flux in Saturated Pool Boiling.

10. To Study Performance of Simple Heat Pipes.

11. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat

Exchangers.

12. To Find the Heat transfer Coefficient in Forced Convection in a tube.

13. To determine the total thermal conductivity and thermal resistance of the given compound resistance in series.

14. To find out the thermal conductivity of given slab material.

15. To determine the individual thermal conductivity of different lagging in a lagged pipe.

16. To study the rates of heat transfer for different materials and geometries

17. To understand the importance and validity of engineering assumptions through the lumped heat capacity method.

18. Testing and performance of different heat insulators.

TURBOMACHINERY LAB

Course/Paper 06IIE 203

IIE semester VI

1. Determination of Mechanical and volumetric efficiency of Reciprocating Air Compressor.

2. Testing of Reciprocating Air Compressor.

3. Determination of efficiency and Pressure distribution of Axial Flow Compressor.

4. Performance testing of Axial Flow Compressor.

5. Study and Performance of Simple Steam Turbine

6. Performance characteristics of Pelton wheel turbine.

7. Performance characteristics of Francis turbine.

8. Performance characteristics of Kaplan turbine.

9. Performance characteristics of variable speed centrifugal pump.

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10. Performance characteristics of rated speed centrifugal pump.

11. Performance characteristics of multistage centrifugal pump.

COMPUTER ORIENTED NUMERICAL METHODS LAB

Course/Paper 06IIE 204

IIE semester VI

1. To develop computer program to determine roots of a given equation using method of

a. False position

b. Newton -Raphson method,

2. To develop computer programs for solution of system of simultaneous linear equations using:

a. Gauss Elimination Technique, without and with specified boundary conditions, for

full as well as bounded symmetric and unsymmetrical matrices

b. Gauss Shield iterative technique Successive over Relaxation(S.O.R) Technique

3. Linear and Non-Linear curve fitting technique

4. Numerical Integration with Simpson's rule and Gaussian Integration

5. Solution of ordinary differential equations by (i) Eular Method (ii) Runge-Kutta

Method (iii) Taylor Series Methods

6. Solution of partial differential equations using S.O.R. Technique with special reference to heat

conclusion equation.

SEMESTER VII

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COMPUTER AIDED DESIGN

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Course/Paper 07IIE 101

IIE semester VII

UNIT I.

Overview of Computer Graphics, Picture representation, Coordinate Systems, Output

Graphcis Display devices. Raster Scan Graphics : DDA for line generation and Bresenham's

algorithm for line and circle generation.

UNIT II

Wire frame models, Parametric representation of curves, Plane curves : line, circle,

ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline

Curves. Blending of Curves.

UNIT III

Surface models and entities Parametric representation of Hermite Bicubic surfaces, Bezier

surfaces and B-spline surfaces. Solid Models and entities, Solid Representation : B-rep. and CSG.

Comparison between three types of models**.**

UNIT IV

Two and three dimensional transformation of Geometric models: Translation, Scaling

Reflection, Rotation and Shearing. Homogeneous Representation, Combined Transformation.

Projection of Geometric models: Parallel and Perspective Projection.

UNIT V

Clipping : Point clipping, Line clipping, Cohen- Sutherland algorithm etc. Viewing

Transformation, Hidden Line and surface Removal : Techniques and Algorithms.

Reference

1. MATHEMATICAL ELEMENTS OF COMPUTER GRAPHICS, ROGERS AND

   ADAMS

2. CAD/CAM THEORY AND PRACTICE, ZEID IBRAHIM, TATA Mc GRAW HILL

3. COMPUTER GRAPHICS, PLASTOCK AND KALLAY

REFRIGERATION AND AIR CONDITIONING

Course/Paper 07IIE 102

IIE semester VII

Unit 1

Introduction

Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle.

Vapour Compression Refrigeration System

Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle.

Multiple Evaporator and compressor system.

Application, air compressor system, Individual compressor, compound compression, cascade

system. Application, air compressor systems, individual compressor, compound compression, cascade system.

Unit 2

Gas cycle Refrigeration

Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative

H.E.

Air cycle for air craft

Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.

Unit 3

Vapour Absorption System

Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption

refrigeration system, Lithium Bromide Absorption Refrigeration System.

Refrigerants

Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC

Refrigerants.

Refrigeration Equipments

Compressor, condenser, evaporator, expansion devices – types & working.

Unit 4

Psychrometry

Psychometric properties, psychometric relations, pyschrrometric charts, psychrometric

processes, cooling coils, By-pass factor and air washers.

Human Comfort

Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.

Unit 5

Cooling load calculations

Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system

Reference

1. REFRIGERATION AND AIR CONDITIONING: C P GUPTA
2. REFRIGERATION AND AIR CONDITIONING: BALLANEY
3. REFRIGERATION AND AIR CONDITIONING: C P ARORA

4. MODERN AIR CONDITIONING PRACTICE: NARMAN E HARRIS, TATA McGRAW HILLS

STEAM TURBINES AND STEAM POWER PLANT

Course/Paper 07IIE 103

IIE semester VII

Unit 1

Steam Turbines:

Principle and working of steam turbines, type of turbines, impulse and reactions, compounding

for pressure and velocity. Velocity triangles for various types.

Unit 2

Stage efficiency, diagram efficiency, steam speed to blade, speed ratio for optimum performance.

Energy losses in steam turbine, turbine performance at various loads and governing of steam

turbines. Constructional details and description of steam turbine components in brief.

Unit 3

Regenerative feed heating cycles:

Introduction : Most Ideal Regenerative feed heating cycle. Regenerative feed heating cycles and

their representation on T-s and h-s Diagram. Representation of actual process on T-s and h-s

Diagram Regenerative cycles. Other types of feed heating arrangements. Optimum feed water

temperature and saving in Heat Rate. Feed Heaters, Direct Contact Heaters, Surface Heaters

Reheating – Regenerative and Regenerative water – Extraction Cycles.

Reheating of steam, Practical reheating and Non- reheating cycles, advantage &

disadvantages of reheating, regenerative water extraction cycles, practical feed heating

arrangements.

Unit 4

Governing and performance of Steam Turbines.

Description of back pressure Turbines, pass-out Turbines and Mixed Pressure Turbines.

Unit 5

Steam Power Plant

Steam power plants selection of location, working medium. Fuels and fuel handling equipments,

ash handling equipments. Air pre-heater, feed water treatment. Methods of combustion and

various type of combustors. Types of boilers. Modern developments in steam boilers. Description

of cooling tower.

Reference

1. STEAM AND GAS TURBINE, R YADAV CENTRAL PUB. HOUSE. ALLAHBAD

2. THERMODYNAMICS AND HEAT POWER ENGINEERING. VOL 1, M.L.MATHUR AND F.S.MEHTA, JAIN BROS, NEW DELHI

3. GAS DYNAMICS, S.M YAHA

PRODUCT DEVELOPMENT AND LAUNCHING

Course/Paper 07IIE 104

IIE semester VII

Unit 1

Importance of new product-Definition-importance-Development Process.

Importance of new product for growth of enterprise. Definition of product and new product.

Responsibility for new product development. Demands on product development team.

Classification of products from new product development. Point of view- Need based/Market pull

products, Tech. push, Platform based, Process based and customized products. New product

development process and organization. Generic product development process for Market Pull

Products. Modification of this process for other types of products.

Unit 2

Need analysis- Problem Formulation

Establishing economic existence of need, Need Identification and Analysis, Engineering

Statement of Problem, Establishing Target Specification.

Unit 3

Generation of Alternatives and Concept Selection

Concept generation- a creative process, Creativity, Road Elects to creative thinking- Fear of

criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc.,

Creative thinking Process.

Concept feasibility and Concept Selection, Establishing Engineering Specification of Products.

Unit 4

Preliminary & detailed design- Design Review

Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility.

Detailed design of subsystems, component design, Preparation of assembly drawings.

Review of product design from point of view of Manufacturing, Ergonomics and aesthetics.

Unit 5

Management of New Product – development and Launch.

New Product Management's Challenges – Maintaining focus, Promotion of Right Culture,

Management of Creativity, Top Management attention.

Design Team Staffing and Organization. Setting key mile stone, Identification of Risk Areas,

Project Execution and Evaluation Product Launch Strategies.

Project Planning – Project Task matrix, estimation of time & resources, project scheduling.

Reference

1. PRODUCT DESIGN AND MANUFACTURING: CHITAL, A K AND GUPTA R C. PHI

2. PRODUCT DESIGN AND MANUFACTURING: ULRICH KTAND EPPINGER SD MCGRAW HILL

3. PRODUCT DESIGN AND MANUFACTURING: LINDBECK JR, PRENTICE HALL

4. ENGG DESIGN, G E DEITER

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MECHATRONICS

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Course/Paper 07IIE 105

IIE semester VII

Unit 1

Introduction about Mechatronics, scope of Mechatronics, application, process control automation

and N/c Machines.

Unit 2

Sensors and Transducers

Introduction, classification, specification, characteristics of transducers, type of transducers

displacement, strain, vibration pressure, flow, temperature, force & torque, tactile.

Unit 3

Hydraulic Pneumatic & Electrical actuators

Pumps & Compressors, control valves & accessories, actuators, fluid power symbols, fluid power

systems, switching devices, solenoids, motors.

Unit 4

Data Acquisition and Control System

Introduction, Quantitizing theory, Analog to Digital Conversion, Digital to Analog (D/A)

conversation, transfer function, transient response & frequency response & frequency response,

stability criteria.

Unit 5

Design of Mechatronic systems

Introduction, Automatic front and book and cutting in steel rolling mill, lift control system, CNC

lathe, temperature control of a heat treatment furnace, EOT crane control panel, Grey grain

separators, electrode arm control in electric arc furnace.

Reference

1. A TEXTBOOK OF MECHRATOICS : R.K.RAJPUT S.CHAND & CO
2. MECHRATONICS : ASHISH DUTT SHARMA

QUANTITAVIE METHODS AND OPERATIONS RESEARCH

COURSE/PAPER 07 IIE 106
IIE SEMESTER VII

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Role of quantitative methods in decision making. Probability and decision making, decision making under
uncertainty, the value of additional information, Bay's theorem. Probability models and decision making.
Sample survey methods. Methods of measuring and forecasting business changes, index numbers, time
series analysis.
Markov Analysis.
Background of Operations Research, classification of problems in operations
research, phases of operations research study. Linear programming, formulation of mathematical models,
solution of linear programming problems involving design of product mix, resource allocation,
transportation and assignment by graphical, simplex and dual simplex methods, Duality theorem and
applications, use of computer to solve linear programming problems.
Dynamic programming, principles of optimality, characteristics of dynamic programming problem,
deterministic programming models for solution of investment problem, allocation problem, production

scheduling and equipment replacement problem, probabilistic dynamic programming. Games theory, mini max - minimum pure strategies, mixed strategies and expected pay off, solution of 2x2, 2xn, mx2 games, Brown's algorithm.

Queuing theory notation and assumptions, Poisson's queuing models, non- Poisson queuing models, queues in series, queuing decision models, Application to scheduling and maintenance problems.

Reference
1. Quantitative Techniques Vohra, N.D Tata McGraw Hill 1995 in Management
2. Principles of Operations Research Wagner H.M Prentice Hall 1982
3. Operations Research Hira D.S & Gupta S. Chand & Co. 1995P.K
4. Operations Research Taha, H.A Macmillan Pub. Co. 1972
5. Quantitative Methods and Ahuja, K.K Kalyani Publisher 1990
6. Operations Research for Gopikuttan, G. Himalya Publishers 1994
7. Business and Economics

RESEARCH METHODOLOGY

COURSE/PAPER 07 IIE 107
IIE SEMESTER VII

.Nature and objectives of research. Methods of Research: historical, descriptive and experimental Alternative approaches to the study of the research problem and problem formulation. Formulation of hypotheses, Feasibility, preparation and presentation of research proposal

Introduction to statistical analysis : Probability and probability distributions; binomial, Poisson, exponential and normal distributions and their applications.

Sampling: Primary and secondary data, their collection and validation, methods of sampling: Simple random sampling, stratified random sampling and systematic sampling, Attitude Measurement land Scales: Issues, Scaling of attitude, deterministic attitudes, measurement models, summative models, multi dimensional scaling.

Regression and correlation analysis. Tests of significance based on normal., t and chisquare distributions. Analysis of variance.

Basic Principles of design of experiments, completely randomized and randomized block designs.

Reference
1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Triphati, Research Methodology, Sultan Chand & Sons, N.Delhi
3. Fisher, Design of Experiments, Hafner
4. Sadhu Singh, Research Methodology in Social Sciences, Himalya Publishers
65. Stoufferetal, Measurement & Prediction, Wiley, N.York
6. J.W Bames, Statistical Analysis for Engineers & Scientists, McGraw Hill, N.York
7. Donald Cooper, Business Research Methods, Tata McGraw Hill, N.Delh

LAB-I

COURSE/PAPER 07 IIE 201
IIE SEMESTER VII

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in VII semester.

MECHANICAL VIBRATIONS LAB

COURSE/PAPER 07 IIE 202
IIE SEMESTER VII

1. To verify relation $T = 2\eth / (l/g)$ for a simple pendulum.

2. To determine radius of gyration of compound pendulum.

3. To determine the radius of gyration of given bar by using bifilar suspension.

4. To determine natural frequency of a spring mass system.

5. Equivalent spring mass system.

6. To determine natural frequency of free torsional vibrations of single rotor system.

(a) Horizontal rotor (b) Vertical rotor

7. To verify the Dunkerley's rule.

8. Study of free damped torsional vibration to performing the experiment to find out damping

co-efficient.

9. To conduct experiment of trifler suspension.

10. Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.

11. Study of Vibration measuring instruments.

I. C. Engine Lab.

COURSE/PAPER 07 IIE 203
IIE SEMESTER VII

Perform any 10 experiments

1. Study of IC Engine models

2. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut

section models.

3. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section

models.

4. Study of fuel supply system of a petrol engine (fuel pump and simple carburetor)

5. Study of complete carburetor (Solex carburetor)

6. Study of Petrol Injection System.

7. Study of fuel supply system of a Diesel engine (fuel pump and fuel injector)

8. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system) and

Electronic ignition system.

9. Study of Lubrication system of an IC Engine (mist, splash and pressure lubrication)

10. Study of cooling systems of an IC Engine (air cooling and water cooling)

11. To conduct a performance test on diesel engine to draw heat balance sheet for given load and

speed

12. To determine friction power of diesel engine by Willan's line or fuel rate extrapolation

method.

13. To conduct a performance test on the variable compression ratio engine and to draw the heat

Balance sheet for given compression ratio, speed and load and plot the performance curves.

14. To conduct a performance test on a four cylinder four stroke petrol engine and to draw the

heat balance sheet and performance curves.

15. To calculate the indicated power, friction power and mechanical efficiency of four stroke four cylinder petrol engine at full load and rated speed by Morse test.

16. To draw the valve timing diagram of a Four stroke S.I. or C.I. Engine using experimental

setup.

17. Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.

PRACTICAL TRAINING & INDUSTRIAL VISIT

Course/Paper 07IIE 204

IIE semester VII

Industrial visit (20 marks) is for the duration of 10 days at the end of V semester and

Practical Training (80 marks) is for the duration of 30 days at the end of VI semester.

Both will be evaluated during the VII semester and graded accordingly

SEMESTER VIII

RENEWABLE ENERGY TECHNOLOGY

Course/Paper 08IIE 101

IIE semester VIII

Unit 1

Global and National scenarios, Form and characteristics of renewable energy sources

Solar Energy

Solar radiation, its measurements and prediction. Solar thermal collectors, flat plate collectors, concentrating collectors. Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems.

Solar Photovoltaic

Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes

Unit 2

Wind Energy

Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristics, applications.

Unit 3

Ocean Energy

Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

Unit 4

Other Sources:

Nuclear fission and fusion; Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; Magneto-hydro-dynamic (MHD) energy conversion. Formation of biomass, photosynthesis; Biomass resources and their classification; Chemical constituents and physicochemical characteristics of biomass; Biomass conversion processes;

Unit 5

Fuel Cells

Thermodynamics and electrochemical principles; Basic design, types, applications.

Hydrogen Energy

Economics of hydrogen; Production methods.

Reference

1. RENEWABLE ENERGY SOURCES: G N TIWARI, SAYESTA SUNEJA NAROSA PUBLISHING HOUSE
2. SOLAR ENGINEERING, H.P.GUPTA
3. SOLAR THERMAL ENGINEERING BY DUFFIE AND BACKURAN

OPERATIONS MANAGEMENT

Course/Paper 08IIE 102

IIE semester VIII

Unit 1

Introduction: Scope of Operations Management, operations manager and the management

process. Operations Strategy, Competitiveness and Productivity.

Demand Forecasting: components of forecasting demand, Approaches to forecasting: Qualitative

methods, Time series methods, Regression methods, Accuracy and control of forecasts, Selection

of forecasting technique.

Unit 2

Products and Services, Process, Types of Production Systems: Mass, Batch, Job shop production.

Product and process matrix. Process planning and Process analysis. Capacity Planning: Defining

and measuring capacity, steps in capacity planning process, determining capacity requirements,

Capacity alternatives, Evaluation of alternatives- Cost- Volume analysis etc.

Unit 3

Production Planning: Production planning objective and functions, Bill of material, Capacity and

man power requirement planning, Planning levels: long range, Intermediate range and Short

range planning, aggregate planning; Objective, Strategies, graphical and mathematical techniques

of aggregate planning, master production scheduling, MRP and MRPII Systems

Unit 4

Production Control: Capacity control and priority control, production control functions; Routing,

scheduling, dispatching, expediting and follow up. Techniques of production control in job shop

production, batch production and mass production systems,

Unit 5

Material Management: Objectives, scope and functions of material management, planning,

procurement, storing, ending and inventory control. Purpose of inventory, inventory cost,

inventory control systems, Selective inventory control systems, Determination of EOQ, Lead

time and reorder point. Methods of physical stock control

Reference

1. PRODUCTION AND OPERATION MANAGEMENT, ADAM EVERETT E. & EBERT RONALD J. PHI
2. PRODUCTION AND MANAGEMENT: S N CHARRY. TMH
3. OPERATIONAL MANGEMENT: THEORY AND PROBLEMS ON MONK J. G McGRAW HILL
4. PRODUCTION SYSTEMS, RIGGS, J.L WILEY EASTERN

<u>**GAS TURBINES AND GAS POWER PLANT**</u>

Course/Paper 08IIE 103

IIE semester VIII

Unit1

Review of basic principles and fundamentals of rotating machines.

Cycle arrangements, open cycle arrangements, closed cycle arrangements, basic requirement of

the working medium, properties of various working media, applications of gas turbine,

comparison of gas turbines with reciprocating engines.

Ideal cycles: simple gas turbine cycle, heat exchange cycle, reheat cycle, reheat and heat

exchange cycle, intercooled cycle, intercooled cycle with heat exchanger, intercooled and reheat

cycle, intercooled cycle with heat exchange and reheat. Comparison of various cycles.

Unit 2

Practical cycles and their analysis, effect of variable specific heat, mechanical losses, loss due to

incomplete combustion, polytropic efficiency, performance of actual cycles, comparison of ideal

vs actual cycles.

Jet propulsion cycles.

Unit 3

Thermodynamic cycles, advantages, disadvantages and performance characteristics of Ramjet

engine, pulsejet engine, turboprop engine, turbojet engine, turbofan engine.

Calculation of specific thrust and efficiency.

Unit 4

Combustion systems, combustion theory applied to gas turbine combustor, factors affecting

combustion chamber design and performance. Combustion chamber geometry, fuel injection and

ignition, use of cheap fuels.

Impulse and reaction type gas turbines. Velocity triangles and calculation of work done,efficiency etc..

Unit 5

Advantages of a gas turbine power plant, comparison with steam, diesel and hydel power plant.
Performance of GT power plant-part load efficiency, airflow rate, thermal efficiency, gas turbine blading
and fuels. Gas turbine materials. Free piston engine plant.

Reference

1. STEAM AND GAS TURBINES, R YADAV, CENTRAL PUB. HOUSE ALLAHBAD
2. THERMODYNAMICS AND HEAT POWER ENGINEERING M L MATHUR AND F S MEHTA JAIN BROS. NEW DELHI
3. GAS DYNAMICS, S M YAHA
RELIABILITY AND MAINTENANCE ENGINEERING

Course/Paper 08IIE 104 (I)

IIE semester VIII

Unit 1

Introduction: Maintenance Objectives and Functions; Maintenance Organization and

Administration of Maintenance Systems. Need of planned maintenance. Maintenance policies;
Breakdown, time based maintenance: Block replacement, age replacement and periodic replacement
policy. Corrective and preventive maintenance. Maintenance planning, Scheduled maintenance. Cost of
maintenance versus Cost of equipment and production delays. Inspection: Inspection intervals, Inspection
reports, card history system.

Unit 2

Predictive maintenance. Equipment wear records, standards. Equipment used in predictive

maintenance. Computerized maintenance, Total Productive Maintenance. Methods of condition

monitoring, Non-destructive testing, Liquid Penetrate, Magnetic particles, Ultrasonic testing, and

Vibration analysis. Oil analysis, Radiographic testing.

Unit 3

Reliability: Definition, failure data analysis, Mean failure rate, mean time to failure (MTTF),

mean time between failures (MTBF) , hazard rate, Bathtub curve. Use of Weibull probability

chart foe assessing characteristics life, guarantee period etc.

Unit 4

System reliability: Series, parallel and mixed configuration; Simple problems. Reliability

improvement: Techniques, use of Pareto analysis-Design for reliability, redundancy unit and

stand by redundancy, Optimization of reliability.

Unit 5

Spare Parts Management: Spare parts, features and categorization of spares, cost considerations,
Techniques of cost reduction; Selective controls used in spare parts control; ABC analysis, FSN, XYZ,
VED and other approaches. Inventory control of spares.

COMPUTATIONAL FLUID FLOW AND HEAT TRANSFER

Course/Paper 08IIE 104 (II)

IIE semester VIII

Unit1

Review of basic fluid mechanics and the governing (Navier-Stokes) equations.

Types of partial differential equations- hyperbolic, parabolic and elliptic.

Traditional solution methods- method of characteristics, separation of variables, Greens function method.

Unit2

Preliminary computational techniques: Discretisation, converting derivatives to discrete algebric
expressions, spatial derivatives, time derivatives. Approximation of derivatives, Taylor series expansion,
general techniques. Accuracy of discretisation process-higher order vs lower order formulae.

Unit3

Finite difference method: conceptual implementation, application to transient heat conduction

problem. Convergence, consistency and stability of FD equation.

Unit4

Weighted residual methods: General formulation, Introduction to Finite Volume method.

Finite Volume method: Equations with first derivatives and second derivatives. FV method applied to Laplace's equation.

Unit5

Finite Element method: Linear interpolation, quadratic interpolation, two dimensional

interpolation. Application to heat transfer problems.

Reference

1. ENGINEERING FLUUID MECHANICS: K L KUMAR, EURESIA PUBLISHING HOUSE
2. FLUID MECHANICS AND MACHINES: F M WHITE, JOHN WILLY AND SONS
3. FLUID MECHANICS : R.K.RAJPUT S. CHAND COMPANY LTD
4. FLUID MECHANICS VM STREETER McGRAW HILL
5. ENGINEERING FLUID MECHANICS BY D S KUMAR

FINITE ELEMENT

Course/Paper 08IIE 104(III)

IIE semester VIII

Introduction to FEM and its applicability, Review of mathematics : Matrix algebra, Gauss

elimination method, Uniqueness of solution, Banded symmetric matrix and bandwidth. Structure

analysis : Two-force member element, Local stiffness matrix, coordinate transformation,

Assembly, Global stiffness matrix, imposition of Boundary conditions. Properties of stiffness

matrix.

UNIT II : One-dimensional Finite Element Analysis

Basics of structural mechanics : stress and strain tensor, constitutive relation. Principle of

minimum Potential. General steps of FEM, Finite element model concept / Discretization,

Derivation of finite elements, equations using potential energy approach for linear and quadratic 1-D bar element, shape functions and their properties, Assembly, Boundary conditions, Computation of stress and strain.

UNIT III: Two dimensional Finite Element Analysis :

Finite element formulation using three nodded triangular (CST) element and four nodded

rectangular element, Plane stress and Plain strain problems. Shape functions, node numbering and connectivity, Assembly, Boundary conditions. Isoparametric formulation of 1-D bar elements, Numerical integration using gauss quadrature formula, computation of stress and strain.

UNIT IV : Finite Element Formulation from Governiing Differential Equation :

Method of Weighted Residuals : Collocation, Subdomain method, Least Square method and

Galerkin's method. Application to one dimensional problems, one-dimensional heat transfer, etc. Introduction to variational formulation (Ritz Method.)

UNIT V :

Higher order elements, Lagrange's interpolation formula for one and two independent variable. Convergence of solution, compatibility, element continuity, static condensation, p and h methods of mesh refinement, Aspect ratio and element shape.

Application of FEM, Advantages of FEM. Introduction to concept of element mass matrix in

dynamic analysis.

Reference

1. INTRODUCTION TO FINITE ELEMENT IN ENGINEERING, TIRUPATI R.CHANDRAPATLA & ASHOK D. BELEGUNDU, PRENTICE HALL OF INDIA Ltd.
2. CONCEPTS AND APPLICATIONS OF FINITE ANALYSIS, ROBERT D. COOK, DAVID S. MALKUS MICHAIEL E. PALESHA
3. FINITE ELEMENT PROCEDURES : KLAUS JURGAN BATHEPRENTICE HALL OF INDIA

SUPPLY CHAIN MANAGEMENT

COURSE/PAPER 08 IIE 105
IIE SEMESTER VIII

Introduction: Objectives of supply chain Management, key components of supply chain i.e. sourcing, distribution strategy, customer service strategy; supply chain Management as Integrated logistics, generic activities, architecture of supply chain, future potential of supply chain Management.
Corporate Profitability: Link to supply chain, evaluation of SCM strategies, customer focus in SCM, inventory and logistic Management, vendor Management, justin- time (JIT).
Quality Management: Inherent link to SCM: Suppliers development, distribution channel, re-engineering of supply chain, IT – enabled supply chain: Electronic data interchange, enterprise resource planning, implementation of IT, Scope of emerging distributed cooperative tele manufacturing over internet.
Organizational Issues: Application of knowledge Management for effectiveness SCM, social interactions and linking of functional units in a supply chain, Combined core competency of SC : Global sourcing, technology and tools – essential enablers,
Framework for managing a knowledge intensive supply chian.Recent Trends in SCM: Tierisation of supplies, Reverse logistics, JIT II, MilkRound System (MRS), bar coding, Hub and Spoke Concept and other latest concepts.
Reference
1. Chopra, Supply Chain Management, Pearson Education Asia, New Delhi
2. Christopher, Logistics and Supply Chain Management, 2/E, Pearson EducationAsia, New Delhi
3. Taylor & Brunt, Manufacturing Operations and Supply Chain Management (TheLean Approach), Business Press Thomson Learning N.Youk.Arjan J. Van Weele,
4. Purchasing and Supply Chain Management (Analysis Planning and Practice), 2/Engineering, Business Press, Thomson Learning N.Youk.

5. Donalad Bowersox, Logistic Management - The Integrated Supply Chain process, McGraw Hill, N.York

PRODUCTION AND INVENTORY CONTROL

COURSE/PAPER 08 IIE 106
IIE SEMESTER VIII

.
Production systems, Types & Characteristic features, analysis of production system:
Objective approaches, Demand forecasting, horizons, techniques and applications: production planning, capacity planning, aggregate planning, master production scheduling, MPR, MRP II, concept of ERP and supply chain management; production control, functions information requirements, modern developments in Production and
operations management, inventory control, deterministic and stochastic models, relationship with production control, computer application in Production and Inventory
Control.

Reference
1. Krejewski, Operations Management, Pearson Education Asia, New Delhi
2. Chase, Aquilano & Jacob, Production/Operations Management, Tata McGrawHill, New Delhi
3. Martinich, Operations Management, John Wiley & Sons, New York
4. Simuel Eilon, Production and Planning & Control, Wiley. New York
5. Steven Nahimas, Production & Operations Analysis, McGraw Hill, N.York
6. H.B Maynard Associates, Industrial Engineering (Handbook), Prentice Hall,N.York.
7. Ebert and Adams, Production/ Operations Management, Prentice Hall of India, N.Delhi

SAFETY ENGINEERING

COURSE/PAPER 08 IIE 107
IIE SEMESTER VIII

General Industrial work environment and its implications with regard to safety of operators and equipment, safety concepts, safety as essential parameter in the design of industrial of industrial production systems, organization of safety. Hazards, their nature, consequences and classifications. Hazards analysis techniques, Hazard prevention strat6egies and measures, accident cost and the assessment;
System safety concept. Safety engineering analysis, safety factors in opea5tion and maintenance of plant and equipment, strategic for risk reduction, safety considerations with regard to handling of hand tools, machine tools
pressure vessels, pipes, electric lines and fire, types of fire, fire prevention and strategies.
Safety measures. Standards and programs, measuring safety performance, contribution of ergonomics to operator and plant safety, contribution of safety engineering to plant productivity industrial safety acts, dangerous machines act and B.I.S codes on Machinery guarding. Relevant clauses of Indian Boiler Regulations in reference to safety.

Reference
1. Product Safety Engineering for Managers Seident.R
2. Industrial Safety-Management and Technology Colling D
3. Hand Book of Industrial Health Engineering
Occupational safety and Health Antom Management State Safety regulations

CAD LAB.

COURSE/PAPER 08 IIE 201
IIE SEMESTER VIII

EXPERIMENTS TO BE PERFORMED (MINIMUM FIVE EXPERIMENTS)

1. Introduction & different features of the CAD Software

2. 2-D Drafting

3. 3-D Modeling

4. 3-D Advanced Modeling

5. Assembly modeling

6. Feature Modification and Manipulation

7. Detailing

8. Sheet Metal Operations

9. Surface Modeling

10. One Dimensional problems of Finite Element Method.

(These exercises may be performed by any of the following Advanced CAD Software such   as Pro E /Epigraphic/ AutoCAD Inventor)

CAM AND ROBOTICS LAB.

COURSE/PAPER 08 IIE 202
IIE SEMESTER VIII

EXPERIMENTS TO BE PERFORMED

CAM (Minimum Five Experiments)

1. To prepare part programming for plain turning operation.

2. To prepare part programming for turning operation in absolute mode.

3. To prepare part program in inch mode for plain turning operation.

4. To prepare part program for taper turning operation.

5. To prepare part program for turning operations using turning cycle.

6. To prepare part program for threading operation.

7. To prepare part program for slot milling operation.

8. To prepare part program for gear cutting operation.

9. To prepare part program for gear cutting using mill cycle.

10. To prepare part program for drilling operation.

11. To prepare part program for multiple drilling operation in Z-axis.

12. To prepare part program for multiple drilling in X-axis.

13. To prepare part program for multiple drilling in X and Z axis using drilling cycle.

Robotics (Minimum Five experiments)

1. To detect the sensor scanning system to overcome limitation of fixed sensors on various

Robotic applications, ultrasonic sensor, laser range finders, infrared detectors and miniature.

2. To find the horizontal and vertical movement up to 180o in either direction.

3. To detect objects with infrared ray detector.

4. To determine object distance (3cm – 300cm).

5. To detect distance (10cm to 80 cm) with infrared object detector.

6. To determine 5 Axis Robotic Arm movement and its degree of rotation.

7. To lift the object and place 100m away in various directions.

8. To find the gripper movement (0 to 50mm).

9. To study various Robotic Arm Configurations.

10. To study Pick and Place Robot

INDUSTRIAL ENGINEERING LAB.

COURSE/PAPER 08 IIE 203
IIE SEMESTER VIII

1. Determination of time standard for a given job using stopwatch time- study.

2. Preparation of flow process chart, operation process chart and man-machine charts for an

   Existing setup and development of an improved process.

3. Study of existing layout of a workstation with respect to controls and displays and   suggesting improved design from ergonomic viewpoint.

4. to carryout a work sampling study.

5. To conduct process capability study for a machine in the workshop.

6. To design a sampling scheme based on OC curve.

7. To conduct Stewart's experiments on known population

8. Generation of random numbers for system simulation such as facility planning, job shop

   Scheduling etc.

COURSE/PAPER 08 IIE 204
IIE SEMESTER VIII

One lab /field/industrial oriented project /problem will be allocated to each
student related to the subjects related to the subjects taught in VIII semester.

SIMULATION OF INDUSTRIAL SYSTEMS

COURSE/PAPER 09 IIE 101
IIE SEMESTER IX

.
Unit1. Introduction and overview, concept of system, system environment, elements of system, system modeling, types of models, Monte Carlo method, system simulation – a management laboratory, advantages & limitations of system simulation, continuous and discrete system.
Unit 2. Simulation of continuous system: Characteristics of a continuous system, comparison of numerical integration with continuous simulation system. Simulation of an integration formation.
Unit 3. Simulation of queuing system: Concept of queuing theory, characteristics of queues, stationary and time dependent queues, queue discipline, time series analysis, measure of system performance, Kendal's notation, auto covariance and auto correlation function, auto correlation effects in queuing system, simulation of single server queues, multi server queues, queues involving complex arrivals and service times with blanking and reneging.
Unit 4. Simulation of inventory systems: Rudiments of inventory theory, MRP, in process inventory. Necessity of simulation in inventory problems, forecasting and regression analysis, forecasting through simulation, generation of Poisson and Erlang variates, simulation of complex inventory situations.
Unit5. Simulation Languages: Continuous and discrete simulation languages, block structures continuous languages, special purpose simulation languages, SIMSCRIPT, GPSS SIMULA importance and limitations of special purpose languages.
Reference
Simulation and Modeling Loffict Tata Mcgraw Hill
System Simulation with Digital Deo Narshing Prantice Hall
Computer
System Simulation Hira, D.S S.Chand & Co.
Computer Simulation and Meeiamkavil John Willey
Modeling
System Simulation Gerden Prentice Hall
METHODS ENGINEERING AND EROGONOMICS

COURSE/PAPER 09 IIE 102
IIE SEMESTER IX

Introduction to Industrial Engineering and productivity, measurement of productivity. Introduction to work study, methods study principles and motion economy, design cycle, filming techniques and micro motion analysis, recording techniques,
Introduction to work measurement, time study, performance allowances, work sampling, predetermined motion systems, job evaluation and merit ration, wage incentive plans, methods time measurement.
Introduction to ergonomics, man/machine/environment systems concept, development of ergonomics.
Design approach: A new design, modification of existing design, assessment of a design, limitations of man & machine with respect to each other, Posture – standing at work, seated at work, work station heights and seat geometry. Human anthropometry and its use in work place layout.

Controls: Hand controls and foot controls, location of controls and work place envelope, recommendation about hand and foot push buttons, rotary selector switches, hand wheels, cranks, levers etc. instruments and displays.

Climates: (a) Heat Humidity – Body heat balance, effective temperature scales, zones of discomfort, effect of heat on body and work performance.

(b) Vibrations: Technology, response of body to low frequency vibrations, vibrations and discomfort, effect on health of worker, high frequency vibrations, effect of high frequency vibrations, methods of reducing vibrations.

(c) Noise: Terminology, physiological effects of noise, annoyance of noise, speed interference, hearing loss, temporary and permanent threshold shift, effect of noise on performance, reduction of noise, personal noise protection.

Reference
1. Methods Engineering Study Krick, E.V
2. Work Study and Ergonomics Shan, H.S Dhanpat Rai & Sons 1992
3. Introduction to Ergonomics Bridger Tata McGraw Hill 1995
4. Work Study Khanna, O.P Dhanpat Rai & Sons 1995
5. Sound, Noise and Vibration Control Lyle, F. Yerges Van Nostrand 1978

INDUSTIRAL PSYCHOLOGY

COURSE/PAPER 09 IIE 103
IIE SEMESTER IX

.
Introduction: Definition, nature and development of work psychology, methods of research, basis of job related behaviour - individual and situational variables. Individual and their evaluation, role of heredity, environment, types of individual.

Psychological tests in industries, their utility, reliability and validity

Human Engineering: Job Methods, Time study, Fatigue, Work Environment, Accidents and safety.

Motivation and frustration; Work motivation, Theories (contents and cognitive) and applied implication incentives, moral, job satisfaction.

Frustration symptoms and coping strategies.

Attitudes and Conflicts: Definition, sectors, influencing attitude measurement and attitude change. Conflict, nature, level and its sources.

Work stress and metal health: Stress and stressors, sectors, pre-disposing and individual to stress and cost of work stress – general principals of coping with stress, individual and organizational strategies in stress management

Counseling. Job Redesign and new technologies: Human factor approach to job design, man machine system, work methods, control, play, linkages, work space envelops. Jobs simplification, job enrichment, job enlargement.

New Technology – introduction and its implications for the organization.

Reference
1. Work Psychology – Understanding Behaviour at work by John Earnold, Robertson and Cooper
2. Industrial Psychology by Tiffin and Meccormic
3. Social Psychology of Organization Behaviour by Katz and Kahn
4. Handbook of Industrial Psychology Porter and Lawler
5. Industrial Psychology by Ghosh and Ghorpede

MATERIALS MANAGEMENT

COURSE/PAPER 09 IIE 104
IIE SEMESTER IX

.
Scope and importance of materials and inventory Management, Functions and objectives of material Management, Suppliers and purchasing function,

Purchasing objectives and procedures, Quality considerations in purchasing, Receiving and shipping, The receiving
functions and shipping systems.
Traffic and physical distribution: Classifying inventory problems, Number of items, nature of demand, number of times period, lead time, stock outs, inventory costs, inventory management systems. ABC inventory analysis: Control system for independent demands, Cycle counting, decision models for inventory Management, Economic order quantity (EOQ) model,
Determining an inventory policy for EOQ model, Economic production lot size model, An inventory model with planned shortages, Lot sizing for dynamic demand, Periodic order quantity, para period balancing, service levels and uncertainty in demand, Single period inventory models, simulation models for inventory analysis.

Reference

1. Production and materials Management Bhagde, S.D USG pub.
2. Production and inventory control Plossl, G.W & Wright, O.W Prentice Hall
3. Purchasing Management Lee Lamber

MANAGEMENT INFORMATION SYSTEM

COURSE/PAPER 09 IIE 105
IIE SEMESTER IX

.
Information & System Concepts-Introduction --Concepts, Classification of Information, Methods of Data & Information Collection, Value of Information, Organization and Information, System: A Definition. Types of Systems, System Decomposition, Integration of Sub Systems, Elements of a System, Human as an Information Processing System. International Business and IT.

Management Information System-MIS: Definition, Nature & Scope, MIS Characteristics, Functions, Structure of MIS, Role of MIS, MIS as a Control System, Process of Management, Application of MIS, ERP & IT's Benefits.

New Information Technology: Interconnection and networking, Multimedia, Neural Networks, Artificial Intelligence, Executive Information System, Decision Support System (DSS) and Expert Systems.

Issues for Senior Management: Management Control, Management Issues, Security Issues: Viruses, Worms and other creatures, I T issues for Management, Management in a Technological Environment, the changing world of Information.

References:

1. Computer Fundamental Concepts & system, P. K. Sinha, BPB PUB. N.D.
2. Management Information System, Jawadekar, macgraw Hill, N.D.
3. Management Information System, Lucas, macgraw Hill, N.D.
4. Management Information System, Davis, TMH
5. Information System Solutions: A Project Approach, Van Horne.TMH
6. Management Information System , O'Brien, TMH
7. Management Information System, Haag, TMH.
8. Managemnet Information System, James O' Brain, Tata McGrawHill.
9. Managemnet Information System, Dharminder Kumar/Sunita, Excel Books, Delhi.
10. Managing With Information, Jerome Kanter, Prentise Hall Of India.

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VALUE ENGINEERING

COURSE/PAPER 09 IIE 106

IIE SEMESTER IX

Concept of value, cost and price, customer and value, philosophy and objectives of value analysis, types of value, areas of application of value engineering, limitations of value analysis, difference between value engineering and cost reduction techniques; Tool of technology in value analysis, method & engineering, cause and effect diagram, SWOT analysis, break even analysis, system approach; Job plan for value analysis approach: Information Phase, Function Phase, Creation Phase, Evaluation Phase, Recommendation Phase, Implementation Phase, Audit Phase; Value Engineering Cell, Value Manual, composition of cell, cost cutting, various cost cutting techniques; Case studies in value engineering and analysis from manufacturing and service industries.

Reference
1. Mudge, Value Engineering, SAVE, N.York
2. Miles Lawerence, Techniques of value analysis and value engineering, McGraw Hill, N.York
3. ASME, Value Engineering in Manufacturing, Prentice Hall India, N.Delhi
4. Getting More at less Cost Value Engg. Tata McGraw Hill, N.Delhi
5. Parker, D.E. Value Engg. Theory, L.D. Miles Value Foundation, N.York

PRACTICAL TRAINING & INDUSTRIAL VISIT

Course/Paper 09IIE 201

IPE semester IX

Industrial visit (20 marks) is for the duration of 10 days at the end of VII semester and

Practical Training (80 marks) is for the duration of 30 days at the end of VIII semester.

Both will be evaluated during the IX semester and graded accordingly

SEMINAR

OBJECTIVE

Course/Paper: 09IIE-202
MPE Semester-IX

The students are to select one technical topic related its branch for Seminar. The student is to submit the synopsis for assessment and approval. Progress for preparation of the seminar topic would be continuously assessed from time to time. Two periods per week are to be allotted and students are expected to present the seminar Progress. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain the attendance.
 Students have to give a final presentation for 15 minutes on his topic. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews

PROJECT WORK

Course/Paper: 09IIE-203
MPE Semester-IX

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution.

The student should select any one of the topics offered from the department or select one on his own duly approved from the department. Candidate is required to submit the detailed synopsis of the work that he would complete in the part-II

Each student shall finally produce a comprehensive report covering back ground information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

SEMESTER X

DISSERTATION

Course/Paper: 10IIE 201PT

IIE Semester X

The student will submit a synopsis at the beginning of the semester for the approval from

the University project committee in a specified format. Synopsis must be submitted within a

Two weeks. The first defense, for the dissertation work, should be held with in a one

month. Dissertation Report must be submitted in a specified format to the University for

Evaluation purpose.