## III SEMESTER

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## IV SEMESTER

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Objective

To impart knowledge in the area of Method study and Time study so that students can implement these principles and techniques to improve productivity in manufacturing and Service sectors.

1. PRODUCTIVITY

Total time for a job or operation, total work content and ineffective time, – Production and Productivity - Productivity and standard of living, Factors affecting Productivity, Productivity measurement Models.

2. METHODS ENGINEERING

Methods Engineering-Steps -Tools and techniques, Motion study.

3. WORK MEASUREMENT


4. APPLIED WORK MEASUREMENT

Work sampling, Group Timing Technique (GTT), predetermined time systems, types, Methods Time Measurement (MTM), Wage incentive plans.

5. WORK DESIGN FOR OFFICE WORK

Organization and methods (O & M), Work measurement of office work, Work Analysis techniques applied to support staff, Form design and control.

TEXT BOOK


REFERENCE BOOKS

MA9211 MATHEMATICS III  

1. FOURIER SERIES  

Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier Series – Parseval’s identity – Harmonic Analysis.

2. PARTIAL DIFFERENTIAL EQUATIONS  

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions - Lagrange’s Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

3. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  

Method of separation of Variables – Solutions of one dimensional wave equation, -One-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

4. FOURIER TRANSFORM  


5. Z – TRANSFORM AND DIFFERENCE EQUATION  

Z-transform-Elementary properties-Inverse z transform – Convolution theorem- Formation of difference equation-Solution of difference equation using z transform.

Total: 45+15=60

TEXT BOOK  

REFERENCES  
OBJECTIVE
This course aims to impart the knowledge about various manufacturing processes. It deals with metal casting, metal forming and metal joining processes. After this course, a student will have a good exposure about the manufacturing processes and various operations and machinery. This also gives the recent trends in these processes also.

1. FOUNDRY TECHNOLOGY 11
Pattern and core making – moulding sand and testing – green sand moulding – melting furnaces: cupola and induction furnaces – special casting processes – shell, investment, die casting, centrifugal castings principles of gating system design - fettling and finishing of castings – defects in casting.

2. HOT AND COLD WORKING 7

3. FORGING 9

4. ADVANCES IN FORMING PROCESS 9
High energy rate forming process; explosive forming, electro- hydraulic, electro magnetic forming, dynapack machine, advances in super forging. plastic materials and processes: types of plastics – types of moulding – compression moulding - transfer moulding – injection moulding.

5. PRINCIPLES AND APPLICATIONS OF JOINING PROCESSES 9
Gas welding, basic arc welding processes: thermit welding, electron beam welding, laser beam welding, and solid state welding: cold welding, ultrasonic welding, friction welding, resistance welding and explosive welding and welding defects. principles and applications of brazing and soldering – recent development in joining processes.

Total : 45

TEXT BOOK

REFERENCES
OBJECTIVES:

1. To understand the principles in the formation of mechanisms and their kinematics.
2. To understand the effect of friction in different machine elements.
3. To analyse the forces and torques acting on simple mechanical systems.
4. To understand the importance of balancing and vibration.

1. KINEMATIC OF MECHANICS

2. GEARS and GEAR TRAINS

3. FRICTION

4. FORCE ANALYSIS

5. BALANCING AND VIBRATION

TEXT BOOK

REFERENCES


STANDARDS

Objective: To study the behaviour of deformable bodies due to external loads, bending of beams and effect of torsion on circular bars.

1. STRESS, STRAIN AND DEFORMATION OF SOLIDS
Rigid and deformable bodies — Axial and Shear Stresses — Deformation of simple and compound bars — Thermal stresses — Elastic Constants - Volumetric strains- Stresses and deformation of thin cylinders and thin shells — Stresses on inclined planes — Principal stresses and principal planes — Mohr’s circle of stress.

2. BENDING OF BEAMS
Beams — types and transverse loading on beams — shear force and bending moment in beams — Cantilever beams — Simply supported beams and over-hanging beams - Theory of simple bending — bending stress distribution — Load carrying capacity — Proportioning of sections — Leaf springs — Flitched beams — Shear stress distribution.

3. DEFLECTION OF BEAMS
Double Integration method — Macaulay’s method — Area moment method — Conjugate beam method for computation of slopes and deflections in determinate beams.

4. ENERGY PRINCIPLES
Strain energy and strain energy density — Strain energy in axial force, shear, flexure and torsion — Castigliano’s and Engessor’s theorems — Principle of virtual work — Application of energy theorems for computing deflections in beams — Maxwell’s reciprocal theorem.

5. TORSION
Theory of simple torsion - Stresses and deformation in circular and hollow shafts — Stepped shafts — Shafts fixed at both ends — Stresses and deflection in helical springs.

TEXT BOOKS:

REFERENCE:
1. Irving H.Shames, James M.Pitarresi, “Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
IE9202 OPERATIONS RESEARCH – I

L T P C
3 1 0 4

OBJECTIVE
To learn the basics of deterministic optimization tools

LINEAR PROGRAMMING 10
Introduction - formulation of linear programming model - Graphical solution – solving LPP using simplex algorithm – Revised Simplex Method

ADVANCES IN LPP –I 10
Duality theory - Dual simplex method - Sensitivity analysis — Transportation problems – Assignment problems- Traveling sales man problem -Data Envelopment Analysis

ADVANCES IN LPP –II 6
Integer programming – Multi objective optimization - Goal programming

NETWORK MODELS 12

DYNAMIC PROGRAMMING 7
Elements of dynamic programming – state –stage-recursive equations – computational procedure – applications

Lecture ; 45 hours
Tutorial ; 15 hours
Total : 60 hours

TEXT BOOKS

REFERENCES
OBJECTIVE
Student should have knowledge on common basic machining operations

LIST OF EXPERIMENTS
Measurement of the Machined Components and Machining time estimation of:
1. Taper Turning
2. External thread cutting
3. Internal thread cutting
4. Eccentric Turning
5. Knurling
6. Square Head Shaping
7. Hexagonal Head Shaping
8. Drilling and Tapping
Objective:
To understand the theory better and apply in practice, practical training is given in the following areas:
1. Graphic tools for method study
2. Peg board experiment
3. Stop watch time study
4. Performance rating exercise
5. Work sampling
6. MTM practice

TOTAL = 20
Objective:
To study the properties of materials when subjected to different types of loading.

1. Tension test on mild steel / tor steel rod
2. Double shear test on metal
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals
6. Compression test on helical spring
7. Deflection test on carriage spring

Reference
Relevant Indian Standard Codes
MA9261 PROBABILITY AND STATISTICS

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9 + 3

1. RANDOM VARIABLES
Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions - Functions of random variable.

2. TWO-DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables-Linberg Levy central limit theorem

3. TESTING OF HYPOTHESIS

4. DESIGN OF EXPERIMENTS
Completely randomized design – Randomized block design – Latin square design - 2²-factorial design.

5. STATISTICAL QUALITY CONTROL
Control charts for measurements ( "X" and R charts) – Control charts for attributes ( p, c and np charts) – Tolerance limits - Acceptance sampling.

L: 45, T: 15, Total : 60

BOOKS FOR STUDY:

BOOKS FOR REFERENCE:
OBJECTIVES:

a. The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.

b. The applications of the conservation laws to flow through pipes and hydraulics machines are studied

I. INTRODUCTION

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

II. FLOW THROUG CIRCULAR CONDUITS


III. DIMENSIONAL ANALYSIS

Dimension and units: Buckingham’s П theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

IV. ROTO DYNAMIC MACHINES


V. POSITIVE DISPLACEMENT MACHINES


TOTAL : 60

TEXT BOOKS:


REFERENCES:

OBJECTIVE

i) To understand the various steps involved in the Design Process.
ii) To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
iii) To learn to use standard practices and standard data
iv) To learn to use catalogues and standard machine components.

1. FUNDAMENTALS OF DESIGN FOR STRENGTH AND STIFFNESS OF MACHINE MEMBERS


2. DESIGN OF SHAFTS AND COUPLINGS

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and keys ways – Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings

3. DESIGN OF FASTENERS AND WELDED JOINTS

Threaded fasteners – Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures- Design of Knuckle joints and cotter joints.

4. DESIGN OF SPRINGS

Design of helical, leaf, disc , torsional, and spiral springs under constant loads and varying load – Concentric springs – Optimum design of Helical Springs- Surge in springs-Belleville springs.

5. DESIGN OF ENGINE PARTS BEARINGS AND FLYWHEELS


Total 60

Note: (Use of Approved Design Data Book is permitted in the University examination)
Design Data Books:
1) PSG Design Data Book ( OR )
TEXT BOOKS

REFERENCE

STANDARDS
3. IS 10260: Part 1: Terms, definitions and classification of Plain bearings
OBJECTIVE
To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching. To understand the basic concepts of (CNC) Computer Numerical Control of Machine tools and CNC Programming.

1. THEORY OF METAL CUTTING                                                                                 8
Mechanics of chip formation, single point cutting tool, forces in machining, thermal aspects of chip formation. orthogonal metal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

2. CENTRE LATHE AND SPECIAL PURPOSE LATHES                                      10
Centre lathe, constructional features, specification, cutting tools, nomenclature various operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. capstan and turret lathes – tool layout, - automatic lathes: semi automatics – single spindle: swiss type, automatic screw type- multi spindle:

3. RECIPROCATING MACHINES, MILLING MACHINES AND GEAR CUTTING        12
Reciprocating machine tools: shaper, planer, slotter: milling: types, milling cutter attachments, change gear calculations, machining time calculation, operations. hole making: drilling, reaming, boring, tapping, machining time calculations. gear cutting: forming, generations, shaping, planning and hobbing-tool and cutter grinders.

4. ABRASIVE PROCESS, BROACHING                                     8

5. CNC MACHINE TOOLS AND PART PROGRAMMING                       7
Numerical control (NC) machine tools – CNC types, constructional details, special features. machining centre, training centre.part programming fundamentals – manual programming.

TEXT BOOKS

REFERENCES
1. **BASIC CONCEPTS OF THERMODYNAMICS**


2. **FIRST AND SECOND LAW OF THERMODYNAMICS**


3. **HEAT ENGINES**


4. **GASES AND VAPOUR MIXTURES**


5. **HEAT TRANSFER**


**TEXT BOOKS**


**REFERENCE BOOKS**

OBJECTIVE:
(i) To impart knowledge in the areas of cost estimation, pricing of products, cost control methods and principles of accounting.
(ii) After undergoing the course, the students will be able to estimate cost of products, analyze product cost and suggest cost reduction measure.

1. INTRODUCTION:

2. PRODUCTION ANALYSIS AND PRICING:
Production Function-Least Cost Combination of Inputs-Factor Productivities & Return to Scale-Determinants of Price-Pricing under different objectives and Market Structures-Price Discrimination & Pricing methods in practice.

3. ESTIMATION
Estimation of Material, Labor and Overhead Cost, Allocation of Overheads. Estimation for different types of jobs.

4. COSTING
Job Costing-Operating Costing-Process Costing- Standard Costing (Variance Analysis)

5. ACCOUNTING
Balance Sheet-Profit & Loss Statement-Evaluation of Investment decisions- Average Rate of Return-Payback Period-Net Present Value & IRR.

L: 45  T: 15 Total: 45

TEXT BOOKS:
1. Jawaharlal, Cost Accounting, TMH, 1996

REFERENCE:
1. FLOW MEASUREMENT

Calibration of Flow Measuring instruments – venturimeter, orificemeter, rotometer,
Calibration of flows in open channels – weirs and notches. Estimation of friction factor
in flow through pipes.

2. PUMPS

Determination of performance characteristics of pumps – centrifugal pumps,
submersible pumps, turbine pumps and positive displacement pumps – reciprocating
and gear pumps.

3. TURBINES

Determination of performance characteristics of turbines – reaction turbines and
impulse turbines.

Total : 45

REFERENCE

1. CWR, Hydraulics Laboratory Manual, 2004
OBJECTIVE

Student should acquire skills on common basic machining operations and press working.

LIST OF EXPERIMENTS

1. Contour Milling using vertical milling machine
2. Gear Cutting & Gear Hobbing
3. Hexagonal Machining using Horizontal Milling Machine
4. Gear Cutting – Gear Shaping
5. Spline Broaching
6. Exercise in Surface Grinding
7. Exercise in Cylindrical Grinding
8. Exercise in Tool and Cutter Grinder
9. Spur and helical gear cutting in Milling Machine
10. Determination of cutting forces in Milling Machine
11. Study of Turret and Capstan lathe
12. Forming of Simple Components in Press Working and simple Calculations of sheet metal work