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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by Andhra Pradesh Act No.30 of 2008)

Kukatpally, Hyderabad – 500 085, Andhra Pradesh (India)

B.TECH. MECHANICAL ENGINEERING

II YEAR II SEMESTER

Code	Subject	L	T/P/D	C
	Production Technology	4	-	4
	Kinematics of Machinery	4	-	4
	Thermal Engineering -I	4	-	4
	Mechanics of Fluids and Hydraulic Machines	4	-	4
	Machine Drawing	-	6	4
	Mathematics –II	4	-	4
	Production Technology Lab	-	3	2
	Mechanics of Fluids & Hydraulic Machines Lab	-	3	2
	Total	20	12	28

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House/2nd Edition.

II Year B.Tech. ME-II Sem

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(A40312) PRODUCTION TECHNOLOGY

UNIT – I

Casting: Steps involved in making a casting - Its applications - Patterns and Types of patterns – Pattern allowances and their construction. Types of casting processes – Solidification of casting.

UNIT – II

Welding: welding Types - Oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding – Resistance welding, Thermit welding.

UNIT – III

Inert Gas Welding, TIG Welding, MIG welding, Friction welding, induction welding, explosive welding, Laser Welding, Laser Welding Soldering and Brazing, Heat affected zone in welding. Welding defects – causes and remedies – destructive and non- destructive testing of welds.

UNIT – IV

Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements

Stamping, forming and other cold working processes : Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning – Types of presses and press tools. Forces and power requirement for the above operations.

UNIT – V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging. **Forging hammers:** Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS :

1. Manufacturing Technology (Vol.1) / P.N. Rao/TMH/2nd Edition
2. Workshop Technology (Vol.1) /Hajra Chowdary/Asia Publishing

REFERENCE BOOKS:

1. Production Technology /Sarma P C /S.Chand.
2. Production Technology / R.K. Jain/Khanna Publishers.
3. Metal Casting / T.V Ramana Rao / New Age.
4. Principles of Metal Castings / Rosenthal/TMH.
5. A Course in Workshop Technology/B.S. Raghuvamshi /Dhanpat rai & Sons.
6. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson Edu.

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(A40309) KINEMATICS OF MACHINERY**UNIT – I**

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – Types of constrained motion-kinetic chain- Mechanism-machine-Structure - inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage-Grubler's Criterion.

UNIT – II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane Motion of Body: Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Links construction - Coriolis acceleration – determination of Coriolis component of acceleration

Analysis of Mechanisms: Analysis of slider crank chain for displacement-velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III

Straight-Line Motion Mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt - Tchebicheff's and Robert Mechanism - Pantographs

Steering Gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

Hooke's Joint: Single and double Hooke's joint – velocity ratio – application – problems.

UNIT – IV

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of Motion Of Followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V

Higher Pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding.

Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing.

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/Oxford/ 3rd Edition/International Edition.
2. Theory of Machines / Thomas Bevan/Pearson/3rd Edition.

REFERENCE BOOKS:

1. Theory of Mechanism and Machines /Jagdish Lal/Metropolitan Book Company.
2. Theory of Machines /S.S.Rattan / Tata McGraw Hill Publishers.
3. Kinematics & Dynamics Of machinery/Norton/TMH.
4. Theory of Machines / Sadhu Singh / Pearson.
5. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age.
6. Theory of Machines by / R.K. Bansal (Lakshmi Publications).

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(A40313) THERMAL ENGINEERING - I**UNIT - I****I.C. Engines:**

Four & Two stroke engine - SI & CI engines - Valve and Port Timing Diagrams
 - Fuel Injection Systems for SI engines - Fuel injection systems for CI engines-
 Ignition - Cooling and Lubrication system - Fuel properties and Combustion
 Stoichiometry.

UNIT - II

Combustion in SI and CI Engines: Normal Combustion and abnormal combustion in SI engines - Importance of flame speed and effect of engine variables - Abnormal combustion - pre-ignition and knocking in SI Engines
 -Fuel requirements and fuel rating - anti knock additives - combustion chamber - requirements - types of SI engines.

Four stages of combustion in CI engines - Delay period and its importance
 - Effect of engine variables - Diesel Knock- Need for air movement, suction, compression and combustion induced turbulence in Diesel engine - open and divided combustion chambers and fuel injection- Diesel fuel requirements and fuel rating.

UNIT III

Testing and Performance of Engines and Compressors: Measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power - Performance test - Heat balance sheet and chart - Classification of compressors - Fans, blowers and compressors - positive displacement and dynamic types - reciprocating and rotary types.

UNIT - IV

Rotary, Dynamic and Axial Flow (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor - mechanical details and principle of working - efficiency considerations. **Centrifugal compressors:** Mechanical details and principle of operation - velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient - velocity diagrams - power. Mechanical details and principle of operation - velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations - Polytropic efficiency.

UNIT - V

Refrigeration : Mechanical Refrigeration and types - units of refrigeration

Air Refrigeration system, details and principle of operation - applications of air refrigeration, Vapour compression refrigeration systems - calculation of COP - effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants- Vapour absorption system - mechanical details - working principle, Use of p-h charts for calculations.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan/ TMH.
2. Thermal Engineering / R.K. Rajput / Lakshmi Publications/Reprints 2011.

REFERENCE BOOKS:

1. Thermal Engineering / P.K.Nag/3rd Edition.
2. IC Engines - Mathur & Sharma - Dhanpath Rai & Sons.
3. Engineering fundamentals of IC Engines - Pulkrabek / Pearson /PHI
4. Thermal Engineering / Rudramoorthy / TMH.
5. Thermodynamics & Heat Engines / B. Yadav/ Central Book Depot., Allahabad.
6. I.C. Engines / Heywood /McGrawHill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**II Year B.Tech. ME-II Sem****L T/P/D C****4 -/- 4****(A40112) MECHANICS OF FLUIDS AND HYDRAULIC MACHINES****UNIT I**

Fluid statics : Dimensions and units: physical properties of fluids- specific gravity, viscosity, surface tension- vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT II

Fluid kinematics : Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT III

Boundary Layer Concepts : Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line- hydraulic gradient line. Measurement of flow: pitot tube, venturimeter, and orifice meter, Flow nozzle

UNIT IV

Basics of turbo machinery : Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines : Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines : Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT V

Centrifugal pumps : Classification, working, work done – barometric head-

losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps : Working, Discharge, slip, indicator diagrams.

TEXT BOOKS :

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCES :

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

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(A40310) MACHINE DRAWING**PART-A****MACHINE DRAWING CONVENTIONS:**

Need for drawing conventions – introduction to ISI conventions - Conventional representation of materials, common machine elements such as screws, nuts, bolts, keys, gears, webs, ribs. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features. Title boxes, their size, location and details - common abbreviations and their liberal usage. Types of Drawings – working drawings for machine parts.

DRAWING OF MACHINE ELEMENT:

Simple parts - Selection of Views, additional views for the following machine elements and parts with every drawing proportions. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws. Keys, cottered joints and knuckle joint. Rivetted joints for plates. Shaft coupling, spigot and socket pipe joint. Journal, pivot and collar and foot step bearings.

PART- B**ASSEMBLY DRAWINGS:**

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions. Engine parts – stuffing boxes, cross heads, Eccentrics - Connecting Rod – Piston Assembly. Machine tool parts: Tail stock, Tool Post, Machine Vices - Screws jacks- Plummer block. **VALVES:** Spring loaded safety valve, feed check valve and air cock.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOK :

1. Machine Drawing /K.L.Narayana/ New Age International Publishers.
2. Textbook of Machine Drawing/K.C. John/PHI/Eastern Economy Edition.

REFERENCE BOOKS:

1. Machine Drawing / P.S.Gill.
2. Machine Drawing / Junnarkar N.D./ Pearson Edu.
3. Machine Drawing/Bhattacharya/Oxford University Press
4. Machine Drawing/N.D. Bhat/ Charotar.
5. A Textbook of Machine Drawing/R. K. Dhawan/ S. Chand.

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(A40006) MATHEMATICS - II**Objectives:**

- The objective is to find the relation between the variables x and y out of the given data (x,y) .
- This unit also aims to find such relationships which exactly pass through data or approximately satisfy the data under the condition of least sum of squares of errors.
- The aim of numerical methods is to provide systematic methods for solving problems in a numerical form using the given initial data.
- This topic deals with methods to find roots of an equation and solving a differential equation.
- The numerical methods are important because finding an analytical procedure to solve an equation may not be always available.
- In the diverse fields like electrical circuits, electronic communication, mechanical vibration and structural engineering, periodic functions naturally occur and hence their properties are very much required.
- Indeed, any periodic and non-periodic function can be best analyzed in one way by Fourier series and transforms methods.
- The unit aims at forming a partial differential equation (PDE) for a function with many variables and their solution methods. Two important methods for first order PDE's are learnt. While separation of variables technique is learnt for typical second order PDE's such as Wave, Heat and Laplace equations.
- In many Engineering fields the physical quantities involved are vector-valued functions.
- Hence the unit aims at the basic properties of vector-valued functions and their applications to line integrals, surface integrals and volume integrals.

UNIT – I

Vector Calculus: Vector Calculus: Scalar point function and vector point function, Gradient- Divergence- Curl and their related properties. Solenoidal and irrotational vectors – finding the Potential function. Laplacian operator. Line integral – work done – Surface integrals -Volume integral. Green's

Theorem, Stoke's theorem and Gauss's Divergence Theorems (Statement & their Verification).

UNIT – II:

Fourier series and Fourier Transforms: Definition of periodic function, Fourier expansion of periodic functions in a given interval of length 2π , Determination of Fourier coefficients – Fourier series of even and odd functions – Fourier series in an arbitrary interval – even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Fourier integral theorem - Fourier sine and cosine integrals. Fourier transforms – Fourier sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT – III:

Interpolation and Curve fitting

Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences- Backward differences – Central differences – Symbolic relations of symbols. Difference expressions – Differences of a polynomial-Newton's formulae for interpolation - Gauss Central Difference Formulae – Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

Curve fitting: Fitting a straight line – Second degree curve-exponential curve-power curve by method of least squares.

UNIT – IV : Numerical techniques

Solution of Algebraic and Transcendental Equations and Linear system of equations: Introduction – Graphical interpretation of solution of equations .The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method .

Solving system of non-homogeneous equations by L-U Decomposition method (Crout's Method). Jacobi's and Gauss-Seidel iteration methods.

UNIT – V

Numerical Integration and Numerical solutions of differential equations:

Numerical integration - Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ and $3/8$ Rule , Gauss-Legendre one point, two point and three point formulas.

Numerical solution of Ordinary Differential equations: Picard's Method of successive approximations. Solution by Taylor's series method – Single step methods-Euler's Method-Euler's modified method, Runge-Kutta (second and classical fourth order) Methods.

Boundary values & Eigen value problems: Shooting method, Finite difference method and solving eigen values problems, power method

TEXT BOOKS:

1. Advanced Engineering Mathematics by Kreyszig, John Wiley & Sons.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.

REFERENCES:

1. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi & Others, S. Chand.
2. Introductory Methods by Numerical Analysis by S.S. Sastry, PHI Learning Pvt. Ltd.
3. Mathematical Methods by G.Shankar Rao, I.K. International Publications, N.Delhi.
4. Advanced Engineering Mathematics with MATLAB, Dean G. Duffy, 3rd Edi, 2013, CRC Press Taylor & Francis Group.
5. Mathematics for Engineers and Scientists, Alan Jeffrey, 6th Edi, 2013, Chapman & Hall/ CRC.
6. Advanced Engineering Mathematics, Michael Greenberg, Second Edition, Person Education.
7. Mathematics For Engineers By K.B.Datta And M.A S.Srinivas, Cengage Publications.

Outcomes: From a given discrete data, one will be able to predict the value of the data at an intermediate point and by curve fitting, can find the most appropriate formula for a guessed relation of the data variables. This method of analysis data helps engineers to understand the system for better interpretation and decision making

- After studying this unit one will be able to find a root of a given equation and will be able to find a numerical solution for a given differential equation.
- Helps in describing the system by an ODE, if possible. Also, suggests to find the solution as a first approximation.
- One will be able to find the expansion of a given function by Fourier series and Fourier Transform of the function.
- Helps in phase transformation, Phase change and attenuation of coefficients in acoustics.

After studying this unit, one will be able to find a corresponding Partial

Differential Equation for an unknown function with many independent variables and to find their solution.

- Most of the problems in physical and engineering applications, problems are highly non-linear and hence expressing them as PDEs'. Hence understanding the nature of the equation and finding a suitable solution is very much essential.
- After studying this unit, one will be able to evaluate multiple integrals (line, surface, volume integrals) and convert line integrals to area integrals and surface integrals to volume integrals.
- It is an essential requirement for an engineer to understand the behavior of the physical system.

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II Year B.Tech. ME-II Sem

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(A40382) PRODUCTION TECHNOLOGY LAB

Minimum of 12 Exercises need to be performed

I. METAL CASTING LAB:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. WELDING LAB:

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises
(Water Plasma Device)

III. MECHANICAL PRESS WORKING:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press : Deep drawing and extrusion operation.
3. Bending and other operations

IV. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

1. Dictionary of Mechanical Engineering – G.H.F. Naylor, Jaico Publishing House.

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(A40188) MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems

Note : Any 10 of the above 12 experiments are to be conducted.