



ख्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
(Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956 & B.Tech. Approved by (AICTE))

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Paper Code- AS-301
Credit- 4

MATHEMATICS-III

Course Outcomes:

In this Course Student will learn how to -

1. Compute Laplace Transform and Inverse Laplace Transforms.
2. Compute Moments, Curve Fitting, Correlation and Regression, Probability Distribution and Chi-Square Test.
3. Compute Solution of Transcendental and Polynomial Equations, Finite Differences and Interpolation.
4. Compute Solution of System of Linear Equations, Numerical Differentiation and Integration as well as Solution of Ordinary Differential Equations.
5. Compute Fourier Transforms and Z-Transforms.

UNIT - I

Laplace Transform: Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

UNIT - II

Statistical Techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non-linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests of significations: Chi-square test, t-test.

UNIT - III

Numerical Techniques - I: Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods, Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals.



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UNIT - IV

Numerical Techniques – II: Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss Seidel method, Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third and three-eight rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler's, Picard's and fourth-order Runge-Kutta methods

UNIT – V

Integral Transforms: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one-dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Text Books:

1. H.K. Das, Advanced Engineering Mathematics, S. Chand & Company Pvt. Ltd., 2022
2. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
3. Jain, Iyenger & Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi., 2020
4. J N Kapur, Mathematical Statistics, S. Chand & Company Pvt. Ltd. 2014
5. BS Grewal, Higher Engineering Mathematics, Khanna Publishers., 1965

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Paper Code- ME-301
Credit- 4

ENGINEERING THERMODYNAMICS

Course Outcomes:

1. To learn about work and heat interactions, and balance of energy between system and its surroundings.
2. To learn about application of I law to various energy conversion devices and II law related concepts.
3. Understand the concept of entropy and irreversibility.
4. To understand the properties of steam and other associated terms, also to develop a better understanding of Rankine cycle.
5. To understand various refrigeration cycles and properties of refrigerants.

UNIT I

Review of Fundamental Concepts and Definitions: Introduction- Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic Viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi - static Process, Irreversible Process, Causes of Irreversibility Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Property of mixture of gasses, electrical, magnetic, gravitational, spring and shaft work. Zeroth law of thermodynamics: Concept of Temperature and its measurement, Temperature scales.

First law of thermodynamics: First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume. Limitations of first law of thermodynamics, PMM-I. Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc

UNIT II

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency, reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements, Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and its corollaries, Thermodynamic Temperature Scale, PMM-II. Entropy: Clausius inequality, Concept of Entropy, Entropy changes of pure substance in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

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UNIT III

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function. Thermodynamic relations: Conditions for exact differentials, Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion. Adiabatic and Isothermal compressibility

UNIT IV

Properties of steam and Rankine cycle: Pure substance, Property of Pure Substance (steam), Triple point, Critical point, Saturation states, Subcooled liquid state, Superheated vapor state, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T, P-V and P-h diagrams, T-S and H-S diagrams, Dryness factor and its measurement, processes involving steam in closed and open systems. Simple Rankine cycle. Air-water vapor mixture and Psychrometry: Psychrometric terms and their definitions, Psychrometric chart, Different Psychrometric processes and their representation on Psychrometric chart

UNIT V

Refrigeration Cycles: Reversed Carnot Cycle for gas and vapor. Refrigeration capacity, unit of refrigeration. Air Refrigeration cycles; Reversed Brayton Cycle and Bell Coleman Cycle. Vapor compression refrigeration cycle; simple saturated cycle and actual vapor compression refrigeration cycle. Analysis of cycles, effect of superheating, subcooling and change in evaporator and condenser pressure on performance of vapor compression refrigeration cycle. Refrigerants; their classification and desirable properties. Vapor absorption refrigeration system

References

- 1-Basic and Applied Thermodynamics by PK Nag, MCGRAW HILL INDIA.,2017
- 2-Thermodynamics for Engineers by Kroos& Potter, Cengage Learning.,2015
- 3-Thermodynamics by Shavit and Gutfinger, CRC Press.2008
- 4-Thermodynamics- An Engineering Approach by Cengel, MCGRAW HILL INDIA,2019
- 5-Basic Engineering Thermodynamics, Joel, Pearson.2008
- 6-Engineering Thermodynamics by Dhar, Elsevier.2008

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Paper Code- ME-302
Credit- 4

MECHANICS OF DEFORMABLE SOLIDS

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Recognize various types loads applied on machine components of simple geometry
2. Able to understand the nature of internal stresses that will develop within the components
3. Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading
4. Able to understand the influence of twisting on shaft and the energy theorems.
5. Analyze and design beams, shafts and hollow cylinders.

UNIT-I

Stress and strains:

Introduction, normal stress and strain, shear stress and strain, stresses on inclined sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr's circle for plane stress, three dimensional states of stress & strain, generalized Hook's law, theories of failure. Thermal Stresses.

UNIT-II

Mechanics of Beams

Transverse loading on beams, point and distributed loads; Shear force and bend moment diagrams; Types of beam supports – simply supported, over-hanging, cantilevers, fixed and guided beams; Static determinacy and indeterminacy; Theory of bending of beams, pure bending stress distribution and neutral plane, second moment of area; Different cross-sections of beams; Shear stress distribution.

Deflection of Beams

Deflection of a beam using the double integration method; Computation of slopes and deflection in beams; Myosotis method for computing deflections and slopes.

UNIT-III

Helical and Leaf Springs

Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

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Columns and Struts

Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended columns, effect of end conditions on column buckling.

UNIT- IV

Bending

Simple bending theory, concept of pure bending, bending stresses in beams or derivation of elastic flexural formula, section modulus and comparison of different cross-section of beams under bending condition.

Shear stress

Concept of different shear stress and its distribution in various cross-section.

Torsion and Twist

Torsion stresses and deformation of circular and hollow shafts; Polar moment of area, stepped shafts; Deflection of shafts fixed at both ends; Stresses and deflection of helical springs.

Energy Theorem

Principle of virtual work; Minimum potential energy theorem; Castigliano's theorems; Maxwell reciprocity theorem.

UNIT -V

Thin and Thick cylinders

Thin cylinders & spheres: Introduction, difference between thin walled and thick walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.

Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits.

Text /Reference Books:

1. E. P. Popov, "Engineering Mechanics of Solids," Pearson, 2015.
2. Timoshenko and Gere, "Mechanics of Materials", CBS Publishers, 2011.
3. R. Subramanian, "Strength of Materials," Oxford University Press, 2007.
4. D.S. Bedi, "Strength of Materials", Khanna Book Publishing, 2022.
5. D.S. Bedi, "Engineering Mechanics", Khanna Book Publishing, 2021.
6. F. P. Beer, R. Johnson Jr and J. J. Dewole, "Mechanics of Materials," Tata Mc Graw Hill, Delhi, 2005.
7. L.S Srinath, Advanced Mechanics of Solids, McGraw Hill, 2017.



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Paper Code- ME-303
Credit- 4

ENGINEERING MATERIALS AND APPLICATIONS

Course Outcomes:

At the end of this course students will

1. Know the range of engineering materials, their mechanical properties and applications
2. Know various methods to measure the mechanical properties of materials
3. Learn how to improve the properties of ferrous alloys through various heat treatments
4. Interpretation of equilibrium phase diagrams of alloys
5. Different heat treatment methods to tailor the properties of Fe-C alloys.

UNIT-I

Engineering Materials and Classification

Metals, plastics, ceramics and composites; Relevant properties (physical, mechanical, thermal, electrical, chemical), cost; Range of applications; Material designation and standards; Ashby diagrams; Selection criteria and process

UNIT-II

Mechanical Properties and Testing

Tensile compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength; ductility, resilience, toughness and elastic recovery; Hardness measurement their relation to strength; SN curve, endurance and fatigue limits; Introduction to non-destructive testing (NDT).

UNIT-III

Metal and Alloys

Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze & cupro-nickel; Aluminium & Al-Cu-Mg alloys; Nickel based superalloys & Titanium alloys; Phase diagrams and interpretation of microstructure; Iron Iron-carbide phase diagram and cooling (TTT) diagrams of slopes and deflection in beams; Myosotis method for computing deflections and slopes.

Heat Treatment

Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

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UNIT-IV

Polymers, Ceramics and Composites

Polymers – Classification and applications; Polymerization techniques; Ceramics – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; Composites – Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Other advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nanomaterials..

UNIT-V

Electrical and Magnetic Materials

Conducting and resisting materials – types, properties and applications; Semiconducting materials – properties and applications; Magnetic materials – Soft and hard magnetic materials and applications; Superconductors and dielectric materials – properties and applications; Smart materials; Sensors and actuators; Piezoelectric, magnetostrictive and electrostrictive materials.

Text/Reference Books:

1. W. D. Callister, "Materials Science & Engineering," Wiley India, 2014.
2. K. G. Budinski and M.K. Budinski, "Engineering Materials", PHI India, 2002
3. V. Raghavan, "Material Science and Engineering", PHI India, 2015.
4. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.
5. M.F. Ashby and D.R.H. Jones, Engineering Materials 1 - An Introduction to Properties, Applications and Design, Butterworth-Heinemann, USA, 2011



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Paper Code- ME-304
Credit- 4

FLUID MECHANICS

Course Outcomes:

1. To understand the property of fluid for analysing state of fluid.
2. To understand the pressure measurement of the fluid and analysis of force/pressure on the floating body in water.
3. To understand the various type of simple flow and importance of dimensional analysis.
4. To obtain the velocity and pressure variations of fluid flow and losses of energy.
5. To understand the complex nature of fluids in disturbed conditions and analysis of many problems in aerodynamics, including wing stall, the skin friction drag on an object, and the heat transfer that occurs in high speed flight.

UNIT-I

Properties of Fluid

Definition of fluid; Types of Fluid; Properties of fluids & Units and dimensions; Viscosity, Newton's law of viscosity, Sutherland's correlation; Vapour pressure and cavitation; Surface tension, Bursting pressure for different fluid bodies; Capillarity.

Manometry

Pressure: Fluid pressure at a point, Pascal's law, Pressure variation in a fluid at rest, absolute, gauge, atmospheric and vacuum pressures; hydrostatic law; Measurement of Pressure: manometers, mechanical gauges; Simple Manometers: Piezometer, U-tube manometer, single column manometer; Differential Manometers: U-tube differential manometer, inverted U-tube differential manometer.

UNIT-II

Buoyancy and Floatation

Archimedes Principle, Principal of Flotation, Meta-Centre, Meta-centric height, Analytical method for meta-centric height problems, Condition of equilibrium of a floating and submerged bodies: stability of a submerged body, stability of a floating body; Time period of oscillation.

Kinematics of Fluid Flow

Introduction, Concept of Continuum: Knudsen number, slip flow, transition flow, free molecular flow; Method of fluid motion; Types of fluid flow: steady and unsteady flows, uniform and non-uniform flows, laminar and turbulent flows, compressible and incompressible flows, rotational and irrotational flows, 1D, 2D and 3D flows; Discharge; Continuity equation; Continuity equation in 3D; Velocity potential function; Streamline function.

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UNIT-III

Dynamics of Fluid Flow

Introduction, Equation of motion, Euler's equation, Bernoulli's equation from Euler's equation, Assumptions in Bernoulli's equation, Bernoulli's equation for real fluid, Application of Bernoulli's equation: Venturimeter, Orifice meter or orifice plate, Pitot-tube; Orifices: Introduction, Classification, flow through an orifice, Hydraulic Co-efficient.

Dimensional Analysis

Dimensional homogeneity; Methods of dimensional analysis: Rayleigh's method, Buckingham Pi Theorem, Procedure for solving Buckingham Pi Theorem; Type of forces acting on fluid; Dimensionless Numbers.

UNIT-IV

Laminar and Turbulent Flow

Laminar Flow: Introduction, Reynold's experiment, Reynold's number, Critical flow, Introduction of boundary layer development, Velocity profile at different point at pipe, hydro-dynamically developed flow, fully developed flow, Variations of shear stress, Shear stress distribution in fully developed laminar flow, velocity profile in fully developed laminar flow, Laminar flow through two fixed parallel plate; Turbulent flow: Frictional loss in pipe flow- expression for loss of head due to friction in pipe, expression for co-efficient of friction in terms of shear stress; Shear stress in turbulent flow- Reynold expression for turbulent shear stress, prandtl mixing length theory for turbulent shear stress.

UNIT-V

Flow Through Pipe

Introduction, Energy losses (Head losses) in pipe; Major energy loss: frictional loss (Darcy Welsbach equation), frictional coefficient in terms of wall shear stress; Minor energy loss: loss due to sudden expansion, loss due to sudden contraction, loss at entry of pipe, loss at exit, losses due to pipe bend, obstruction in pipe, losses due to fitting, Chezy's formula; Energy gradient line or Total energy line, Hydraulic gradient line; Pipe Connection: Series connection, Parallel connection; Flow through branch pipe; Power transmission through pipes; efficiency, condition of maximum power, maximum efficiency; Pipe Network: Hardy cross method; Flow through syphon; Water hammer in pipes.

Boundary Layer Theory

Introduction, Definition: Laminar and turbulent boundary layer, laminar sub-layer, boundary layer thickness, displacement thickness, momentum thickness; Characteristics of boundary layer, velocity profile shape factor;

Submerged body

Stream line body and bluff body; concept of lift and drag force; local and average co-efficient of drag and lift; concept of terminal velocity.

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Text /Reference Books:

1. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing, 2019.
2. Hydraulics and fluid mechanics including hydraulics machines by Modi and Seth, Standard book house, 2011.
3. P.J. Pritchard, A.T. McDonald and R.W. Fox, "Introduction to Fluid Mechanics," Wiley India, 2012.
4. F.M. White, "Fluid Mechanics," Tata McGraw Hill, 2011.
5. R. K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines," Laxmi Publication, 2005.
6. Mechanics of Fluids, Shames, McGraw Hill Book Co., New Delhi, 1988
7. G. Biswas and S. Chakraborty "Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2017.
8. F. M. White, Fluid Mechanics, 6th Ed., Tata McGraw-Hill, 2008.

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Code- ME-351
Credit- 1

ENGINEERING MATERIAL LAB

Course Outcomes:

1. To learn about stress and strain and UTM.
2. Understand phase transformation.
3. Learn cyclic load tests.
4. Study about various NDT methods.

List of Experiments: (At least 8 of the following)

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot on the machine.
2. Other tests such as shear bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index test on spring testing machine.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (non-destructive testing) methods like magnetic flaw detector, detector, eddy current testing machine, dye penetrant tests.



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Paper Code- ME-352
Credit- 1

FLUID MECHANICS LAB

Course Outcomes:

1. To understand the principles and performance characteristics of flow,
2. To able to measurement of the fluid flow properties,
3. To be able to measure metacentric height of floating body.
4. Understand the basics of Bernoulli's theorem and determine various parameters associated with it.

List of Experiments: (At least 8 of the following)

1. To determine coefficient of discharge of an orifice meter.
2. To determine the coefficient of discharge of Notch (V and Rectangular types).
3. To determine the friction factor for the pipes.
4. To determine the coefficient of discharge of venturi meter.
5. To determine the coefficient of discharge, contraction & velocity of an orifice.
6. To verify the Bernoulli's Theorem.
7. To find critical Reynolds number for a pipe flow.
8. To determine the meta-centric height of a floating body.
9. To determine the coefficient of discharge of Notch (V and Rectangular types).
10. To measure viscosity of different fluid.
11. To measure the pressure with the help of U-tube manometer.
12. To understand the basics of open channel flow and measure the velocity and shear with the help of open-channel flow apparatus.
13. To measure the drag on a circular cylinder in high Reynolds number flow
14. To Study the laminar-turbulent transition for flow in a tube



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Paper Code- ME-353
Credit- 1

COMPUTER AIDED MACHINE DRAWING LAB

Course Outcomes:

1. Identify the national and international standards pertaining to machine drawing.
2. Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings
3. Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.
4. Preparation of the part or assembly drawings as per the conventions.

List of Experiments: (At least 8 of the following)

1. To Review of graphic interface of the software, basic sketching commands and navigational commands
2. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section)
3. To draw the Hidden line conventions and Precedence of lines.
4. To draw the Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids).
5. To draw Conversion of pictorial views into orthographic projections of simple machine parts (with section planes indicated on the part).
6. To study the Thread terminology, sectional views of threads, ISO Metric (Internal & External), BSW (Internal & External) square and Acme, Sellers thread, American Standard thread.
7. To draw the Key, Coupling and Joints.
8. To Assemble Drawings the Plummer block (Pedestal Bearing)
9. To Assemble Drawings the Lever Safety Valve
10. To Assemble Drawings the I.C. Engine connecting rod
11. To Assemble Drawings the Screw jack (Bottle type)
12. To Assemble Drawings the Tailstock of lathe
13. To Assemble Drawings the Machine vice
14. To Assemble Drawings the Tool head of shaper



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Paper Code- ME-354
Credit- 1

THERMODYNAMICS LAB

Course Outcomes:

1. Apply the concept of fire and water tube boiler.
2. Apply the concept of 2-stroke and 4-stroke petrol engine.
3. Apply the concept of heat balance sheet for diesel engine.
4. Understanding compounding of steam turbine.

List of Experiments: (At least 8 of the following)

1. Study of Fire Tube boiler.
2. Study of Water Tube boiler.
3. Study and working of Two stroke petrol Engine.
4. Study and working of Four stroke petrol Engine.
5. Determination of Indicated H.P. of I.C. Engine by Morse
6. Prepare the heat balance sheet for Diesel Engine test rig.
7. Prepare the heat balance sheet for Petrol Engine test rig.
8. Study and working of two stroke Diesel Engine Test.
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine
11. Study of Pressure compounded steam turbine.
12. Study of Impulse & Reaction turbine.
13. Study of steam Engine model.
14. Study of Gas Turbine Model.



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SEMESTER-IV

भाषा विश्व योजयति



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Paper Code- ME-401
Credit- 4

APPLIED THERMODYNAMICS

Course Outcomes:

1. To learn about of I law of thermodynamics for reacting systems and combustion value of fuels.
2. To learn about gas and vapor cycles and their first law and second law efficiencies.
3. Understand air flow and steam through nozzles.
4. Learn about reciprocating compressors with and without intercooling.
5. Analyze the performance of steam turbines.

UNIT I

Introduction to solid, liquid and gaseous fuels- Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy, Introduction and Otto, Diesel and Dual cycles.

Fuels and Combustion: Combustion analysis, heating values, air requirement, Air-Fuel ratios heat of reaction and effect of temperature on standard heat of reaction, heat of formation

UNIT II

Vapour Power cycles: Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Rankine cycle, effect of pressure and temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapor cycle, Combined cycles, Cogeneration.

UNIT III

Boilers: Classifications and working of boilers, boiler mountings and accessories, Draught and its calculations, air preheater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

Condenser: Classification of condenser, air leakage, condenser performance parameters.

Steam and Gas Nozzles: Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, Choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Effect of friction on nozzle, Super saturated flow.

UNIT IV

Steam Turbines: Classification of steam turbine, Impulse and Reaction turbines, Staging, Stage and Overall efficiency, reheat factor, Bleeding, Velocity diagram of simple and compound multistage

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impulse and reaction turbines and related calculations, work done, efficiencies of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines, Comparison with steam engine,

UNIT V

Gas Turbine: Gas turbine classification, Brayton cycle, Principles of gas turbine, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency.

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.

Books and References:

1. Basic and Applied Thermodynamics by P.K. Nag, mcgraw hill india, 2017, 6th edition
2. Applied thermodynamics by Onkar Singh, New Age International, 2018
3. Applied Thermodynamics for Engineering Technologists by Eastop, Pearson Education, 2002
4. Applied Thermodynamics by Venkanna And Swati, PHI, 2011.
5. Thermodynamics: An Engineering Approach (SIE), by Yunus A. Cengel and Michel A Boles, mcgraw hill india, 2017
6. Fundamentals of Thermodynamics, by Richard E. Sonntag (Author), Claus Borgnakke (Author), Gordon J. Van Wylen (Author), 2002.

(Signatures of faculty members)



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Paper Code- ME-402
Credit- 4

FLUID MACHINERY

Course Outcomes:

1. To understand how jet deflection produces a force on turbine vanes and force affects the rate of momentum flow in the jet.
2. To understand useful for applications that require a constant source of power.
3. To understand the generation of power and efficiency for renewable energy.
4. To understand the controlling and conversation of power/energy transmission by the fluid pressure.
5. To understand the controlling, the precise amount of fluid is required to be delivered and power transmission device.

UNIT-I

Impact of jet

Introduction, Force exerted by the jet on stationary plate: (vertical plate/ inclined flat plate/curved plate); Force exerted by the jet on moving plate in the direction of jet: (vertical plate/ inclined plate/curved plate); Force exerted by a jet on un-symmetrical moving curved plate; Force exerted by a jet of water on a series of vanes

UNIT-II

Turbine

Introduction, Definitions, Head and type of heads, Efficiency of hydraulic turbine, Classification of hydraulic turbine;

Impulse (Pelton turbine)

Tangential flow impulse turbine (Pelton turbine): Constructional details, velocity triangles, Work done, power and efficiency calculation. Governing of Turbines

Reaction Turbine

Francis and Kaplan turbine: Classifications, Constructional details, velocity triangles, power and efficiency calculations, Degree of Reaction; Draft tube, Draft tube theory, Efficiency of draft tube; Specific speed; Unit quantities: unit speed, unit discharge, unit power, use of unit quantities; Model law of turbine; Performance characteristics curve for reaction turbine, Governing of reaction turbine and selection of turbine.

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UNIT-III

Centrifugal Pumps

Introduction, Classification of pumps; Centrifugal pump: Element, working, calculations of head and efficiency, minimum speed for starting; Multistage Centrifugal pump; Specific speed of Centrifugal pump; Model law in pump; Priming of centrifugal pump; Characteristics curve of centrifugal pump, Cavitation: Precaution, Effect; Suction height; Net positive suction head (NPSH); Cavitation in turbine and Centrifugal pumps.

UNIT-IV

Reciprocating Pumps

Introduction, Classifications, Element of Reciprocating pump, Working of reciprocating pump, slip of reciprocating pump; Indicator diagram; speed calculation- Air vessels and their purposes, saving in work done to air vessels multi cylinder pumps. Multistage pumps-selection of pumps-

UNIT-V

Hydraulic Machines

Power transmission device with fluid; Instruction, Hydraulic press, Hydraulic accumulator, Hydraulic ram, Hydraulic lift, Hydraulic coupling, Hydraulic torque converter,

Pumping Devices-Hydraulic Ram, Accumulator, Intensifier, Jet Pumps, Gear Pumps, Vane Pump and Lobe Pump.

Text /Reference Books:

1. Hydraulic Machines by Jagdish Lal, Metropolitan book co. Pvt Ltd, 2023.
2. Hydraulic Machines by K Subramanya, Tata McGraw Hill, 2018.
3. Fluid Power with Applications, by Esposito, Pearson, 2024
4. Fluid Mechanics and hydraulic machines by Modi & Seth, Standard Book House, 2019
5. Fundamentals of Turbomachinery by Venkanna B.K., PHI, 2009
6. Hydraulic Machines: Theory & Design, V.P. Vasandhani, Khanna Pub, 1990.
7. Fluid Mechanics and Hydraulic Machines by Sukumar Pati, Tata McGraw Hill, 2017



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Paper Code- EE-401
Credit- 4

ELECTRICAL MACHINES AND AUTOMATIC CONTROL

Course Outcomes:

1. They will get knowledge about different transformers, D.C. motors and their applications.
2. The electrical machines induction motor, synchronous motor, servo motor and their controlling mechanism.
3. The knowledge about analogy in mechanical system, concept of various types of control system and mathematical representation of signals.
4. Explore to time response analysis, Routh Hurwitz Criterion and its application, Nyquist stability.
5. Concept of root locus, Frequency Response Analysis, Introduction to P, PI and PID controllers

UNIT I

Basic concept of single-Phase Transformer: Efficiency and voltage regulation, Open circuit & Short circuit Tests. Three Phase Transformer: Three phase transformer connections, 3-phase to 2-phase or 6-phase connections and their applications. Auto Transformer: Volt- Amp relations, efficiency, advantages & disadvantages, applications. D.C. Motors: Concept of starting, speed control, losses and efficiency.

UNIT II

Concept of three phase Induction Motor: Construction and equivalent circuit, Relation between torque equation and torque-slip characteristics, speed control. Alternator: Schematic construction, e.m.f. equation, Voltage regulation and its determination by synchronous impedance method. Synchronous Motor: Starting and excitation on line current (V-curves) and inverse V-curve. Servo Motor: a. c. servo motor & its application.

UNIT III

Concept of Mechanical System: linear mechanical elements, force-voltage and force current analogy, electrical analog of simple mechanical systems; Details theory of coupled circuit, transfer function & its determination for simple systems. Control System: Open loop & closed loop controls, servo mechanism; concept of various types of system. Signals: Unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics.

UNIT IV

Time Response Analysis: Time response of a standard second order system and response specifications, steady state errors and error constants. Stability: Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability, limitations; Polar plot, Nyquist stability Criterion and assessment of stability.

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UNIT V

Root Locus Techniques: Concept of root locus, construction of root loci. Frequency Response Analysis: Correlation between time and frequency responses of a second order system; Bode plot, gain margin and phase margin and their determination from Bode and Polar plots. Process Control: Introduction to P, PI and PID controllers and their characteristics, representation and applications in devices.

Text /Reference Books:

1. Afzal Sikander, Chandan Kumar Chanda, Dulal Acharjee, Jerzy R. Szymanski, Advanced Energy and Control Systems, Springer Nature Singapore, 2022.
2. Dawson, Nonlinear Control of Electric Machinery, CRC Press, 2019.
3. Rik W. De Doncker, Duco W.J. Pulle, André Veltman, Advanced Electrical Drives, Springer International Publishing, 2020.
4. Juha Pyrhonen, Valeria Hrabovcova, R. Scott Semken, Electrical Machine Drives Control, Wiley, 2016.
5. Claiton Moro Franchi, Electrical Machine Drives, CRC Press, 2019.
6. P. Aruna Jeyanthi, Christeena Francois, Sunil K. Joseph, Electrical Drives and Control for Automation, Independently Published, 2018.
7. J.B. Gupta, S. Hasan Saeed, Electrical machine and automatic control, S.K. Kataria & Sons, 2023.
8. J. P. Navani Sonal Sapra Electrical Machines And Automatic Control , S.Chand,2023.



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Paper Code- ME-403
Credit- 4

MEASUREMENT & METROLOGY

Course Outcomes:

1. Able to describe basic concepts of mechanical measurement and errors in measurements.
2. To understand the linear and angular measuring instrument for measurement of various components
3. Able to describe methods of measurement for force, torque, power.
4. Able to describe methods of measurement for displacement, velocity/seed and acceleration and temperature measuring device for various applications.
5. Students will able to describe basic concepts of Metrology and separate different gears through measurement of various dimensions of gears.

UNIT-I

Mechanical Measurement

Need of mechanical measurement, Basic definitions: Hysteresis, Linearity, Resolution of measuring instruments, Threshold, Drift, Zero stability, loading effect and system response. Measurement method, Generalized measurement system, Static performance characteristics, Errors and their classifications.

UNIT-II

Limits, Fit and Tolerances: Definitions; Tolerance zone and grades, Hole and shaft system, Geometric tolerances, Tylor's principle of gauging, Design of tolerances for various applications; Tolerance analysis in manufacturing and assembly; Role of metrology in Design of Manufacturing.

Linear and angular measurements

Linear Measurement Instruments, vernier calliper, Micrometre, interval measurements: Slip gauges, checking of slip gauges for surface quality, Optical flat, Limit gauges, Problems on measurements with gauge.

UNIT-III

Measurement of Force, Torque and Strain

Force measurement: load cells, cantilever beams, proving lings, differential transformers. Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements, Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, Temperature compensation.

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UNIT-IV

Displacement, Velocity/Speed, and Acceleration, Measurement

Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic accelerometer

Temperature measurement

Temperature measuring devices: Thermocouples, Resistance Temperature detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring device, Numerical example on flow measurement.

UNIT-V

Metrology: Basics of Metrology, Need for Inspection, Accuracy and Precision, Objectives, Standards of measurements.

Metrology of Gears and screw threads: Gear tooth terminology, Sources of errors in manufacturing of gears, Measurement of tooth thickness: Gear tooth vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope or projector, Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking, Measurement of concentricity, Alignment of gears.

Text /Reference Books:

1. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press, 2013
2. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication (KATSON), 2013
3. Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar, 1995
4. Industrial Instrumentation & Control by S K Singh, McGrawHill, 2017
5. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill, 2017
6. Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry McGraw-Hill
A Text book of Engineering Metrology, J.C Gupta, Dhanpat Rai Publications, 2018

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Paper Code- ME-401
Credit- 4

MANUFACTURING SCIENCE

Course Outcomes:

Upon completion of this course, students will be able to

1. Analyze the application of casting processes in production and understand the working of various casting processes
2. Understand the process of metal cutting and finishing along with process variables and the working of different types of machine tools.
3. Explain the conventional and advanced metal forming processes
4. Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application.
5. Understand the different conventional and unconventional manufacturing methods employed for making different products.

UNIT-1

Casting Processes: Introduction, Industrial applications, testing of moulding sand, types of casting processes (Die, Centrifugal, Continuous, and investment casting), Solidification time, Gating and rising system design, Sprue design: Modulus method.

Metal Cutting-

Mechanics of metal cutting, Geometry of tool and nomenclature, ASA system Orthogonal vs. oblique cutting, Mechanics of chip formation, types of chips, Shear angle relationship, Merchant's force circle diagram, Cutting forces, and power required, Heat generation and cutting tool temperature, Cutting fluids/lubricants, Tool materials, Tool wear and tool life, Machinability, Dynamometer, Brief introduction to machine tool vibration and surface finish, Economics of metal cutting.

UNIT-2

Plastic deformation and yield criteria; Terminology used in plastic deformation; Recrystallization temperature, grain growth, malleability, fundamentals of hot and cold working processes; Advantages and disadvantages of hot and cold working.

Rolling: Types of rolling operations: Hot rolling, cold-rolling, ring rolling etc. Defects in rolling, Analysis of rolling operation.

Forging: Forging, advantages and disadvantages of forging, Forgeability, draft, flash, gutter, Drop forging and press forging, other types of forging.

Extrusion: Extrusion, Extrusion ratio, Direct and indirect extrusion, hydrostatic extrusion, lubrication for extrusion, wire drawing, rod and tube drawing, wire drawing analysis.

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Sheet metal operation: Punching and blanking, clearance in punching and blanking, punching force and blanking force, the capacity of press for punching and blanking, energy, and power for punching and blanking, shear on punch, the force required with shear on punch, other types of sheet metal operations.

Drawing: Blank size, Drawing force, deep drawing, deep drawability, limiting drawing ratio, defects in drawing.

Spinning: Spinability, blank diameter.

UNIT-3

Drilling: Types of drilling machines, portable, bench, upright, Radial, Spot facing. Drilling process parameters, Estimating machine time. Reaming: Types of reamer, reaming operations. Broaching: Types of broaches, tool material, teeth terminology and other details. Methods of broaching. Working principle and operation of shaping, planing and slotting.

Milling Machine: types, working principle, milling parameters, operations (slab, end, slot, face milling), up and down milling, Estimating machining time in lathe and milling operations, different types of indexing methods in milling.

Grinding & Super finishing

(i) Grinding: Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification.

Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and cylindrical grinding. Centerless grinding

(ii) Super finishing: Honing, lapping and polishing.

UNIT-4

Metal Joining

Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG & MIG processes and their parameters. Resistance welding - spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electro slag, and friction welding. Soldering & Brazing. Adhesive bonding. Thermodynamic and Metallurgical aspects in welding and weld, Weldability, Shrinkage/residual stress in welds. Distortion & defects in weld and remedies. Weld decay in HAZ.

UNIT-V

Unconventional Machining

Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM, AJM, WJM. Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma- arc welding, Diffusion welding, Explosive welding/cladding, Induction to Hybrid machining processes

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Books and References:

1. Manufacturing Science - A. Ghosh and A.K. Mallik, East-West Press, 2nd Edition, 2010
2. Manufacturing Science - G S Sawhney, Dreamtech Press, 2019.
3. Manufacturing Engineering and Technology, 8e in SI Units, Serope Kalpakjian, Steven R. Schmid, Pearson, 8th Edition, 2023.
4. Fundamentals of Metal Machining and Machine Tools - Geoffrey Boothroyd, CRC Press, 2005
5. Production Technology - R.K. Jain Khanna Publishers.
6. A Textbook of Manufacturing Technology - Er. R.K. Rajput, Laxmi Publication, 2nd Edition, 2020
7. Advances in Non-Conventional Manufacturing Processes - Dr. Syed Asghar Husain Rizvi, Amber Publishers, Volume-1, 2023.
8. Manufacturing Science - MI Khan, Serajul Haque, PHI Publication
9. A Textbook Of Production Engineering- PC Sharma, S Chand Publication

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Paper Code- EE-451
Credit- 1

ELECTRICAL MACHINES AND AUTOMATIC CONTROL LAB

Course Outcomes:

1. To understand the controlling the machine and automation.
2. To able to measurement and characterization of machines.
3. To understand the usage and application of PVTR.
4. To be able to understand the working of Electro-Pneumatics and Electro-hydraulic System

List of Experiments: (At least 8 of the following)

1. Study to speed characterization of D.C Shunt motor.
2. Analysis of S.C and O.C test of Transformer.
3. To Study of Load variation by PID Controller.
4. To determine the efficiency of single phase transformer and three phase transformer.
5. To determine the efficiency of auto transformer.
6. To study Electro-Pneumatics and Electro-Hydraulics System
7. To study Programmable Logic Controller Trainer
8. The experiments on PVTR



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Paper Code- ME-451
Credit- 1

MANUFACTURING SCIENCE LAB

Course Outcomes:

1. To perform the joining of metal and measurement the tool life for characterization of tool.
2. To understand various welding process available and their applications.
3. To understand the basic principal of 3D printer and analyses the variables
4. To Perform drilling operation and estimate the machining time.

List of Experiments: (At least 8 of the following)

1. Study of different types of tools and its angles & materials.
2. Experiment on jigs/Fixtures and its uses
3. To perform turning and step turning on Lathe machine.
4. To perform knurling and grooving on Lathe machine.
5. Experiment on tool wear and tool life.
6. To study the taylor's tool life equations and the factor influencing tool life.
7. Finishing of a surface on surface-grinding machine.
8. Drilling holes on drilling machine and study of twist-drill.
9. Gas welding experiment
10. Arc welding experiment
11. Spot Resistance welding experiment.
12. Soldering & Brazing experiment
13. MIG Welding
14. To study the apparatus of 3D Printer and analyses the variable associated with it.

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Paper Code- ME-452
Credit- 1

MEASUREMENT & METROLOGY LAB

Course Outcomes:

1. Demonstrate the necessary skills for calibration and testing of different gauges and instruments.
2. Demonstrate the necessary skills to collect data perform analysis and interpret results to draw valid conclusions through standard test procedures using various metrology instruments.
3. To understand the basics of micrometer and importance of least count.
4. To understand the basics of tolerance by uses of gauges.

List of Experiments: (At least 8 of the following)

1. Measure the least count of Vernier Calipers and measure the thickness of solid wire.
2. Measurement of gear tooth profile using gear tooth Vernier / Gear tooth micrometre.
3. Measure the least count of micrometer and measure the thickness of solid wire.
4. Calibration of Micrometre using slip gauges.
5. Measurement of angle using Sine Centre / Sine bar / bevel protractor
6. Determine the clearance between surface of mechanical component Filer Gauge
7. Study the limit friction tolerance and perform experiment by using Go NOgo Gauge
8. Measurement of Screw threads Parameters using two wire or Three-wire methods.
9. Measurement of Surface roughness, using Tally Surf/Mechanical Comparator.