Objectives:

- The objective is to find the relation between the variables x and y out of the given data (x,y).
- This 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


UNIT – II:


UNIT – III:

Interpolation and Curve fitting


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

UNIT – IV: Numerical techniques


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\(3/3\) and 3/8 Rule, Gauss-Legendre one point, two point and three point formulas.


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

TEXT BOOKS:
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.
UNIT – I

UNIT II

UNIT – III

UNIT IV

UNIT - V

TEXT BOOKS:

REFERENCE BOOKS:
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Thermodynamics – J.P.Holman / McGrawHill
4. Engineering Thermodynamics – Jones & Dugan
UNIT – I

UNIT – II
Shear Force And Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III
Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT-IV
Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr’s circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

UNIT – V

TEXT BOOKS:
2. Solid Mechanics, by Popov

REFERENCES:
7. Strength of Materials by R.K Rajput, S.Chand & Company Ltd.
Aim & Objectives:
The student will gain insight into a number of potentially useful phenomena involving movement of fluids. He/she will learn to do elementary calculations for engineering application of fluid motion. This course also prepares the student for more advanced courses such as Aerodynamics-I & -II.

UNIT I
Fluid Properties: Density, specific weight, specific gravity, surface tension & capillarity, Newton's law of viscosity, incompressible & compressible fluid, numerical problems.
Hydrostatic forces on submerged bodies: Pressure at a point, Pascal's law, pressure variation with temperature and height, Center of pressure on vertical, inclined and curved surfaces.

UNIT II
Fluid Kinematics: Stream line, path line, streak line, stream surface, stream tube, classification of flows: steady, unsteady, uniform, non uniform, laminar, turbulent flows. One dimensional approximation, examples of real 1-D flows, two dimensional approximation, 2-D flow in wind tunnel, continuity equations for 1-D and 2-D flows both compressible and incompressible, stream function for two dimensional incompressible flows. Vorticity, irrotational flow, Velocity potential function.

UNIT III
Fluid Dynamics: Surface & body forces, substantive derivative, local derivative and convective derivative, momentum equation, Euler equation, Bernoulli’s equation, Phenomenological basis of Navier-Stokes equation, Introduction to vortex flows.
Statement of Buckingham’s π-theorem, Similarity parameters: Reynolds number, Froude number, Concepts of geometric, kinematic and dynamic similarity. Reynolds number as a very approximate measure of ratio of Inertia Force and Viscous Force, flow measurements: pressure, velocity and mass flow rate, viscosity, Pitot-static tube, venturi meter and orifice meter, viscometers.

UNIT IV
Boundary Layer: Introductory concepts of boundary layer, Large Reynolds number flows and Prandtl's boundary layer hypothesis, Qualitative description of Boundary layer thickness and velocity profile on a flat plate and flow around submerged objects. Pressure drag and skin friction drag.

UNIT V
Pipe flow: Reynolds experiment, Darcy’s equation, major and minor losses in pipes and numerical problems. Exact solutions of Navier stokes equations, flow between parallel plates, flow through long tubes, Fully developed flow, turbulent flow, variation of friction factor with Reynolds number, Moody’s chart.

TEXT BOOKS:

REFERENCES:
2. Fluid Mechanics- Fox and Mc Donald
3. Fluid Mechanics – E. Rathakrishnan

Outcome:
It makes the student ready to understand advance Aero dynamics.
INTRODUCTION TO AEROSPACE ENGINEERING

Objective: To introduce to the student, the field of Aerospace Engineering.

UNIT – I

History of Flight- the Aerospace Environment: Balloons and dirigibles, heavier than air aircraft, commercial air transport, introduction of jet aircraft, helicopters, missiles, conquest of space, commercial use of space, exploring solar system and beyond. Earth's atmosphere, standard atmosphere, the temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity. The near earth radiative environment. The magnetosphere. Environmental impact on spacecraft. Meteoroids and micrometeoroids, space debris. Planetary environments.

UNIT – II


UNIT- III


UNIT – IV


UNIT – V

Introduction to Engineering Design, Air Transportation: Design as a critical component of engineering education- as a skill- the process, design thinking, design drawing. Design for mission, performance and safety requirements. Concurrent engineering. Computer aided engineering, design project. Example: the lighter-than – air vehicle student design project at MIT. Air Transportation Systems- civil, military- objectives- principal constituents- the vehicle, the ground facilities, the organisation- role. Regulation- national and international. Flight safety and security. Indian effort- civil and military- in the field of Aerospace Engineering.

TEXT BOOKS
3. The Wikipedia (on the web): Transportation Systems, Air Transportation, Aviation, Space Transportation

REFERENCES:

Outcome: The student would have sufficient acquaintance with Aerospace Engineering to take up study of the field in detail through subsequent courses.
ENVIROMENTAL STUDIES

Objectives:
1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations.

UNIT-I:
Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure and function of an ecosystem. Food chains, food webs and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II:
Natural Resources: Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dam: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III:
Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV:

UNIT-V:

SUGGESTED TEXT BOOKS:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

Outcomes:
Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which inturn helps in sustainable development.
Aircraft Engineering Drawing Lab with CAD

Aim:
Learn to draw the machine components and to give the better exposure of aircraft components drawing.

UNIT I
Machine Drawing conventions. Need for Drawings conventions – Introduction to ISI - Conventions
a) Conventional representation of materials, common machine elements, and parts such as screws, nuts, bolts, keys, gears, webs, ribs
b) Types of sections – Selection of sectional planes and drawing of sections.
Parts not usually sectioned
(c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features

UNIT II
Drawing of Machine Elements and simple parts. Section of views, additional views for the following machine elements and parts with every drawing proportion
a) Popular forms of screw threads, bolts, set screws and bolted joints.
b) Various types of Riveted joints.
c) Shaft couplings, spigot and socket joint.
d) Journal, pivot, collar and foot step bearing
e) Welded joints and welding symbols.

UNIT III
Following simple Aircraft assembly drawings only.
a) Different types of trusses used in wings fuselage including ribs, stringers, skin, brackets
b) Different elements of fuselage structures, bulkhead, rings (frame), long irons
c) Different types of fuselage.
d) Landing gear basic elements, structural brackets, wheel, shock absorber and Hydraulic cylinder
e) Connecting rod for aero piston engine

TEXT BOOKS:

REFERENCES:
2. Air Craft structures by Bruhn, E.H
5. Machine Drawing by Rajput

Note: 40% Course Work Should be Done on Drawing Board & 60% Course Work Should Be Done By Computer aided drafting (CAD).

Equipment Needed
1. Hardware assembly models relevant to above are needed for demonstration
2. Drawing Boards with Mini drafting machines, 60 required for strength of 60 capacity.

Outcome:
Students are familiarized with the drawings of the air craft components.
MECHANICS OF SOLIDS AND MECHANICS OF FLUIDS LAB

(A) MECHANICS OF SOLIDS LAB:
1. Direct tension test
2. Torsion test
3. Hardness test
   a) Brinells hardness test
   b) Rockwell hardness test
4. Test on springs
5. Compression test on cube
6. Impact test
7. Punch shear test

(B) MECHANICS OF FLUIDS LAB
1. Calibration of Venturimeter
2. Determination of co-efficient of discharge for a small orifice by a constant head method.
3. Calibration of Triangular notch
4. Verification of Bernoulli’s apparatus.
5. Pipe friction.
6. Calibration of orifice meter
7. Determination of co-efficient of discharge for an external mouth piece by variable head method.
8. Determination of co-efficient of loss of head in a sudden retraction.

Note: A minimum of ten experiments should be taking at least four experiments from each lab.