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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

# SJC INSTITUTE OF TECHNOLOGY

**An Autonomous Institution under VTU from 2024-25**

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV ), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

# III Semester
# Scheme & Syllabus of B.E. Programme
# Aeronautical Engineering
# (2025 Scheme)

## Core Values

**S**piritual, **J**udicious, **C**ommitment, **I**ntegrity, **T**rustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NAAC A+

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

||jai sri gurudev||
Sri Adichunchanagiri Shikshana Trust (R.)
SJC INSTITUTE OF TECHNOLOGY
(An Autonomus Institute Under VTU Belagavi & Approved by AICTE, New Delhi)
Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV ), NIRF (151-300), QS-I Gauge GOLD Rated
Estd.:1986
Post Box #20, B.B. Road, Chikkaballapur - 562 101, Karnataka

## B.E. in Aeronautical Engineering,
## Scheme of Teaching and Examinations -2025

Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS) (Effective from the academic year 2025-26)

**III SEMESTER**

| Sl. No | Course | Course Code | Course Title | Teaching Department (TD) /Question Paper Setting Board (PSB) | Teaching and Learning Scheme | | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | CI | | LI | TW & SL | Total hours per Sem | Duration in hours | CIEMarks | SEEMarks | TotalMarks | |
| | | | | | L | T | P | SL | | | | | | |
| 1 | ASE | 1BMATM301 | Applied and Computational Engineering Mathematics | Mathematics | 42 | 28 | 0 | 50 | 120 | 3 | 50 | 50 | 100 | 4 |
| 2 | IPCC | 1BAE302 | Aero Engineering Thermodynamics | AE | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | 4 |
| 3 | IPCC | 1BAE303 | Fluid Mechanics | AE/AS | 42 | 0 | 28 | 50 | 120 | 3 | 50 | 50 | 100 | 4 |
| 4 | PCC | 1BAE304 | Aircraft Materials &Processes | AE | 42 | 0 | 0 | 48 | 90 | 3 | 50 | 50 | 100 | 3 |
| 5 | PCC | 1BAE305 | Metrology and Measurement Systems | AE | 42 | 0 | 0 | 48 | 90 | 3 | 50 | 50 | 100 | 3 |
| 6 | PCCL | 1BAEL306 | Computer Aided Aircraft Drawing and GD&T | AE | 0 | 0 | 28 | 02 | 30 | 3 | 50 | 50 | 100 | 1 |
| 7 | AEC | 1BAEL307x | Ability Enhancement Course Laboratory** | AE | 0 | 0 | 28 | 02 | 30 | 2 | 50 | 50 | 100 | 1 |
| 8 | SDC | 1BCP308 | Community Project | Any Department | 0 | 0 | 0 | 30 | 30 | 2 | 50 | 50 | 100 | 1 |
| 9 | NCMC | 1BNS309 | National Service Scheme | Campus: NSS coordinator | 0 | 0 | 0 | 28 | 28 | -- | 100 | -- | 100 | PP |
| | | 1BPE309 | Physical Education | Physical | | | | | | | | | | |
| | | 1BYO309 | Yoga | Yoga Teacher | | | | | | | | | | |
| | | 1BMU309 | Music | Music Teacher | | | | | | | | | | |
| | | 1BNC309 | National Cadet Corps-I | NCC coordinator | | | | | | | | | | |
| 10 | NCMC | 1BCE310 | Competency Enhancement Course-1 | CDCAC | 14 | 0 | 0 | 14 | 28 | -- | 100 | -- | 100 | PP |
| 11 | NCMC | 1BMATDIP311 | Additional Mathematics-I | Mathematics | 14 | 0 | 0 | 14 | 28 | -- | 100 | -- | 100 | PP |
| | | | | | | | | | | **Total** | **700** | **400** | **1100** | **21** |

**Ability Enhancement Course (Laboratory)1BAEL307x**

| | | | |
|---|---|---|---|
| 1BAEL307A | Metrology and Measurement Lab | 1BAEL307C | Drone Development and Assembly |
| 1BAEL307B | Computational Tools for Aircraft Performance Analysis | | |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Applied and Computational Engineering Mathematics Stream: ME** | | | | | |
| **Course Code** | : | 1BMATM301 | **Credits** | : | 4 |
| **Hours/Semester (L:T:P:SL)** | : | 42:28:0:50 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 50 | **SEE** | : | 50 Marks |
| **Course Type** | : | ASC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Differential Calculus and linear algebra<br>• Multivariable Calculus and Numerical Methods: |
| **Knowledge on Fundamental Concepts** | Basic Differentiation, Integration |
| **Knowledge on Connected Tools (If any)** | Basic computer knowledge |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand the concept of curve fitting and its importance in data analysis. |
| **CLO2** | Identify and select the appropriate probability distribution model for engineering and scientific problems based on given data and conditions. |
| **CLO3** | Learn integral transforms such as Laplace and Fourier to solve engineering problems. |
| **CLO4** | Understand the fundamental concepts of signals, frequency spectra, and Fourier transforms used in engineering analysis. |
| **CLO5** | Gain Knowledge of numerical techniques for solving partial differential equations in aerospace structures. |

| **Module – 1** | **10 Hrs** |
|---|---|
| **Curve fitting and Statistical Analysis:** Curve fitting by method of least squares: y = ax+b, y = $ax^2+bx+c$ and $y=ax^b$. Correlation–Karl Pearson's coefficient of correlation, Rank correlation, Regression analysis – lines of regression (without proof)- problems. | |
| **Module – 2** | **10 Hrs** |
| **Probability Distributions:** Random Variables (Discrete and Continuous). Probability mass and density functions. Mathematical expectation, Mean and variance. Discrete probability distributions: Binomial, Poisson, and Normal distributions (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. | |
| **Module – 3** | **10 Hrs** |
| **Introduction to Laplace Transform:** Definition, basic properties and simple problems. Laplace transforms of Periodic functions (statement only), Inverse Laplace transform, Problems using partial fractions, Solving ODEs using Laplace transform. | |
| **Module – 4** | **10 Hrs** |
| **Fourier series and practical harmonic analysis:** Fourier series expansion of functions Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period $2\pi$ and with arbitrary period: Half-range Fourier series. Practical harmonic analysis. | |
| **Module – 5** | **10 Hrs** |

| |
|---|
| **Applications of Partial Differential Equations:** Classifications of second-order partial differential equations, finite difference approximations to derivatives, Solution of Laplace's equation using standard five-point formula. Solution of heat equation by Schmidt explicit formula and Crank- Nicholson method. |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | Applications: Vibrational Modal Analysis, Machining and Manufacturing.<br>Self-Study: Angle between regression lines. |
| **Module – 2** | Applications: Analyze the performance of the algorithms.<br>Self Study: Exponential distribution. |
| **Module – 3** | Applications: Modeling mass-spring-damper systems<br>Self Study: Unit step function. |
| **Module – 4** | Applications: Aircraft autopilot sampling systems.<br>Self Study: periodic rectangular wave, Half-wave rectifier |
| **Module – 5** | Applications: Vibration analysis (wave equation) – in structures like aircraft fuselage and turbine blades.<br>Self Study: Solution of the wave equation problems. |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Apply the principles of least squares to perform curve fitting |
| **CO2** | Solve illustrative problems involving Binomial, Poisson, and Normal distributions in engineering and scientific applications. |
| **CO3** | Apply Laplace transform techniques to solve ordinary differential equations and model dynamic systems relevant to aerospace and mechanical engineering. |
| **CO4** | Analyze signals using Fourier transforms to interpret frequency-domain behavior in vehicles. |
| **CO5** | Solve partial differential equations numerically using finite difference methods to analyze physical phenomena in mechanical & aerospace structures. |

| **Text Books** | |
|---|---|
| **1** | Higher Engineering Mathematics, B. S. Grewal, 43rd Edition, 2015, Khanna Publishers,ISBN:978-81-933284-9-1.<br>Ch 4: 4.1-7.4.1 & Ch 5: 5.1 - 5.4<br>Ch 21: 21.1 to 21.5, 21.7 to 21.12, 21.15.<br>Ch 10: 10.2, 10.3, 10.5, 10.6, 10.7, 10.11.<br>Ch 18: 18.1 to 18.4, 18.9. |
| **2** | Advanced Engineering Mathematics, E. Kreyszig, 10th Ed, 2018, John Wiley & Sons.<br>Ch 4: 4.1 to 4.7, 4.9, 4.10, 4.13.<br>Ch 5: 5.2 to 5.7, 5.9, 5.11, 5.12, 5.15.<br>Ch 6: 6.6 to 6.9, 6.11, 6.12.<br>Ch 11: 11.1 - 11.3. |

| **Reference Books** | |
|---|---|
| **1** | Higher Engineering Mathematics, B. V. Ramana, 11th Ed., 2017, McGraw-Hill |

| | |
|---|---|
| | Education |
| **2** | A Textbook of Engineering Mathematics, N.P Bali and Manish Goyal, 10th Ed, 2022, Laxmi Publications. |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | http://www.class-central.com/subject/math |
| **2** | http://nptel.ac.in/courses.php?disciplineID=111 |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | | | | | | | 1 | 2 | 1 |
| **CO2** | 3 | 3 | 2 | 1 | | | | | | | 1 | 2 | 1 |
| **CO3** | 3 | 3 | 2 | 1 | | | | | | | 1 | 2 | 1 |
| **CO4** | 3 | 3 | 2 | 1 | | | | | | | 1 | 2 | 1 |
| **CO5** | 3 | 3 | 2 | 1 | 1 | | | | | | 1 | 2 | 1 |

| | **ME** | | **AE** | | **AS** | |
|---|---|---|---|---|---|---|
| | **PSO1** | **PSO2** | **PSO1** | **PSO2** | **PSO1** | **PSO2** |
| **CO1** | 1 | | 2 | 1 | 1 | |
| **CO2** | 1 | | 2 | 1 | 1 | |
| **CO3** | 1 | | 2 | 1 | 1 | |
| **CO4** | 1 | | 2 | 1 | 1 | |
| **CO5** | 1 | | 2 | 1 | 1 | |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Aero Engineering Thermodynamics (Branch: AE)** | | | | | |
| **Course Code** | : | 1BAE302 | **Credits** | : | 4 |
| **Hours/Semester (L:T:P:SL)** | : | 42:0:28:50 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 120 | **SEE** | : | 50 Marks |
| **Course Type** | : | IPCC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Applied Physics<br>• Differential Calculus and Linear Algebra<br>• Applied Chemistry<br>• Elements of Aeronautical Engineering.<br>• Introduction to Artificial intelligence |
| **Knowledge on Fundamental Concepts** | Units and dimensions (SI units especially),Energy forms: kinetic, potential, internal, mechanical, Concepts of temperature, pressure, volume |
| **Knowledge on Connected Tools (If any)** | --- |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Grasp knowledge of fundamental thermodynamic concepts, properties, processes, and laws relevant to aeronautical engineering applications. |
| **CLO2** | Develop the ability to apply thermodynamic principles for analyzing energy transfer and thermodynamic processes in engineering systems. |
| **CLO3** | Impart understanding of the behavior of pure substances, ideal gases, and real gases using thermodynamic property relations and charts. |
| **CLO4** | Evaluate the performance of reciprocating engines, gas turbine cycles, and aerospace propulsion systems through theoretical, experimental, and AI-assisted approaches. |

| **Module – 1** | **08 Hrs** |
|---|---|
| **Fundamental Concepts & Definitions**: Thermodynamics: Definition, scope, and applications in Aeronautical Engineering. Microscopic and macroscopic approaches. Thermodynamic systems, boundaries, and control surfaces with aeronautical examples. Thermodynamic properties, intensive and extensive properties. Thermodynamic state, state point, path and process, quasi-static, cyclic and non-cyclic processes. Thermodynamic equilibrium, mechanical, thermal, and chemical equilibrium, diathermic wall. Zeroth law of thermodynamics.<br>**Work and Heat:** Mechanical definition of work and its limitations in Aeronautical Engineering applications. Thermodynamic definition of work, examples, and sign convention related to aircraft systems. Displacement work as part of a system boundary and as a whole system boundary, with expressions for various processes using P–V diagrams. Shaft work in gas turbines, compressors, and propeller systems. | |

| Module – 2 | 08 Hrs |
|---|---|
| **First Law of Thermodynamics:** Joule's experiments and the equivalence of heat and work. Statement of the First Law of Thermodynamics and its extension to non-cyclic processes with applications in Aeronautical Engineering. Energy as a property and modes of energy in aircraft propulsion and thermal systems. Enthalpy, Specific heat at constant volume and specific heat at constant pressure relevant to air and combustion gases, along with the relationship between the two specific heats.<br>**First Law for Control Volume:** Steady-state, steady-flow energy equation with applications to compressors, turbines, nozzles and diffusers. | |
| **Module – 3** | **08 Hrs** |
| **Second Law of Thermodynamics:** Thermal efficiency of Heat engines, Devices converting work to heat in a thermodynamic cycle: reversed heat engine, schematic representation, and coefficient of performance. Kelvin–Planck statement of the Second Law of Thermodynamics; PMM-I and PMM-II. Clausius statement of the Second Law of Thermodynamics. Equivalence of the two statements. Reversible and irreversible processes; factors that make a process irreversible. Reversible heat engine, Carnot cycle, and Carnot principles.<br>**Entropy:** Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, calculation of entropy using Tds relations. | |
| **Module – 4** | **08 Hrs** |
| **Pure Substances:** Basic definitions of pure substances, two-property rule, sensible heat, latent heat. Triple point and critical point. P–T and P–V diagrams. Subcooled liquid, saturated liquid, saturated liquid–vapour mixture, saturated vapour, and superheated vapour states of a pure substance, with water. Enthalpy of phase change. Dryness fraction (quality). T–S and h–s diagrams and representation of various thermodynamic processes related to thermal systems.<br>**Ideal and Real Gas:** Equation of state for a perfect gas, characteristic gas equation, universal gas constant, and Avogadro's law. Van der Waals equation, reduced parameters, and compressibility factor. Mass fraction, volume fraction, and mole fraction. Dalton's law of partial pressure, generalized compressibility chart, and law of corresponding states. | |
| **Module – 5** | **08 Hrs** |
| **Reciprocating Engine Power Cycles:** Efficiency of air-standard cycles, Otto and Diesel cycles, P–V and T–S diagrams, and calculation of efficiency. Comparison of Otto and Diesel cycles. Performance analysis of I.C. engines, heat balance and Morse test. Introduction to AI-based engine performance prediction, fault diagnosis and efficiency optimization.<br>**Gas Turbine Power Cycles:** Gas turbine (Brayton) cycle, description and analysis. Regenerative gas turbine cycle. Intercooling and reheating in gas turbine cycles. AI applications in gas turbines for predictive maintenance, combustion monitoring, and fuel efficiency improvement. | |

| **Practical component** | |
|---|---|
| **Module – 1** | 1. Thermodynamic System Identification Simulation for Open, Closed and Isolated Systems. |
| | 2. To measure the areas of regular & irregular plane figures using Planimeter instrument & determine its accuracy |
| | 3. Determination of Flash point and Fire point of lubricating oil using Abel Apparatus |

| | |
|---|---|
| | 4. Determination of Flash point and Fire point of lubricating oil using Pensky Martin Apparatus |
| **Module – 2** | 5. Determination of Calorific value of solid, liquid and gaseous fuels |
| | 6. Heat transfer by Conduction Using Virtual Experiment |
| | 7. Heat Transfer by Natural Convection Using Virtual Experiment |
| | 8. Heat Transfer by Radiation Using Virtual Experiment |
| | 9. Simulation of Entropy Change During Heating and Cooling Processes |
| **Module – 4** | 10. Determination of Steam Properties Using Steam Tables |
| **Module – 5** | 11. To draw the valve timing diagram for a 4-stroke I C Engine |
| | 12. Morse test on Four stroke Multi-cylinder Petrol Engine |
| | 13. Performance test on Four stroke Petrol Engine |
| | 14. AI-Based Optimization of Otto and Diesel Cycle Efficiency Using Machine Learning |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | • Temperature sensors used in aircraft engines<br>• Thermal management in aerospace vehicles<br>• Temperature concepts & scales |
| **Module – 2** | • Energy analysis of turbofan engines<br>• Fuel energy utilization in aircraft propulsion<br>• Case studies on aircraft engine efficiency |
| **Module – 3** | • Entropy generation in aircraft engines<br>• Entropy and sustainability in aviation<br>• Irreversibility in real gas turbine engines |
| **Module – 4** | • Real gas behavior at high-altitude flight conditions<br>• Cryogenic fuels for aerospace applications<br>• Compressibility effects in supersonic aircraft |
| **Module – 5** | • Turbofan, turbojet and turboprop engines<br>• AI-enabled aircraft engine health monitoring<br>• Hydrogen-powered gas turbine engines<br>• Future trends in aerospace propulsion systems |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Describe the fundamental concepts, properties, processes, and laws of thermodynamics. |
| **CO2** | Demonstrate the application of the First Law of Thermodynamics to energy interactions in closed and open systems. |
| **CO3** | Differentiate reversible and irreversible processes and examine entropy changes using the Second Law of Thermodynamics. |
| **CO4** | Investigate the thermodynamic behavior of pure substances, ideal gases, and real gases using property relations and diagrams. |
| **CO5** | Evaluate the performance of air-standard cycles, IC engines and gas turbines for aircraft applications. |

| Text Books | |
|---|---|
| 1 | Basic and Applied Thermodynamics, PK Nag, 2nd Edition, Tata Mc Graw Hill Pub. 2002, ISBN 13: 9780070151314<br>Module:1,2,3,4,5 |
| 2 | Engineering Thermodynamics, R K Rajput, 4th Edition, Laxmi Publications, 2019.<br>Module:4 |
| 3 | IC engine, V Ganesan, 4th Edition, Tata McGraw Hill Education Private Limited New Delhi.<br>Module:5 |
| 4 | Artificial Intelligence in Aviation and Aerospace, Rajiv S. Ramachandran, 1st Edition, 2023, Wiley-Scrivener, ISBN: 978-1119903413.<br>Module:5 |

| Reference Books | |
|---|---|
| 1 | Thermodynamics: An engineering Approach, Yunus A Cenegal and Michael A Boles, Tata McGraw Hill 2002. |
| 2 | Engineering Thermodynamics, J B Jons and G A Hawkins, Wiley 1986. |
| 3 | An Introduction to Thermodynamics, Y V C Rao, Wiley eastern 1993. |
| 4 | Basic Thermodynamics, B K Venkanna, Swathi B Wadavadagi, PHI, New Delhi 2010. |
| **Hand Books of Tables/Charts/Data Sheets** | |
| 1 | Thermodynamics Data Hand Book, SI Units, B T Nijaguna and B S, Samaga Sudha Publications. |

| Web links and Video Lectures ( e – Resources ) | |
|---|---|
| 1 | https://nptel.ac.in/courses/112105123 |
| 2 | https://nptel.ac.in/courses/101104063 |
| 3 | https://www.vlab.co.in/ |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | | | 1 | | 1 | | 1 | 3 | 1 |
| **CO2** | 3 | 3 | 1 | 2 | 1 | 1 | | 1 | 1 | 1 | 1 | 3 | 1 |
| **CO3** | 3 | 3 | 2 | 2 | 1 | 2 | | 1 | 1 | 1 | 1 | 3 | 2 |
| **CO4** | 2 | 3 | 1 | 3 | 2 | | | 1 | 1 | | 1 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 1 | | 1 | 1 | 2 | 2 | 3 | 3 |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Fluid Mechanics (Common to the Branches: AE & AS)** | | | | | |
| **Course Code** | : | 1BAE303 | **Credits** | : | 4 |
| **Hours/Semester (L:T:P:SL)** | : | 42:0:28:50 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 120 | **SEE** | : | 50 Marks |
| **Course Type** | : | IPCC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Engineering Mathematics,<br>• Physics (Mechanics). |
| **Knowledge on Fundamental Concepts** | Units and Dimensions, Basic Fluid Properties, Newton's Laws of Motion, Calculus and Differential Equations. |
| **Knowledge on Connected Tools (If any)** | -- |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Gain Knowledge of fluid properties and pressure measurement techniques. |
| **CLO2** | Learn fluid motion using kinematics and conservation equations to various flow types. |
| **CLO3** | Acquire knowledge of Bernoulli's equation and its applications in fluid dynamics. |
| **CLO4** | Study the development of boundary layers, flow separation and drag. |
| **CLO5** | Explore aerodynamic lift and drag on submerged bodies and the behavior of air in high-speed compressible flows. |

| **Module – 1** | **08 Hrs** |
|---|---|
| **Introduction to Fluid Mechanics:** Fluid mechanics- Fluid Statics, Fluid Kinematics and Fluid Dynamics; Properties of Fluids, Newton's law of viscosity, Types of fluids, Effect of temperature on viscosity, Effect of pressure on viscosity, Continuum view of gases and liquids, Surface tension and capillarity, Pressure inside a liquid jet, Compressibility and bulk modulus, Vapor pressure.<br>**Fluid Pressure and its Measurement**: Definition of pressure and pressure head. Pascal's law and the hydrostatic law governing pressure variation in a static fluid. Relationship between absolute, gauge, atmospheric, and vacuum pressures. Pressure measurement using manometers, Buoyancy and stability of floating and immersed body, Meta-centric height, Numerical. | |
| **Module – 2** | **08 Hrs** |
| **Fluid Kinematics:** Introduction, Conservation Equation, Differential form- Continuity equation, Navier's stokes equation and Energy equation, Continuity equation in Cartesian coordinates, Circulation and vorticity.<br>Types of fluid flow, Types of flow lines, Rate of flow or discharge, Description of fluid motion, Lagrangian method, Eulerian method, Velocity potential and stream function, Numerical. | |

| Module – 3 | 08 Hrs |
|---|---|
| **Fluid Dynamics:** Introduction, types of forces acting on moving fluid, Different types of Heads or Energies of a liquid in motion, Bernoulli's equation, Euler's equation for motion.<br>**Dimensional Analysis:** Introduction to dimensional analysis, dimensions, Dimensional homogeneity. Methods of dimensional analysis: Rayleigh's method and Buckingham's Pi-theorem, Limitations of dimensional analysis.<br>**Model Analysis:** Introduction, types of similarity and Similitude, Significant dimensionless numbers, Model or similarity laws- Reynolds model law, Froude model law, Euler model law, Weber model law, and Mach model law. | |
| **Module – 4** | **08 Hrs** |
| **Boundary Layer Theory:** Introduction, Boundary layer definitions and characteristics, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness,Numericals, Momentum equation for boundary layer by Von Karman,Total drag due to laminar and turbulent layers, Boundary layer separation and its control. | |
| **Module – 5** | **08 Hrs** |
| **Flow Around Submerged Bodies- Drag and Lift** Introduction, Force exerted by a flowing fluid on a body, Expressions for drag and lift, drag on a sphere, Terminal velocity of a body, drag on a cylinder, Circulation and lift on a circular cylinder, Development of lift on an airfoil, Use AI to estimate pressure at different points on an airfoil.<br>**Compressible flow:** Steady, one-dimensional gas dynamics, propagation of pressure waves in compressible medium, velocity of sound, Mach Number, Mach cone, stagnation properties, Normal shock waves. | |

| **Practical component** | |
|---|---|
| **Module – 1** | 1. Determination of the viscosity of the given lubricating oil using a Redwood viscometer. |
| | 2. Determination of the viscosity of the given lubricating oil using a Torsion viscometer. |
| **Module – 2** | 3. Determination of Coefficient of discharge of a given Pipe Flow using Venturi meter. |
| | 4. Determination of Coefficient of discharge of a given Pipe Flow using Orifice meter. |
| **Module – 3** | 5. Verification of Bernoulli's equation. |
| | 6. Calibration of contracted Rectangular Notch and Determine the Coefficient of Discharge. |
| | 7. Calibration of contracted Triangular Notchand Determine the Coefficient of Discharge. |
| **Module – 4** | 8. Determination of Major Head Loss Due to Friction in a Pipe. |
| | 9. Determination of Minor Head Losses in Pipe Fittings. |
| | 10. Boundary layer over a flat plate (Virtual Lab Experiment) |
| **Module – 5** | 11. Impact of jet (Virtual Lab Experiment) |
| | 12. Flow over a delta wing (Virtual Lab Experiment) |

| Topics for Self learning | |
|---|---|
| **Module – 1** | Transition to Turbulence in Internal and External Flows |
| | Dynamic Stability of Floating Bodies and Metacentric Analysis |
| **Module – 2** | Vorticity Dynamics and Circulation Theorems in Fluid Flow |
| | Flow Visualization and Topology of Complex Fluid Motion |
| **Module – 3** | Energy Conservation in Fluid Flow and Extended Bernoulli Equation |
| | Dimensional Analysis in Complex Fluid Systems and Governing Similarity Laws. |
| **Module – 4** | Mathematical Formulation of Boundary Layer Equations and Von Kármán Momentum Integral Equation |
| | Boundary Layer Separation: Mechanism, Mathematical Conditions, and Flow Reversal. |
| **Module – 5** | Force exerted by a flowing fluid on a body, Development of lift on an airfoil. |
| | Circulation Theory and Lift Generation on Circular Cylinders |

| Course Outcomes: After completing the course, the students will be able to | |
|---|---|
| **CO1** | Understand fluid properties and determine pressure or stability for floating bodies. |
| **CO2** | Apply continuity equations for real-world piping and motion problems. |
| **CO3** | Analyze Bernoulli's principle for different types of fluid flow to measure flow rates in pipes. |
| **CO4** | Evaluate head losses due to friction and boundary layer thickness for smooth and rough surfaces. |
| **CO5** | Predict lift and drag forces on airfoils and cylinders to determine Mach number and stagnation properties in gas flows. |

| Text Books | |
|---|---|
| **1** | Fluid Mechanics, Frank M White, ISBN-10-9355322046, ISBN-13. 978-9355322043, Edition-Standard, Publisher- McGraw Hill · Publication date. 16 June 2022<br>Chapters:1,2,3,4,5,6,7,8 |
| **2** | Fluid Mechanics and Hydraulics Machines, Bansal, R.K, Laxmi Publications (P)Ltd., New Delhi 2015, ISBN13: 978-8131808153.<br>Chapters:1,2,4,5,6,12,13,14,15 |
| **3** | Fluid Mechanics and Applications- Yunus A. Cengel& John M Cimbala, McGraw Hill Education; Edition 5thPublisher. McGraw Hill · Publication date. 20 May 2024, ISBN-10. 1266968369 · ISBN-13. 978-1266968365<br>Chapters:1,2,3,4,5 |

| Reference Books | |
|---|---|
| **1** | Hydraulic Fluid Mechanics and Fluid Machines- Ramamritham. S, Dhanpat Rai& Sons, Delhi, Publication date. 1 January 2018; ISBN-10. 9352161955; ISBN-13. 978-9352161959. |

| | |
|---|---|
| **2** | Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow - Aurélien Géron, SPD; Third Edition – 2020. |
| **3** | Engineering Fluid Mechanics- Kumar. K. L, Eurasia Publishing House (P) Ltd., New Delhi, VII Ed., 2008 ISBN: 8121901006 |
| **4** | Fluid Mechanics- Streeter. V. L., and Wylie, E.B, New Delhi : Tata McGraw Hill Education Private Limited, , Edition: 9th , ISBN: 9780070701403 |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://onlinecourses.nptel.ac.in/noc21_me68/preview |
| **2** | https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ce159 |
| **3** | https://alison.com/tag/fluid-mechanics |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 2 | 2 | | | 2 | 1 | 1 | | 3 | 1 |
| **CO2** | 3 | 3 | 1 | | 2 | | 1 | | | | 1 | 3 | 1 |
| **CO3** | 3 | 3 | 2 | 3 | 2 | | | 3 | 2 | | | 3 | 1 |
| **CO4** | 3 | 3 | 2 | 2 | 3 | | | | 1 | 1 | 1 | 3 | 1 |
| **CO5** | 3 | 3 | 3 | 2 | 3 | 1 | | | 1 | | 1 | 3 | 1 |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Aircraft Materials & Processes (Branch: AE)** | | | | | |
| **Course Code** | : | 1BAE304 | **Credits** | : | 3 |
| **Hours/Semester (L:T:P:SL)** | : | 42:0:0:48 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 90 | **SEE** | : | 50 Marks |
| **Course Type** | : | PCC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Elements of Aeronautical Engineering<br>• Introduction to Artificial intelligence |
| **Knowledge on Fundamental Concepts** | Metals, Non Metals, Composite Materials |
| **Knowledge on Connected Tools (If any)** | --- |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Impart knowledge of aircraft material properties, classification, mechanical behavior and selection criteria for aerospace applications. |
| **CLO2** | Discuss the characteristics, heat treatment procedures and aerospace applications of high-performance Aluminium, Magnesium and Titanium alloys. |
| **CLO3** | Gain knowledge of properties, manufacturing processes and aerospace applications of steels, superalloys, shape memory alloys, ceramics and composite materials. |
| **CLO4** | Learn the fabrication methods, corrosion prevention techniques and various non-destructive testing methods used for aircraft materials. |
| **CLO5** | Identify modern concepts of Artificial Intelligence in predictive maintenance, material failure analysis and AI-based non-destructive testing in aerospace engineering. |

| **Module – 1** | **08 Hrs** |
|---|---|
| **Mechanical Behavior of Aircraft Materials:** Introduction to Aircraft materials and their classification, Mechanical and Thermal properties, Stress vs. Strain Curves-Yielding and Strain hardening, Toughness, Modulus of resilience and Bauchinger's effect. Requirements of materials for Aircraft applications, Knowledge of various Aircraft material testing, Case study on the fatigue failure analysis in Aircraft components. Introduction to Quality Control and Quality Assurance in Aerospace Industries. Aerospace Material Standards and Specifications (ASTM, AMS, MIL Standards, ISO Standards) | |
| **Module – 2** | **08 Hrs** |
| **Non-ferrous Materials In Aircraft Construction:**<br>**Aluminium and its alloys**: Types, Designation system, Properties, Casting, Extrusion, Types of Heat treatments and Surface treatments, Importance of Al-Cu and Al-Zn Alloys in Aircraft<br>**Magnesium and its alloys:** Cast and Wrought alloys, Properties, Applications and Special treatment.<br>**Titanium and its alloys:** Properties, Applications, Machining, Forming, Welding and Heat treatment. Numerical examples on finding suitable material for Aircraft components. | |

| Module – 3 | 08 Hrs |
|---|---|
| **Steels, Superalloys and Shape Memory Alloys In Aircraft Construction:**<br>**Steels**: Plain and low carbon steels, SAE steel numbering system, Aircraft steels properties, Corrosion and heat resistant steels, Structural applications, Heat treatment and Surface hardening.<br>**Maraging Steels:** Properties and Applications<br>**Superalloys:** Properties, Microstructural Constituents and Applications of Nickel based superalloys, Cobalt based superalloys, and Iron based superalloys. Manufacturing Processes- Casting, Powder Metallurgy, Welding, Additive manufacturing and Heat treatment, Case study on Superalloys in Jet Engine Turbines.<br>**Shape memory alloys**: Phase transformation, Functional properties, Applications and Limitations | |
| **Module – 4** | **08 Hrs** |
| **Ceramics and Composites**: Modern ceramic materials, Cermets, and Glass ceramic. Advanced ceramic manufacturing process. Properties, Aerospace applications and Limitations of Carbon/Carbon composites, Metal matrix composites (MMC), Polymer matrix composites (PMC) and Fiber metal laminates<br>**Fabrication Methods:** Carbon/Carbon composites (Chemical Vapor Deposition/Infiltration), PMC (Hand layup, Spray layup, Pultrusion and Resin transfer molding), MMC (Powder metallurgy, Diffusion bonding, Stir Casting and Squeeze Casting) | |
| **Module – 5** | **08 Hrs** |
| **Corrosion Prevention and Non-destructive Testing: Corrosion**: Types, Prevention techniques, Protective treatments and Numerical methods for corrosion rate estimation with examples. Predictive Maintenance Using AI.<br>**Non-destructive testing techniques**: Crack detection, Inspection of parts by Dye-penetrate, Fluorescent and Magnetic particles, X-ray, Ultrasonic, Eddy current and Acoustic emission methods. AI in Non-Destructive Testing (NDT), Materials Failure Analysis using AI. | |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | **Aerospace Material Standards, Certification, and Quality Management Systems**<br>• Material qualification and certification procedures in the aerospace industry.<br>• Quality Assurance (QA) and Quality Control (QC) practices for aircraft materials and components. |
| | **Advanced Composite Materials and Smart Materials for Aerospace Applications**<br>• Mechanical behavior, fatigue resistance, and thermal properties of advanced aerospace materials.<br>• Applications in next-generation aircraft and spacecraft structures. |
| **Module – 2** | **Advanced Titanium Alloys and Additive Manufacturing for Aerospace Applications**<br>• Use of Additive Manufacturing (3D Printing) in producing lightweight titanium components.<br>• Benefits in weight reduction, strength enhancement, and fuel efficiency. |
| | **Corrosion Protection and Surface Engineering of Non-Ferrous Aerospace Materials**<br>• Corrosion mechanisms in aluminum, magnesium, and titanium alloys.<br>• Methods to improve fatigue life, wear resistance, and environmental |

| | |
|---|---|
| | durability. |
| **Module – 3** | **Additive Manufacturing of Superalloys for Aerospace Applications**<br>• Introduction to additive manufacturing (3D printing) of aerospace materials.<br>• Advantages in weight reduction, complex geometry fabrication, and material utilization. |
| | **Smart Aerospace Structures Using Shape Memory Alloys (SMAs)**<br>• Fundamentals of phase transformation and shape memory effect.<br>• Integration of SMAs in adaptive and morphing aircraft structures. |
| **Module – 4** | **Advanced Ceramic Matrix Composites (CMCs) for Aerospace Applications**<br>• High-temperature properties, thermal shock resistance, and lightweight characteristics.<br>• Applications in turbine blades, combustor liners, thermal protection systems, and hypersonic vehicles. |
| | **Automated Composite Manufacturing and Industry 4.0 in Aerospace**<br>• Modern composite fabrication techniques such as Automated Fiber Placement (AFP) and Automated Tape Laying (ATL).<br>• Integration of robotics, artificial intelligence, and digital manufacturing in composite production. |
| **Module – 5** | **AI-Based Predictive Maintenance and Corrosion Monitoring in Aerospace Structures**<br>• Introduction to Predictive Maintenance using Artificial Intelligence.<br>• AI and IoT-based monitoring of corrosion and structural health in aircraft.<br>• |
| | **Artificial Intelligence in Non-Destructive Testing (NDT) and Failure Analysis**<br>• Use of AI, computer vision, and deep learning for automated defect detection.<br>• Materials failure prediction and root-cause analysis using machine learning techniques. |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Apply knowledge of aircraft material classification, mechanical behavior, material testing, and quality standards used in aircraft. |
| **CO2** | Understand the properties, heat treatment, manufacturing processes, and aerospace applications of aluminium, magnesium, and titanium alloys. |
| **CO3** | Elucidate the aircraft steels, superalloys, and shape memory alloys, including their processing, properties, and aerospace applications. |
| **CO4** | Describe the advanced ceramic materials, composite materials, fabrication techniques, and their applications in modern aircraft structures. |
| **CO5** | Illustrate the corrosion prevention methods, non-destructive testing techniques, and the application of Artificial Intelligence in predictive maintenance and material failure analysis. |

| **Text Books** | |
|---|---|
| **1** | Aircraft materials and processes, George F. Titterton, 5th Edition, Himalayan Books, New Delhi. Indian Reprint, 2019<br>Chapters:1,2,3,4,5 |

| | |
|---|---|
| **2** | Introduction to aerospace materials, Adrian P. Mouritz, 1stEdition, Wood head Publishing Limited, United Kingdom, 2012<br>Chapters:1,2,3,4,5 |
| **3** | Manufacturing technology for aerospace structural materials, Campbell F. C,1st Edition, Elsevier Ltd, 2006 |

| **Reference Books** | |
|---|---|
| **1** | Aerospace materials handbook, Sam Zhang and Dongliang Zhao,1st Edition, CRC Press Taylor & Francis Group, 2012 |
| **2** | Composite materials for aircraft structures, Alan A. Baker and Murray L. Scott, 3rd Edition, The American Institute of Aeronautics and Astronautics (AIAA), 2023 |
| **3** | Non-destructive test and evaluation of materials, Prasad J. and Krishnadas Nair C. G, 2nd Edition, McGraw Hill, 2011 |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | **https://nptel.ac.in/courses/101104010** |
| **2** | **https://youtu.be/aOapSoL9f8k** |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | | 2 | | 2 | 3 | 2 | 2 | 3 | 2 |
| **CO2** | 3 | 2 | 1 | | | | 2 | 2 | 3 | 1 | 2 | 3 | 2 |
| **CO3** | 3 | 2 | 1 | 2 | | | | 2 | 3 | 1 | 2 | 3 | 2 |
| **CO4** | 3 | 2 | 1 | | 2 | | | 2 | 3 | 2 | 2 | 3 | 2 |
| **CO5** | 3 | 2 | 1 | | | | | 2 | 3 | 1 | 2 | 3 | 2 |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Metrology and Measurement systems (Branch: AE)** | | | | | |
| **Course Code** | : | 1BAE305 | **Credits** | : | 3 |
| **Hours/Semester (L:T:P:SL)** | : | 42:0:0:48 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 90 | **SEE** | : | 50 Marks |
| **Course Type** | : | PCC | **SEE Duration** | : | 3 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Fundamentals of Algebra<br>• Introduction to Artificial intelligence |
| **Knowledge on Fundamental Concepts** | Fundamental concepts of measurements and units |
| **Knowledge on Connected Tools (If any)** | |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Learn the basics of metrology, its advancements & application of measuring instruments |
| **CLO2** | Acquire knowledge on different standards measurements, calibration of measuring instruments. |
| **CLO3** | Understand the measurement of Force, Torque, Pressure, Temperature and Strain |

| **Module – 1** | **08 Hrs** |
|---|---|
| **Standards of measurement:** Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), **Slip gauges**: Wringing phenomena of slip gauges, Indian Standards -M-81, M-112, Numerical problems on building of slip gauge . | |
| **Module – 2** | **08 Hrs** |
| **System of limits, Fits, Tolerances and gauging:** Definition of tolerance, Specification in assembly, Principle of inter changeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances,<br>**Fits:** Definition of fits, types of fits and their designation (IS 919 -1963), geometrical tolerance, positional - tolerances, hole basis system, shaft basis of system-Numerical problems<br>**Gauges:** classification of gauges, Types of gauges -plain plug gauge, ring Gauge, snap gauge, limit gauge and gauge materials. | |

| Module – 3 | 08 Hrs |
|---|---|
| **Comparators:** Mechanical- Reed, Mikrokator, sigma comparator. Electrical type- LVDT. Optical- Zeiss ultra-optimeter, Angular measurements- Sine bar, sine center, optical bevel protractor<br>**Advances in Metrology:** Precision instruments based on laser-Principles- laser interferometer- Michelson interferometer and machine tool metrology. Coordinate measuring machine (CMM)- Constructional features – types, applications. | |
| **Module – 4** | **08 Hrs** |
| **Measurements and Measurement systems:** Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors.<br>**Transducers:** Definition, Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers. | |
| **Module – 5** | **08 Hrs** |
| **Measurement of Torque, Force & Temperature:** Force- Equal arm, unequal arm, load cell, proving ring. Torque- Torsion bar dynamometer, Prony brake dynamometer. Temperature- thermocouple, RTD, bimetallic strip, pressure thermometers, optical pyrometer, Infrared.<br>**Digital Metrology**: Metrology and Digitalization, Implementation Strategy, Data Acquisition, Setup Fundamentals for Measurement and Data Acquisition, Length Measurement in Open Loop, Thermal Measurement and Data-Acquisition Considerations, Data Transfer to Cloud, Internet of Things (IoT) Metrology, Closed-Loop Data Analysis (In-Process Inspection) | |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | Subdivision of standards |
| | Wringing phenomena of slip gauge |
| **Module – 2** | Compound tolerances, accumulation of tolerances |
| | Gauge materials. |
| **Module – 3** | Angular measurements- Sine bar, sine center, bevel protractor |
| | laser interferometer |
| **Module – 4** | Classification of Errors. |
| | Electronic transducers |
| **Module – 5** | Thermal Measurement |
| | Internet of Things (IoT) Metrology |

| Course Outcomes: After completing the course, the students will be able to | |
|---|---|
| **CO1** | Apply principles of metrology, standards of length, and slip gauges for calibration. |
| **CO2** | Analyze limits, fits, and tolerances using Indian standards for interchangeability and gauging applications. |
| **CO3** | Evaluate comparators and advanced metrology instruments for precision measurements. |
| **CO4** | Understand measurement system characteristics, error sources, based on working principles. |
| **CO5** | Illustrate measurement techniques and interpret digital metrology in modern measurement systems. |

| Text Books | |
|---|---|
| **1** | Engineering Metrology, R.K. JainKhanna Publishers, 2015, ISBN 81-7409-153-X<br>Chapters:1,2,3,4,5 |
| **2** | Mechanical Measurements, Beckwith Marangoni and Lienhard, John H. Lienhard V 6th Ed., 2006, ISBN-13: 978-0201847659.<br>Chapters:4,5 |

| Reference Books | |
|---|---|
| **1** | Engineering Metrology I.C. Gupta DhanpatRai Publications, Delhi, 2013, ISBN 13: 1234567144039 |
| **2** | Industrial Instrumentation, Alsutko, Jerry. D. Faulk Thompson Asia Pvt. Ltd.2002, ISBN-13: 978-0827361256 |
| **3** | Engineering Metrology and Measurements, NV Raghavendra, L Krishna murthy, 2013, Oxford publishers. ISBN: 978-0198085492.<br>Chapters:4,5 |
| **4** | Metrology and Instrumentation, Samir Mekid, Ryszard J. Pryputniewicz, 2022, Wiley-ASME Press Series, ISBN: 9781119721734 |

| Web links and Video Lectures ( e – Resources ) | |
|---|---|
| **1** | https://onlinecourses.nptel.ac.in/noc24_me99/preview#:~:text=This%20course%20is%20designed%20to,to%20enhance%20the%20learning%20process. |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | | | 1 | 2 | 2 | | 2 | 2 | 1 |
| **CO2** | 3 | 2 | 1 | | | | | 2 | 2 | | 2 | 2 | 1 |
| **CO3** | 3 | 2 | 1 | | | | | 2 | 2 | | 2 | 2 | 1 |
| **CO4** | 3 | 2 | 1 | | | 1 | | 2 | 2 | | 2 | 2 | 1 |
| **CO5** | 3 | 2 | 1 | | 1 | | | 2 | 2 | | 2 | 2 | 1 |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Computer Aided Aircraft Drawing and GD&T (Branch: AE)** | | | | | |
| **Course Code** | : | 1BAEL306 | **Credit** | : | 1 |
| **Hours/Semester (L:T:P:SL)** | : | 0:0:28:02 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 30 | **SEE** | : | 50 Marks |
| **Course Type** | : | PCCL | **SEE Duration** | : | 3 Hours |

| **Pre requisites:** | |
|---|---|
| **Courses** | • Computer Aided Engineering Drawing |
| **Knowledge on Fundamental Concepts** | Projection methods (First-angle and Third-angle)<br>Orthographic and isometric drawing techniques<br>Principles of aircraft structural components (fuselage, wings, landing gear, etc.) |
| **Knowledge on Connected Tools (If any)** | 2D CAD software |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Gain knowledge of engineering drawing principles, standards, dimensioning, tolerances, and graphical representation techniques used in aeronautical engineering. |
| **CLO2** | Develop the ability to create and interpret orthographic, sectional, detailed, and assembly drawings of aircraft components and structures. |
| **CLO3** | Learn to design and communicate aeronautical components and assemblies using engineering drawing and CAD tools. |

| **Experiments** |
|---|
| **Part-A** |
| **Geometric Dimensioning and Tolerance:** Introduction to Geometric interpretation Dimensioning and Tolerance, Weld Symbols, GD&T Symbols, Types of Tolerances, Types of views, Roughness Symbols.<br>**Orthographic Views:** Conversion of Isometric views into orthographic projections of simple aircraft parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings). |
| **Part-A** |
| **Fasteners:** Hexagonal-headed bolt and nut (assembly), square-headed bolt and nut (assembly).<br>**Riveted Joints:** Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets/Counter sink head rivets). |
| **Part-A** |
| **1.** Design of Propeller and hub assembly<br>**2.** Design of Wing assembly<br>**3.** Design of Fuselage assembly<br>**4.** Design of Landing Gear assembly<br>**5.** Design of Engine mount assembly |

| Open Ended Experiments | |
|---|---|
| **1** | Modelling and Assembly of a Foldable UAV Wing Mechanism |
| **2** | Modelling of a Modular Payload Bay for UAV Applications |
| **3** | Modelling and Drafting of an Aircraft Cockpit Instrument Panel Layout |
| **4** | Modelling of an Emergency Parachute Deployment Mechanism for Light Aircraft |
| **5** | Modelling of a Smart Aircraft Battery Housing for Electric Aircraft |
| **6** | Modelling and Assembly of a UAV Landing Skid with Shock Absorber System |
| **7** | Modelling and Assembly of a Hydrogen Fuel Tank Mounting System |
| **8** | Modelling and Assembly of a Drone Docking and Charging Station |

| Course Outcomes: After completing the course, the students will be able to | |
|---|---|
| **CO1** | Demonstrate the principles of engineering drawing, orthographic projections, sectional views, dimensioning, tolerances, and standard drawing conventions. |
| **CO2** | Construct orthographic views from isometric drawings of aircraft components following BIS standards. |
| **CO3** | Prepare detailed assembly drawings of mechanical joints, fasteners, and riveted connections used in aircraft structures. |
| **CO4** | Develop engineering drawings of aircraft structural assemblies such as propeller, wing, fuselage, landing gear and engine mount systems. |
| **CO5** | Design aeronautical components and assemblies using engineering drawing and CAD tools. |

| Text Books | |
|---|---|
| **1** | Machine Drawing, N. D. Bhatt and Panchal, V. M, 49th ed., Charotar Publishing, 2014. Part: A,B,C |

| Reference Books | |
|---|---|
| **1** | Textbook of Machine Drawing, John, K. C, PHI Learning, 2009. |
| **2** | Machine Drawing, Narayana, K. L., Kannaiah, P., and Venkata Reddy K.,4th ed., New Age International, 2010. |
| **3** | Machine Drawing, Ajeet Singh, Includes AutoCAD, 2nd ed., Tata McGraw-Hill, 2012. |

| Web links and Video Lectures ( e – Resources ) | |
|---|---|
| **1** | https://www.flight-mechanic.com/aircraft-drawings/ |
| **2** | http://avstop.com/ac/Aviation_Maintenance_Technician_Handbook_General/ch2.html |
| **3** | https://share.google/6Ff8sK9AKpiwS17IS |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | | | 1 | | | | | | | 3 | 2 |
| **CO2** | 3 | 2 | 1 | | 2 | | | | | | | 3 | 2 |
| **CO3** | 2 | 2 | 2 | | 2 | | | | | | | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 1 | 2 | | | | | | | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 2 | 3 | 2 | | 2 | 3 | 2 | 2 | 3 | 3 |

**SCHEME OF EXAMINATION**:

1. **Instructions for the CIE and SEE Examination**:
   a. There is no time restriction for sketching or computerizing the solutions, but the total exam duration is 3 hours.
   b. It is recommended to complete the sketching for Part A and Part B before proceeding with computerization.
   c. Use drawing instruments during sketching.
   d. For Part A and Part B, use the 2D or 3D drafting environment.
   e. For Part C, use the 3D environment for part and assembly drawings and extract 2D views from the assembly.
2. **Question Paper Pattern for CIE and SEE Examinations:** One question will be set from Part A and two questions each from Part B and Part C; students must compulsorily answer the Part A question (20 marks), and any one question each from Part B (20 marks) and Part C (60 marks).
3. **Grading CIE:**
   a. The total marks scored in the sketchbook and drafting work in the lab will be scaled down to 25 marks (50% of the maximum marks).
   b. The test, which is for 100 marks, will also be scaled down to 25 marks (50% of the maximum marks).
4. **Evaluation Scheme :**

| Particulars | Q. No. | CIE | | | SEE | | |
|---|---|---|---|---|---|---|---|
| | | Assignment/Test | | Total Marks | Sketching | Printout | Total Marks |
| | | Marks for Sketching | Marks for Computerization | | Marks for Sketching | Marks for Computerization | |
| **Part A** | **1** | 10 | 10 | 20 | 10 | 10 | 20 |
| **Part B** | **2a** | 10 | 10 | 20 | 10 | 10 | 20 |
| | **2b** | | | | | | |
| **Part C** | **3a** | -- | 60(40 for 3D assembly +10 front View assembly +10 side view or top view assembly) | 60 | -- | 60(40 for 3D assembly +10 front View assembly +10 side view or top view assembly) | 60 |
| | **3b** | | | | | | |
| | | | **Total** | **100** | | **Total** | **100** |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Metrology and Measurements Lab (Branch: AE)** | | | | | |
| **Course Code** | : | 1BAEL307A | **Credit** | : | 1 |
| **Hours/Semester (L:T:P:SL)** | : | 0:0:28:02 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 30 | **SEE** | : | 50 Marks |
| **Course Type** | : | AEC | **SEE Duration** | : | 2 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Fundamentals of Physics<br>• Mathematics |
| **Knowledge on Fundamental Concepts** | Concept of angles, length, weight, force, Temperatures |
| **Knowledge on Connected Tools (If any)** | All measuring Instruments |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Gain basic Knowledge of metrology, its advancements & application of measuring instruments |
| **CLO2** | Learn different standards, calibration of measuring instruments and methods. |
| **CLO3** | Understand the measurement of Pressure, surface roughness Temperature and Strain |

| **Experiments** | |
|---|---|
| **Sl. No.** | **List of Experiments** |
| **1.** | Calibration of Pressure Gauge. |
| **2.** | Calibration of Thermocouple. |
| **3.** | Calibration of LVDT. |
| **4.** | Calibration of Load cell. |
| **5.** | Determination of modulus of elasticity of a mild steel specimen using strain gauges. |
| **6.** | Measurements using Profile Projector / Toolmaker Microscope. |
| **7.** | Measurement of angle using Sine Center / Sine bar / bevel protractor. |
| **8.** | Measurement of alignment using Autocollimator. |
| **9.** | Measurement of Screw threads Parameters using Two-wire or Three-wire method. |
| **10.** | Measurements of Surface roughness, Using Mechanical Comparator. |
| **11.** | Measurement of gear tooth profile using gear tooth vernier. |

| | |
|---|---|
| **12.** | Calibration of Micrometer using slip gauges. |
| **Open Ended Experiments** | |
| **1** | **Virtual Lab Experiments:** Measurement of Flow Using a Turbine Type Flow Meter for Exhaust Gas Flow Measurement. |
| **2** | Identify Suitable Accelerometer for an Application |
| **3** | Measurement of Flow Using a Rotameter for the Fuel Supply |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Apply calibration techniques to assess the accuracy and performance of measuring instruments. |
| **CO2** | Perform dimensional and geometrical measurements using advanced metrology tools. |
| **CO3** | Analyze material properties and engineering components through strain measurement, surface roughness evaluation. |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | | 1 | | 2 | 2 | 1 | 2 | 2 | 1 |
| **CO2** | 3 | 2 | 1 | 1 | | | 1 | 2 | 2 | 1 | 2 | 2 | 1 |
| **CO3** | 3 | 2 | 1 | 1 | 1 | | | 2 | 2 | 1 | 2 | 2 | 1 |

| Semester: IV | | | | | |
|---|---|---|---|---|---|
| **Computational Tools for Aircraft Performance Analysis (Branch: AE)** | | | | | |
| **Course Code** | : | 1BAEL307B | **Credit** | : | 1 |
| **Hours/Semester (L:T:P:SL)** | : | 0:0:28:02 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 30 | **SEE** | : | 50 Marks |
| **Course Type** | : | AEC | **SEE Duration** | : | 2 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Differential Calculus and Linear Algebra<br>• Introduction to Artificial intelligence |
| **Knowledge on Fundamental Concepts** | Matrices<br>Basic principles of aircraft |
| **Knowledge on Connected Tools (If any)** | Basic Computer Knowledge |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Learn fundamental MATLAB programming concepts for matrix operations, mathematical computations, and problem-solving. |
| **CLO2** | Implement numerical methods and iterative techniques for engineering applications using MATLAB. |
| **CLO3** | Visualize engineering and aerospace problems, including using MATLAB tools. |

| **Experiments** | |
|---|---|
| **Sl.No.** | **LIST OF EXPERIMENTS** |
| **1.** | Perform matrix addition, subtraction, and multiplication using built-in MATLAB functions and verify the properties of matrix operations. |
| **2.** | Compute determinant, inverse, and rank of matrices using MATLAB functions and analyze singular and non-singular matrices. |
| **3.** | Solve a system of linear equations using MATLAB (A\b method), verify the solution, and compare with the inverse method. |
| **4.** | Perform element-wise operations and scalar multiplication in MATLAB and compare them with standard matrix operations. |
| **5.** | Implement the trapezoidal rule using a for loop to compute the area under a curve and plot the results. |
| **6.** | Generate a multiplication table using nested loops and display the results in matrix and graphical formats. |
| **7.** | Implement the Newton–Raphson method for root finding, plot convergence behavior, and analyze error reduction. |
| **8.** | Compute and plot the variation of air density with altitude and compare with standard atmospheric conditions. |
| **9.** | Plot lift versus velocity and evaluate aircraft climb performance using excess power concepts. |
| **10.** | Read flight data from files, compute distance using numerical integration, determine rates using differentiation, and visualize results. |
| **11.** | Compute flight path using the Haversine formula, analyze aerodynamic data, and design P/PI/PID controllers to evaluate system response characteristics. |

| Open Ended Experiments | |
|---|---|
| **1** | Aircraft Take-Off Performance Analysis |
| **2** | Climb Performance Prediction Using MATLAB/Python |
| **3** | Aircraft Range and Endurance Estimation |
| **4** | Performance Analysis Under Different Atmospheric Conditions |
| **5** | Aircraft Drag Polar and Power Required Analysis |

| Course Outcomes: After completing the course, the students will be able to | |
|---|---|
| **CO1** | Apply mathematical equations to perform matrix operations, solve linear systems, using built-in functions. |
| **CO2** | Develop algorithms such as numerical integration, root finding, and iterative techniques using MATLAB. |
| **CO3** | Analyze engineering and aerospace problems using MATLAB tools and visualization techniques for various operating conditions. |

| Text Books | |
|---|---|
| **1** | MATLAB for Engineers, Holly Moore, 6th edition", Pearson Publications, 2023 Chapters:1,2,3,4,5 |
| **2** | Modelling & Simulation using MATLAB Simulink, Dr. Shailendra Jain, Wiley – India, 2021.Chapters:1,2,3,4,5 |

| Reference Books | |
|---|---|
| **1** | Applied Numerical Methods Using MATLAB, Won Y. Tang, Wemun Cao, Tae-Sang Ching and John Morris, A John Wiley & Sons, 2021 |
| **2** | MATLAB : An Introduction With Applications, Amos Gilat, John Wiley & Sons Publications, 2017 |

| Web links and Video Lectures ( e – Resources ) | |
|---|---|
| **1** | https://www.youtube.com/watch?v=OHxR8iMHDWw&list=PL7CAABC40B2825C8B&ab_channel=MATLAB |
| **2** | https://in.mathworks.com/learn/training/matlab-fundamentals-for-aerospace-applications.html |
| **3** | https://in.mathworks.com/matlabcentral/fileexchange/5657-matlab-7-fundamentos |
| **4** | https://matlabacademy.mathworks.com/details/solving-ordinary-differential-equations-with-matlab/odes |
| **5** | https://in.mathworks.com/help/matlab/numerical-integration-and-differential-equations.html?requestedDomain |
| **6** | https://www.mathworks.com/matlabcentral/answers/441561-newton-s-method-in-matlab |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 3 | | | 2 | 2 | | 2 | 3 | 2 |
| **CO2** | 3 | 2 | 2 | 2 | 3 | | | 2 | 2 | | 2 | 3 | 2 |
| **CO3** | 3 | 2 | 2 | 2 | 3 | | | 2 | 2 | | 2 | 3 | 2 |

| Semester: IV | | | | | |
|---|---|---|---|---|---|
| **Drone Development and Assembly (Branch: AE)** | | | | | |
| **Course Code** | : | 1BAEL307C | **Credit** | : | 1 |
| **Hours/Semester (L:T:P:SL)** | : | 0:0:28:02 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 30 | **SEE** | : | 50 Marks |
| **Course Type** | : | AEC | **SEE Duration** | : | 2 Hours |

| **Prerequisites:** | |
|---|---|
| **Courses** | • Elements of Aeronautical Engineering. |
| **Knowledge on Fundamental Concepts** | Basics of Aerodynamics, Aircraft Structures & Materials, Angle of attack, Lift, drag, force acting on aircraft, Electrical and Electronic Fundamentals |
| **Knowledge on Connected Tools (If any)** | Basic programming (Python) |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand the construction, components, and working principles of drones and their subsystems. |
| **CLO2** | Develop hands-on skills in assembling, integrating, and configuring drone subsystems. |
| **CLO3** | Analyze drone performance through testing, calibration, and flight operations. |

| **Experiments** | |
|---|---|
| **Sl.No.** | **LIST OF EXPERIMENTS** |
| **1.** | Study the construction, types, and working principles of drone components such as frame, motors, propellers, ESC, and flight controller. |
| **2.** | Assemble the drone frame and mount motors securely following standard assembly procedures. |
| **3.** | Connect and calibrate ESCs with brushless motors and analyze their operation. |
| **4.** | Interface and configure the flight controller using appropriate software and firmware. |
| **5.** | Design and connect the power distribution board, battery, and voltage regulators safely. |
| **6.** | Integrate sensors such as accelerometer, gyroscope, and magnetometer, and perform calibration. |
| **7.** | Bind and configure the transmitter and receiver for communication and control. |
| **8.** | Select appropriate propellers based on specifications and mount them ensuring correct orientation and safety. |
| **9.** | Perform initial flight testing in manual/stabilized mode and observe drone behavior. |
| **10.** | Configure basic autonomous flight modes such as altitude hold and waypoint navigation. |

| | |
|---|---|
| **11.** | Integrate GPS module, acquire satellite data, and test navigation capabilities. |
| **12** | Identify common faults, perform troubleshooting, and evaluate drone performance parameters such as stability, flight time, and control response. |

| **Open Ended Experiments** | |
|---|---|
| **1** | Aircraft Take-Off Performance Analysis |
| **2** | Climb Performance Prediction Using MATLAB/Python |
| **3** | Aircraft Range and Endurance Estimation |
| **4** | Performance Analysis Under Different Atmospheric Conditions |
| **5** | Aircraft Drag Polar and Power Required Analysis |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Apply knowledge of drone components and systems to assemble and configure a functional unmanned aerial vehicle. |
| **CO2** | Integrate and calibrate sensors, control systems, and communication modules for stable drone operation. |
| **CO3** | Analyze flight performance, troubleshoot system issues, and evaluate drone stability, control, and navigation. |

| **Text Books** | |
|---|---|
| **1** | Small Unmanned Aircraft: Theory and Practice, Randal W. Beard and Timothy W. McLain, Princeton University Press, 2012. Chapters:1,2,3,4,5 |
| **2** | Unmanned Aerial Vehicle Design and Technology, T. Hikmet Karakoc and Emre Özbek, Springer, 2024. Chapters:1,2,3,4,5 |

| **Reference Books** | |
|---|---|
| **1** | Small Unmanned Aircraft: Theory and Practice, Randal W. Beard and Timothy W. McLain, Princeton University Press, 2012. |
| **2** | Introduction to UAV Systems, Paul G. Fahlstrom and Thomas J. Gleason, 4th ed., Wiley, 2012. |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://www.riis.com/blog/introduction-to-ardupilot?utm_source=chatgpt.com |
| **2** | https://ardupilot.org/dev/docs/droneapitutorial.html?utm_source=chatgpt.com |
| **3** | https://www.instructables.com/Step-by-step-Guidance-to-Build-a-Drone-From-Scratc/?utm_source=chatgpt.com |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | | | | 2 | 2 | 2 | 2 | 3 | 2 |
| **CO2** | 3 | 2 | 2 | 2 | | | | 2 | 2 | 2 | 2 | 3 | 2 |
| **CO3** | 3 | 2 | 2 | 2 | 3 | | | 2 | 2 | 2 | 2 | 3 | 2 |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **Community Project** | | | | | |
| **Course Code** | : | 1BCP308 | **Credit** | : | 1 |
| **Hours/Semester(L:T:P:SL)** | : | 0:0:0:30 | **CIE** | : | 50 Marks |
| **Total Hours** | : | 30 | **SEE** | : | 50 Marks |
| **Course Type** | : | SDC | **SEE Duration** | : | 2 Hours |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Foster civic engagement and social responsibility by immersing students in communities to identify societal, welfare, and sustainability challenges. |
| **CLO2** | Apply engineering principles and interdisciplinary thinking to analyze community problems and design practical solutions. |
| **CLO3** | Develop professional skills in teamwork, project management, and effective communication with diverse community stake holders. |
| **CLO4** | Instill an understanding of sustainable development, engineering ethics, and the long-term socio-economic impacts of technical interventions. |
| **CLO5** | To cultivate ethical engineering practices and an appreciation for sustainable development by analyzing the long-term impacts of technology on society. |

**Restrictions and professional conduct:**

Community / Societal Projects shall remain academic, socially responsible, technically focused, and politically neutral. Students and faculty shall maintain professionalism, ethical conduct, public respect and institutional integrity while interacting with communities, public groups, organizations and stakeholders.

Students and faculty shall avoid the following during project execution:

- Association with political party activities, campaigns or propaganda.
- Participation in activities that may disturb communal harmony, public order or institutional reputation.
- Use of the project platform for personal, political, ideological or commercial promotion.
- Disrespectful, discriminatory or unethical interaction with community members or stakeholders.

Projects must also recognize constraints related to cost, resources, environment and safety, and stakeholder behavior/cooperation/acceptance when planning and implementing activities.

**SET OF PROJECT ACTIVITIES (TW/SL= 30 HOURS)**

**Methods for project identification:**

Students may identify the project topic using one or more of the following methods:

- Interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.
- Review of issues highlighted in print and electronic media, and social networks (Whats App, Face book, X, Instagram, etc.).
- After selecting a broad topic, students shall collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and then define

the problem statement and objectives clearly.

**List of Project Topics and Engineering Outcomes:**

The following structured sequence of activities is to be carried out during the semester:

| Sl. No. | Project title | Measurable engineering outcome | Mapped POs | SDGs |
|---|---|---|---|---|
| 1 | Rural and urban water conservation and management systems | Prepare a site-specific water-saving plan, estimate water demand–supply gap, and propose a feasible conservation intervention with quantified savings. | PO1, PO2, PO3, PO4, PO10, PO11 | SDG 6, SDG 11, SDG 12 |
| 2 | Waste management and recycling | Conduct waste audit, classify waste streams, and designa segregation/recycling workflow with measurable reduction in mixed waste. | PO2, PO3, PO4, PO6, PO8, PO10 | SDG 11, SDG 12, SDG 13 |
| 3 | Afforestation | Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings. | PO2, PO3, PO4, PO6, PO7, PO11 | SDG 11, SDG 13, SDG 15 |
| 4 | Biogas generation and power generation | Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield. | PO1, PO2, PO3, PO4, PO5, PO10 | SDG 7, SDG 11, SDG 12 |
| 5 | DPR for solar power rural plant | Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback. | PO1, PO2, PO3, PO4, PO5, PO10 | SDG 7, SDG 9, SDG 11 |
| 6 | DPR for electrification of village/tribal community | Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost. | PO1, PO2, PO3, PO4, PO10, PO11 | SDG 7, SDG 9, SDG 10 |
| 7 | DPR for rural drainage system | Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction. | PO1, PO2, PO3, PO4, PO6, PO10 | SDG 6, SDG 9, SDG 11 |
| 8 | Sustainability and environmental health projects | Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use. | PO2, PO3, PO4, PO6, PO7, PO8 | SDG 3, SDG 6, SDG 11, SDG 12 |

| | | | | |
|---|---|---|---|---|
| 9 | Plastic free campaigns | Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change. | PO2, PO3, PO6, PO7, PO8, PO10 | SDG 11, SDG 12, SDG 13 |
| 10 | Health and nutrition awareness | Conduct baseline and post-program awareness survey and document improvement in awareness score or | PO2, PO6, PO7, PO8, PO9, PO10 | SDG 2, SDG 3, SDG 11 |
| 11 | Societal projects involving health wellness | Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes. | PO2, PO3, PO6, PO8, PO9, PO10 | SDG 3, SDG 11, SDG 17 |
| 12 | Air quality monitoring system | Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions. | PO2, PO3, PO4, PO5, PO6, PO10 | SDG 3, SDG 11, SDG 13 |
| 13 | Plastic waste reduction campaign | Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering. | PO2, PO3, PO6, PO7, PO8, PO10 | SDG 11, SDG 12, SDG 13 |
| 14 | Urban greening projects | Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation. | PO2, PO3, PO4, PO6, PO7, PO11 | SDG 11, SDG 13, SDG 15 |
| 15 | Smart agriculture solution | Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support. | PO1, PO2, PO3, PO4, PO5, PO10 | SDG 2, SDG 6, SDG 9 |
| 16 | Smart irrigation system | Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation. | PO1, PO2, PO3, PO4, PO5, PO10 | SDG 2, SDG 6, SDG 12 |
| 17 | Youth mentoring | Deliver a structured mentoring activity and measure participation, | PO6, PO8, | SDG 4, SDG 10, |

| | | | | |
|---|---|---|---|---|
| | programmes | engagement, and skill/awareness improvement. | PO9, PO10, PO11 | SDG 17 |
| 18 | Adult education | Conduct learner-needs assessment, prepare instructional content, and measure improvement in basic literacy or numeracy indicators. | PO6, PO8, PO9, PO10, PO11 | SDG 4, SDG 10, SDG 17 |
| 19 | Food security initiatives / cold storage system | Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage. | PO1, PO2, PO3, PO4, PO5, PO10 | SDG 2, SDG 9, SDG 12 |
| 20 | Human rights awareness with legal systems | Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding. | PO6, PO7, PO8, PO9, PO10 | SDG 5, SDG 10, SDG 16 |
| 21 | House tax collection through digital media | Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time. | PO2, PO3, PO4, PO5, PO10, PO11 | SDG 9, SDG 11, SDG 16 |
| 22 | Use of application / application program | Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement. | PO1, PO3, PO4, PO5, PO9, PO10 | SDG 9, SDG 11, SDG 17 |
| 23 | Creation of Panchayat library | Plan the library model, catalogue resources, and measure usage, accessibility, or participation outcomes. | PO6, PO8, PO9, PO10, PO11 | SDG 4, SDG 10, SDG 11, SDG 17 |

**Suggested Learning Resources:**

**Textbooks:**


1. Phadke, N. D. Community Engagement and Social Innovation. 1st ed., Oxford University Press, New Delhi.
2. Garg, N. R. Project-Based Learning in Engineering Education. 1st ed., Pearson India Education Services, Noida.
3. Gupta, A. and P. Singh. Service Learning and Community Projects. 1st ed., McGraw-Hill Education (India), New Delhi.
4. Wilson, G. Practical Guide to Community Development Projects. 2nd ed., Routledge, London.


**Reference books:**


1. NPTEL courses on Project-Based Learning and Social Innovation.

2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: https://sdgs.un.org
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.

NGO and government field-action case studies related to sanitation, water, health, education, and environment.

**Web links and Video Lectures(e-Resources):**

1. NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
2. NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
3. Virtual Labs – Geotechnical Engineering Virtual Lab (IIT Kanpur): https://vlab.co.in
4. Geological Survey of India (GSI) – Maps, reports, and publications: https://www.gsi.gov.in
5. YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
6. American Society of Civil Engineers (ASCE) – Geotechnical resources and standards

**Teaching Learning Process:**

The suggested TLP for Community / Societal Project is as follows:

| Week | Teaching–Learning Activity | Faculty Role | Student Activity | Output / Evidence |
|---|---|---|---|---|
| 1 | Course introduction, objectives, ethics, conduct, and assessment briefing | Explain course scope, rules, rubrics, and expected deliverables | Understand course requirements and form teams | Team list, course plan |
| 2 | Community problem identification and topic selection | Guide topic framing and feasibility | Identify local issues through discussion and observation | Shortlisted project topic |
| 3 | Stakeholder interaction and preliminary survey | Demonstrate survey methods and stakeholder engagement | Collect initial data from community/users | Survey notes, interview record |
| 4 | Problem statement and objective formulation | Review and refine problem statement | Prepare problem statement, scope, and objectives | Approved problem statement |
| 5 | Literature/case study review and baseline analysis | Suggest relevant references and examples | Study existing solutions and compare approaches | Baseline analysis summary |
| 6 | Project planning | Help teams organize tasks, | Plan activities, divide roles, and | Work plan / |

| | | | | |
|---|---|---|---|---|
| | and role assignment | timeline, and responsibilities | prepare schedule | Gantt chart |
| 7 | Feasibility analysis and solution brainstorming | Check technical feasibility and practicality | Generate possible engineering solutions | Solution alternatives sheet |
| 8 | Selection of final solution and design approach | Review final concept and design logic | Finalize concept, methods, and expected outcome | Concept note / design outline |
| 9 | Data processing / calculations / sizing / mapping | Support computations and technical review | Analyze data, perform calculations, prepare maps/charts | Technical analysis sheet |
| 10 | Prototype / model / audit / DPR / app development | Monitor progress and correct technical issues | Develop the selected output | Working model / draft DPR / map / app |
| 11 | Testing, refinement, and implementation planning | Evaluate technical correctness and improvements | Test prototype or validate proposal with users | Test results / revised output |
| 12 | Field implementation / demonstration / awareness activity | Facilitate community interaction and documentation | Conduct implementation or demonstration | Photos, attendance, implementation record |
| 13 | Documentation of outcomes, feedback, and impact | Review report structure and completeness | Compile findings, stakeholder feedback, and observations | Draft report |
| 14 | Presentation preparation and viva practice | Conduct mock presentation and feedback | Prepare slides/poster and rehearse | Presentation deck |
| 15 | Final presentation, submission, and reflection | Evaluate performance using rubrics | Present project, submit report, reflect on learning | Final report, presentation, viva |

**Assessment structure:**

**A. Continuous Internal Evaluation( CIE)– 50marks**

- Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totaling 50 marks:

**CIE pass requirement:**

- A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible

to appear for SEE.

- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

**B. Semester End Examination(SEE)– 100 marks (scaled to 50)**

- Examination duration: 2 hours.
- Maximum examination marks: 100 scaled to 50
- The SEE shall be conducted batch-wise by two examiners, one faculty from the same department and one from a different department appointed by the Principal.

**SEE pass requirement and overall passing rule:**

- For a pass in SEE, a student shall secure minimum 35 marks out of 100.
- For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40; otherwise, the student is awarded grade F (Fail).

**CIE Rubric— Continuous Internal Evaluation (Total 50 marks):**

| Criterion | Weight (marks) | Excellent (Full marks) | Good | Fair | Needs Improvement |
|---|---|---|---|---|---|
| Problem identification & Relevance to society/industry/ community | 8 | Problem is clearly identified with strong evidence of societal relevance and well-defined scope. | Problem is Relevant and scope is clear with adequate supporting evidence. | Problem defined but justification or evidence is weak. | Problem unclear or not relevant; little/no supporting evidence. |
| Formation of problem statement; Engineering approach, innovation & feasibility | 10 | Problem statement is precise; approach is sound, innovative and clearly feasible. | Problem statement adequate; approach feasible with minor gaps. | Problem statement partial; approach feasibility is marginal. | Problem statement missing or approach not feasible. |
| Interaction with stakeholders; Data collection, analysis & interpretation | 8 | Thorough stakeholder engagement; data collection is comprehensive; analysis is well-interpreted | Good engagement; data and analysis adequate with minor gaps. | Limited engagement; data incomplete and analysis superficial. | Little/no stakeholder contact; insufficient or no data/ analysis. |
| Project documentation; Clarity, organization & problem-solving demonstrated | 10 | Documentation is complete, well-organized, analytical, and shows strong problem-solving | Documentation complete and clear with some analytical content. | Documentation on basic with omissions; problem-solving limited. | Documentation missing/poorly organized; no clear problem-solving. |
| Communication | 6 | Presentation is confident, structured, and answers | Presentation clear and satisfactory; responds to | Presentation acceptable but lacks clarity or | Presentation poor or absent; unable to |

| | | | | | |
|---|---|---|---|---|---|
| & Presentation skills | | queries fully; visuals effective. | most queries. | confidence; weak responses. | respond. |
| Contribution & Benefit to society (impact, sustainability) | 8 | Clear, demonstrable societal benefit and sustainability; realistic path to implementation. | Benefit plausible; sustainability considered with minor gaps. | Limited or unclear societal benefit; sustainability not well addressed. | No evident benefit or sustainability ; project not community-oriented. |

**SEE Rubric — Semester End Examination (Will be conducted for 100 marks; later scaled to 50 marks):**

| Criterion | Weight (marks) | Excellent (Full marks) | Good | Fair | Needs Improvement |
|---|---|---|---|---|---|
| Problem identification& Relevance to society/industry/ community | 16 | Problem and relevance are articulated clearly with strong evidence and context. | Problem relevance clear with reasonable evidence. | Problem stated but evidence/ context weak. | Problem poorly defined or irrelevant. |
| Formation of problem statement; Engineering approach, innovation& feasibility | 20 | Problem statement is precise; approach demonstrates engineering depth, novelty and feasibility. | Approach is technically sound and Feasible with minor limitations. | Approach basic; limited technical depth or feasibility concerns. | No viable engineering approach or infeasible plan. |
| Interaction with stake holders; Data collection, analysis& interpretation | 16 | Excellent stakeholder engagement; rigorous data collection and insightful analysis. | Good engagement and acceptable analysis. | Superficial data collection and limited analysis. | Inadequate or no data; poor analysis. |
| Project documentation; Clarity, technical rigor & problem-solving demonstrated | 20 | Report is comprehensive technically rigorous, and demonstrates systematic problem- solving. | Report is complete and technically correct with minor gaps. | Report lacks technical depth or has notable omissions. | Report missing key elements or technically incorrect. |
| Communication , Presentation & Viva-voce responses | 12 | Candidate presents expertly, defends work persuasively and answers all queries correctly. | Good presentation and satisfactory answers to most queries. | Presentation adequate but fails to Answer some technical questions. | Poor presentation and unable to defend work. |
| | | Clear, evidence- | Reasonable | | |

| | | | | | |
|---|---|---|---|---|---|
| Contribution & Benefit to society; Impact assessment & sustainability | 16 | based assessment of social impact and Sustainability with scaling recommendations | impact discussion and sustainability considerations. | Limited evaluation of impact or sustainability. | No coherent assessment of impact or sustainability |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Investigate a community to identify unmet needs, sustainability gaps, or technical challenges using structured empathy, observations, and interviews. |
| **CO2** | Design a practical, engineering-based solution that directly addresses the identified community issue. |
| **CO3** | Apply engineering concepts and project management principles to execute and deploy the designed solution within community constraints. |
| **CO4** | Assess the social, environmental, ethical, and economic impacts of the project to ensure sustainable development and community welfare. |
| **CO5** | Function effectively individually or in a team, and communicate project progress and outcomes clearly to technical evaluators and community members. |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | | | | 3 | | | | | | 3 | 1 |
| **CO2** | 3 | | 3 | | 2 | 2 | | | | | | 3 | 1 |
| **CO3** | 3 | | | 2 | 2 | | | | | 3 | | 3 | 1 |
| **CO4** | | | | | | 3 | 3 | | | | 2 | 3 | 1 |
| **CO5** | | | | | | | | 3 | 3 | | 2 | 3 | 1 |

| **Semester: III** | | | | | |
|---|---|---|---|---|---|
| **National Service Scheme (Common to the Branches)** | | | | | |
| **Course Code** | **:** | 1BNS309 | **Credit** | **:** | 0 |
| **Hours/Semester (L:T:P:SL)** | **:** | 0:0:0:28 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 28 | **SEE** | **:** | - |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | - |

| **Prerequisites:** | |
|---|---|
| **Courses** | **---** |
| **Knowledge on Fundamental Concepts** | Basic understanding of social responsibility, environmental awareness, community welfare, sustainable development, ethics, teamwork, and communication skills. |
| **Knowledge on Connected Tools (If any)** | Basic use of smartphones, internet, digital communication tools (email, WhatsApp, Google Forms), presentation software (PowerPoint/Canva), video recording tools, and office productivity software (MS Word/Google Docs) for documentation and report preparation. |

| **CourseLearning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand the community, identify its needs and problems, and apply knowledge to develop practical and sustainable solutions for community development and welfare. |
| **CLO2** | Develop social and civic responsibility, leadership, teamwork, communication, and community participation skills through collaborative learning, extension activities, and community engagement. |
| **CLO3** | Demonstrate ethical values, democratic attitudes, responsible citizenship, and a commitment to social service while contributing effectively to community welfare and nation-building |

| **Activity– 1** | **10Hrs** |
|---|---|
| **Sustainable Rural Development** Organic Farming, Indian Agriculture, Sustainable Water Management, Agricultural Marketing | |
| **Activity – 2** | **09 Hrs** |
| **Environmental Sustainability and National Development** Waste Management, 5R's, Swachh Bharat, Digital India, Skill India, Atmanirbhar Bharat, Make in India, etc. | |
| **Activity – 3** | **09 Hrs** |
| **Community Outreach and Social Responsibility** Women's Information Club, Rural Awareness Programs, Social Connect and Responsibilities | |

| **Topics for Self learning** | |
|---|---|
| **Activity – 1** | Sustainable agriculture, organic farming, and water conservation practices. |
| | Digital marketing, e-NAM, and rural development strategies for farmers. |
| **Activity – 2** | Waste management, the 5R principles, and environmental conservation. |
| | Government flagship initiatives and the role of NSS volunteers in nation-building. |
| **Activity – 3** | Women empowerment, digital literacy, and community leadership. |

| | |
|---|---|
| | Rural outreach, public awareness campaigns, social responsibility, and volunteerism. |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution**

| Sl. No. | Topic | Group Size | Location | Activity Execution | Reporting | Evaluation of the Topic |
|---|---|---|---|---|---|---|
| **1.** | Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. | May be individual or team | Farmers land/Villages/ roadside / community area/ College campus etc..... | Site selection /proper consultation/Continuous monitoring/ Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| **2.** | Waste management– Public, Private and Govt organization, 5 R's. | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations /Government Schemes officers/ campus etc..... | Site selection /proper consultation/Continuous monitoring/ Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| **3.** | Setting of the information imparting club for women leading to contribution in social and economic issues. | May be individual al or team | Women empowerment groups/ Consulting NGOs & Govt. Teams / College campus etc..... | Group selection/pro per consultation/Continuous monitoring/ Information board | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |

**Plan of Action (Execution of Activities for 3rd Semester)**

| Sl. No. | Practice Session Description |
|---|---|
| **1.** | Lecture session by NSS Officer |
| **2.** | Selection of topic, Commencement of activity and its progress |
| **3.** | Execution of Activity |
| **4.** | Case study based Assessment, Individual performance |
| **5.** | Sector wise study and its consolidation |
| **6.** | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- In the 3rd semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 3rd semester, consolidated report of all activities compiled report should

| |
|---|
| be submitted as per the instructions. |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Demonstrate social responsibility by identifying and analyzing environmental and societal issues and proposing practical, sustainable solutions for community development. |
| **CO2** | Implement and evaluate government and community-driven initiatives to address societal challenges and promote community welfare. |
| **CO3** | Apply ethical values, teamwork, leadership, and civic responsibility while participating effectively in social service, community engagement, and nation-building activities. |

**Assessment Details for CIE (100 Marks)**

| **Weightage** | **CIE- 100 Marks** |
|---|---|
| Selection of Topic, Commencement of activity and its progress | **40 Marks** |
| Case study based Assessment | **20 Marks** |
| Sector wise study and its consolidation | **20 Marks** |
| Video based seminar for 10 minutes by each student at the end of semester with Report | **20 Marks** |
| Total Marks for the course in the semester | **100 Marks** |

| **Suggested Learning Resources:** | |
|---|---|
| **Books:** | |
| **1** | NSS Course Manual, Published by NSS Cell, VTU Belagavi. |
| **2** | Government of Karnataka, NSS cell, activities reports and its manual. |
| **3** | Government of India, NSS cell, Activities reports and its manual. |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | 3 | 2 | 2 | 1 | | 3 | 1 | |
| **CO2** | | | | | | 3 | 3 | 2 | 1 | | 3 | 1 | |
| **CO3** | | | | | | 3 | 3 | 3 | 3 | | 3 | 1 | |

| Semester: III | | | | | | |
|---|---|---|---|---|---|---|
| **Physical Education**<br>**Common to All Branches** | | | | | | |
| **Course Code** | : | 1BPE309 | | **Credits** | : | 0 |
| **Hours/Week(L:T:P:SL)** | : | 0:0:0:28 | | **CIE** | : | 100 Marks |
| **Total Hours** | : | 28 | | **SEE** | : | - |
| **Course Type** | : | NCMC | | **SEE Duration** | : | - |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Develop awareness about personal health, wellness, and the importance of an active lifestyle through pre-fitness evaluation and orientation. |
| **CLO2** | Improve general physical fitness through structured training in strength, speed, and warm-up exercises. |
| **CLO3** | Acquire sport-specific skills and techniques in traditional games such as Kabaddi or Kho-Kho through practical sessions. |

| **Module – 1** | **4 Hrs** |
|---|---|
| **Orientation**<br>A. Lifestyle.<br>B. Health & Wellness.<br>C. Pre-Fitness test. | |
| **Module – 2** | **4 Hrs** |
| **General Fitness & Components of Fitness**<br>A. Warming up (Free Hand exercises).<br>B. Strength – Push-up / Pull-ups.<br>C. Speed – 30 Mtr Dash. | |
| **Module-3** | **16 Hrs** |
| **Specific games (Any one to be selected by the student)**<br>A. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.<br>B. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. | |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | Healthy lifestyle practices, balanced nutrition, sleep and stress management, and awareness of personal health and wellness. |
| **Module – 2** | Components of physical fitness, principles of fitness training, benefits of regular exercise, and methods for monitoring personal fitness levels. |
| **Module – 3** | Rules and regulations of Kabaddi and Kho-Kho, history and development of indigenous sports, basic game strategies, sportsmanship, teamwork, and prevention of common sports injuries. |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Describe the principles of physical education, health, nutrition, fitness and wellness for maintaining a healthy and active lifestyle. |
| **CO2** | Perform exercises, sports, yoga, and recreational activities to improve physical fitness, mental well-being, teamwork and sportsmanship. |
| **CO3** | Apply health, fitness, and wellness practices to promote lifelong well-being and develop foundational skills for sports and fitness careers. |

**Scheme and Assessment for auditing the course and Grades:**

| Sl.No. | Activity | Marks |
|---|---|---|
| 1. | Participation of student in all the modules. | 20 |
| 2. | Quizzes–2, each of 15marks. | 30 |
| 3. | Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students. | 50 |
| | **Total** | **100** |

**CO – PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | 3 | 2 | | | | 2 | 1 | |
| **CO2** | | | | | | 3 | 2 | 3 | 3 | | 2 | 1 | |
| **CO3** | | | | | | 3 | 3 | 2 | 2 | 2 | 3 | 1 | |

| **Semester: III** | | | | | |
|---|---|---|---|---|---|
| **Yoga** | | | | | |
| **Streams: CSE/ECE/CV/ME** | | | | | |
| **Course Code** | **:** | 1BYO309 | **Credit** | **:** | 0 |
| **Hours/Semester (L:T:P:SL)** | **:** | 0:0:0:28 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 28 | **SEE** | **:** | -- |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | -- |

| **Prerequisites:** | |
|---|---|
| **Courses** | **--** |
| **Knowledge on Fundamental Concepts** | • Basic understanding of physical fitness, health and personal hygiene.<br>• Awareness of body posture, breathing, and general wellness practices. |
| **Knowledge on Connected Tools (If any)** | **--** |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Explain the fundamental concepts, principles, and significance of Yoga for physical and mental well-being. |
| **CLO2** | Demonstrate Suryanamaskara and the fundamental techniques of selected Yogasanas by following proper procedures and precautions. |
| **CLO3** | Practice different categories of Yogasanas to promote flexibility, strength, balance, and overall wellness. |

| **Module - 1** | **04 Hrs** |
|---|---|
| **Introduction and Foundations of Yoga:** Introduction to Yoga: Origin, history, meaning, definitions, schools, aims and objectives of Yoga, Importance of prayer in Yoga practice, Foundations of Yogic Practice: Yogic practices for positive health, rules for practitioners, misconceptions about Yoga, and differences between yogic and non-yogic practices.<br>**T-1: Ch. 1** | |
| **Module - 2** | **05 Hrs** |
| **Suryanamaskara and Fundamentals of Asanas:** Suryanamaskara (Sun Salutation): Prayer, meaning, need, importance, benefits, 12-count structure, and practice of two rounds, Introduction to Asanas: Meaning, need, importance, classification, general techniques, precautionary measures, and benefits.<br>**T-1: Ch. 2, 3** | |
| **Module - 3** | **05 Hrs** |
| **Types and Practice of Asanas:** Sitting Asanas: Padmasana, Vajrasana, Standing Asanas: Vrikshasana, Trikonasana, Prone Lying Asanas: Bhujangasana, Shalabhasana, Supine Lying Asanas: Utthitadvipadasana, Ardhahalasana.<br>**T-1: Ch. 4** | |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | Different Schools of Yoga (Hatha, Raja, Karma, Bhakti, Jnana Yoga) and their applications |
| **Module – 2** | Scientific benefits of Suryanamaskara and Yoga for stress management and lifestyle disorders |
| **Module – 3** | Advanced Asanas, precautions, common mistakes, and role of Yoga in daily life. |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Summarize the philosophy, objectives, and health benefits of Yoga and yogic practices. |
| **CO2** | Demonstrate correct techniques while performing Suryanamaskara and selected Yogasanas safely. |
| **CO3** | Practice appropriate Yogasanas for improving physical fitness, mental concentration and healthy living. |

| **Text Book** | |
|---|---|
| 1 | The Illustrates Light on Yoga, BKS Iyengar, Element Publishers, ISBN-978-8172236069, 2005 |
| 2 | Light on Yoga,BKS Iyengar,Thorsons Publishers, ISBN:978-8172235017, 2006 |

| **Reference Books** | |
|---|---|
| 1 | Teaching Methods for Yogic practices by Dr. M L Gharote& Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245 |
| 2 | Yoga Instructor Course hand book published by SVYASA University, Bengaluru |
| 3 | Yogapravesha in Kannada by Ajitkumar |
| 4 | Yoga for Children –step by step – by Yamini Muthanna |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| 1 | https://www.youtube.com/playlist?list=PLzF4lOyPf_Z9yQ_Gphjh1wZ5fEhMg6hmP |
| 2 | https://www.youtube.com/playlist?list=PLOzRYVm0a65cCcY4qKX5MIyJxBt7hJgQY |
| 3 | https://youtu.be/KB-TYlgd1wE |
| 4 | https://youtu.be/aa-TG0Wg1Ls |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | 2 | 1 | | | | 2 | | |
| **CO2** | | | | | | 3 | 2 | 1 | | | 2 | | |
| **CO3** | | | | | | 3 | 2 | 2 | | | 3 | | |

| **Semester: III** | | | | | |
|---|---|---|---|---|---|
| **Music**<br>**Stream: CSE/ECE/ME/CV** | | | | | |
| **Course Code** | **:** | 1BMU309 | **Credit** | **:** | 0 |
| **Hours/Semester (L:T:P:SL)** | **:** | 0:0:0:28 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 28 | **SEE** | **:** | -- |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | -- |

| **Prerequisites:** | |
|---|---|
| **Courses** | Familiarity with school-level cultural or music activities is beneficial |
| **Knowledge on Fundamental Concepts** | Basic awareness of vocal music and musical instruments. |
| **Knowledge on Connected Tools (If any)** | Metronome or Tala application for rhythm practice.Audio playback device (mobile phone/laptop) for listening to compositions. |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Interpret the foundational concepts of Indian classical music |
| **CLO2** | Analyze the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems. |
| **CLO3** | Illustrate various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system |

| **Module – 1** | **05Hrs** |
|---|---|
| **Preamble:** Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition.<br>**T-1** V-1 Ch. 1-3 | |
| **Module – 2** | **05Hrs** |
| **Origin of the Indian Music:** Origin and Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. Notations of swara , tala and practice.<br>**T-1** V-1 Ch. 3-4 | |
| **Module – 3** | **04Hrs** |
| **Compositions:** Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System.<br>**T-2** Ch. 4-7 | |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | Evolution of Carnatic and Hindustani music – similarities and differences |
| | Role of music in Indian Culture, Yoga, and Meditation |
| **Module – 2** | Study of popular Carnatic ragas and their emotional significance |
| | Importance of Gamakas in Carnatic Music |
| **Module – 3** | Life cycle of a Carnatic concert and the sequence of musical compositions |
| | Identification and practice of different ragas |

| **Course Out comes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Comprehend the fundamental concepts to promote and develop Indian music |
| **CO2** | Analyse the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala |
| **CO3** | Apply the basic Carnatic compositions using standard notation. |

| **Text Books** | |
|---|---|
| **1** | South Indian Music – Vol. I to VI, Prof. P. Sambamoorthy, 2019thEdition,2021.The Indian Music Publishing House, Chennai,ASIN : B093Y3TL52<br>Chapters:1,2,3,4 |
| **2** | A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, 4th Edition ,2008,CBH Publications , ISBN 81 85 381 50<br>Chapters:4,5,6,7 |
| **3** | Karnataka Sangeetha Charitre, Dr. V. S. Sampathkumaracharya, Kannada University, Hampi |

| **Reference Books** | |
|---|---|
| **1** | History of South Indian (Carnatic) Music (From Vedic Times to the Present) , R Rangaramanujaayyangar ,2019 edition ,Vipanchi charitable trust publisher ISBN: 9788187723158. |
| **2** | Music of India, B. Chaitanya Deva, 2nd edition , 1995MunshiramManoharlal Publishers.ISBN-10 : 8121501954 |
| **3** | Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, 2013 Edition, Asian Educational Services |
| **Web links and Video Lectures ( e – Resources )** | |
| **1** | https://youtu.be/DZA_cSb0Zo8?si=55M6QAC2T8VqZN39 |
| **2** | https://www.youtube.com/live/RfM4lAJQgCc?si=xfK0b6exvkBujugr |
| **3** | https://youtu.be/DZA_cSb0Zo8?si=55M6QAC2T8VqZN39 |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | 1 | | 1 | | 1 | 1 | 1 | | 1 | | |
| **CO2** | 3 | | 3 | 1 | 2 | 1 | 2 | 1 | 1 | | 1 | | |
| **CO3** | 3 | | 3 | 1 | 2 | 1 | 2 | 1 | 1 | | 1 | | |

| Semester: III | | | | | |
|---|---|---|---|---|---|
| **National Cadet Corps – I ((Common to all Branches)** | | | | | |
| **Course Code** | **:** | 1BNC309 | **Credit** | **:** | 0 |
| **Hours/Semester (L:T:P:SL)** | **:** | 0:0:0:28 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 28 | **SEE** | **:** | -- |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | -- |

| **Prerequisites:** | |
|---|---|
| **Courses** | Nil |
| **Knowledge on Fundamental Concepts** | **-** |
| **Knowledge on Connected Tools (If any)** | **-** |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Understand the aim, organisation and philosophy of training of the NCC, and appreciate the importance of national integration |
| **CLO2** | Acquire general awareness of disaster management and civil affairs, and the cadet's role during emergencies |
| **CLO3** | Gain general knowledge of social awareness, community development and the youth's role in nation building |

| **Module – 1** | **05 Hrs** |
|---|---|
| **The NCC and National Integration – General Awareness:** The NCC: Aims and Objectives of NCC; Organisation, Training and NCC Song; Incentives for NCC Cadets. National Integration: Religions, Culture, Traditions and Customs of India; Importance and Necessity of National Integration. Freedom Struggle and Nationalist Movement in India; National Interests, Objectives, Threats and Opportunities. Problems/Challenges of National Integration; Unity in Diversity; National Integration Council; Contribution of Youth in Nation Building. | |
| **Module – 2** | **05 Hrs** |
| **Disaster Management and Civil Affairs – General Awareness**: Civil Defence Organisation and the National Disaster Management Authority (NDMA); Types of Emergencies/Natural Disasters. Fire Services and Fire Fighting (general awareness); Essential Services and their Maintenance during a disaster. Assistance during Natural/Other Calamities (Flood /Cyclone /Earthquake /Accident); Setting up of Relief Camps. Collection and Distribution of Aid Material during Disaster Management. | |
| **Module – 3** | **04 Hrs** |
| **Social Awareness and Community Development – General Awareness**: Basics of Social Service and its Need; Rural Development Programmes (MGNREGA, SGSY, NSAP, etc.); Role and Contribution of NGOs. Contribution of Youth towards Social Welfare; Civic Responsibilities; Family Planning (general awareness). Causes and Prevention of HIV/AIDS and Role of Youth; Counter Terrorism (general awareness); Corruption. Social Evils – Female Foeticide, Dowry, Child Abuse/Trafficking; Right to Information (RTI) and Right to Education (RTE). | |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | Reading on the aims/objectives and organization of NCC from the Cadet's Handbook; a short note on any one national integration theme (e.g., Unity in Diversity) |
| **Module – 2** | Case-note on a recent natural disaster and the civil administration's/NDMA's response; awareness reading on relief-camp organization |
| **Module – 3** | Short write-up on one rural development programme (e.g., MGNREGA); awareness reading on RTI/RTE provisions |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Explain the aim, organization and philosophy of training of the NCC and describe the importance of national integration |
| **CO2** | Describe the role of civil defence, NDMA and the cadet during disaster management and relief operations |
| **CO3** | Explain the elements of social awareness, community development programmes and the youth's civic responsibilities |

| **Text Books** | |
|---|---|
| **1** | Cadet's Handbook – Common Subjects (SD/SW), Directorate General NCC, Ministry of Defence, Government of India, Edition dated 06 May 2013 (or latest edition). |
| **2** | NCC Handbook for 'A', 'B' and 'C' Certificate Examinations, Upkar Prakashan, Latest Edition. |

| **Reference Books** | |
|---|---|
| **1** | NCC General Knowledge and Current Affairs, Arihant Publications, Latest Edition. |
| **2** | National Disaster Management Authority (NDMA) – guidelines and awareness publications, Latest Edition. |
| **3** | NCC Directorate/Group HQ training literature and circulars, as issued from time to time. |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | Directorate General National Cadet Corps – https://www.nccindia.gov.in/ |
| **2** | National Disaster Management Authority – https://ndma.gov.in |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | 3 | | 2 | 2 | | | 2 | 1 |
| **CO2** | | | | | | 3 | 2 | 2 | | | | 2 | 1 |
| **CO3** | | | | | | 3 | | 2 | 2 | | | 2 | 1 |

| **Semester: III** | | | | | | |
|---|---|---|---|---|---|---|
| **Competency Enhancement Course-1**<br>**Stream: CSE/ECE/ME/CV** | | | | | | |
| **Course Code** | **:** | 1BCE310 | | **Credits** | **:** | 0 |
| **Hours/Week(L:T:P:SL)** | **:** | 14:0:0:14 | | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 28 | | **SEE** | **:** | - |
| **Course Type** | **:** | NCMC | | **SEE Duration** | **:** | - |

| **Prerequisites:** | |
|---|---|
| **Courses** | Fundamentals of Mathematics & English |
| **Knowledge on Fundamental Concepts** | Arithmetic operations, fractions, decimals, and elementary algebra. comprehension of basic English |
| **Knowledge on Connected Tools (If any)** | **---** |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Gain a strong foundation in aptitude skills such as number systems, percentages, ratio & proportion, and interest calculations to improve quantitative reasoning and problem-solving efficiency. |
| **CLO2** | Apply Vedic Mathematics techniques and shortcuts for rapid mental calculations, leading to increased accuracy and speed in aptitude-based assessments. |
| **CLO3** | Master logical reasoning topics like syllogisms, blood relations, puzzles and seating arrangements to develop structured thinking and effective decision-making skills. |
| **CLO4** | Understand and solve problems involving coding-decoding, visual sequences, clocks, calendars and analogies to enhance pattern recognition and reasoning speed. |
| **CLO5** | Utilize aptitude and reasoning skills to perform well in competitive exams, campus placements, and workplace situations, contributing to overall academic and professional success. |

| **Module – 1** | **6 Hrs** |
|---|---|
| **Introduction to Aptitude and Vedic Mathematics**<br>**Understanding Aptitude:** Overview of aptitude skills and their significance in problem-solving and decision-making. Types of aptitude skills commonly assessed in competitive exams and professional settings.<br>**Vedic Mathematics Techniques**: Introduction to Vedic Mathematics for faster and more efficient calculations. Key techniques and shortcuts to improve speed and accuracy in quantitative problems.<br>**Importance of Aptitude Skills:** The role of aptitude in career development and academic success. How strong aptitude skills enhance analytical thinking, logical reasoning, and performance in assessments.<br>**Number System:** Divisibility & Remainder, Multiples & Factors, Integers, LCM & HCF, Complete a number Series, Find the Missing Term and Wrong Term, Simplification, BODMAS Rule, Approximation, Decimals, Fractions, Surds & Indices<br>**Percentage:** Calculation-oriented basic percentage, Profit and Loss, Successive Selling type, Discount & MP, Dishonest Dealings<br>**T-1,C1-11** | |
| **Module – 2** | **6 Hrs** |
| **Coding Decoding:** Letter Coding, Number Coding, symbol coding Clocks and Calendar<br>**Reasoning -** Blood Relation, Sense of Direction, Arithmetic & Alphabet. Visual Sequence, Visual analogy and classification.<br>**Analytical Reasoning -** Single & Multiple comparisons, Linear Sequencing.<br>**T-3-C2,3,4,6,7,10,12** | |

| **Module-3** | **6 Hrs** |
|---|---|
| **Logical Aptitude -** Syllogism, Venn-diagram method, Three statement syllogism, Deductive and inductive reasoning. Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions.<br>**Linear Seating Arrangement**<br>Single or Double rows facing each other or away from each other in the same direction<br>**Circular Seating Arrangement**<br>Uni- & Bi-directional problems on Circular, Square, Rectangular, Hexagonal tables<br>**T2-C2,5. R-1- C1-3** | |
| **Module-4** | **6 Hrs** |
| **Ratio and Proportion:** Simple Ratios, Compound Ratios, Comprehend and Dividend, Direct & Indirect Proportions, Problems on ages, Mixtures & Allegation<br>**T-1,C12,13&16** | |
| **Module-5** | **6 Hrs** |
| **Partnerships Interest:** Simple Interest, Compound Interest, Mixed Interest, Installments.<br>**T-1,C14,15,17&29** | |

| **Topics for Self learning** | |
|---|---|
| **Module – 1** | Divisibility rules and digital root techniques, Advanced Vedic Mathematics shortcuts (multiplication, squaring, cube roots), Roman numerals and number patterns |
| | Applications of percentages in banking and business, Practice using online aptitude platforms (IndiaBIX, Testbook, etc.) |
| **Module – 2** | Coding-Decoding and Analytical Reasoning, Mirror and water images, Paper folding and paper cutting, Embedded figures and figure completion |
| | Ranking and ordering problems, Introduction to non-verbal reasoning puzzles |
| **Module – 3** | Family tree puzzles, Floor and flat-based puzzles, Scheduling and arrangement puzzles |
| | Statement–Conclusion and Cause–Effect reasoning, Critical reasoning questions from competitive examinations |
| **Module – 4** | Ratio and Proportion, Variation (Direct, Inverse and Joint Variation). Average and weighted average, Time and Work fundamentals |
| | Pipes and Cisterns (introductory concepts), Real-life applications of ratio and proportion in engineering and finance |
| **Module – 5** | Partnership and Interest, Banking concepts related to loans and EMIs, Compound annual growth rate (CAGR) |
| | Basics of financial literacy and investment, Recurring Deposits (RD) and Fixed Deposits (FD) calculations, Introduction to annuities and financial planning |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Solve numerical problems using Vedic Math and number systems to boost speed and accuracy. |
| **CO2** | Apply logical reasoning to puzzles, syllogisms, seating and classification problems. |
| **CO3** | Develop letter, number and symbol patterns and solve visual reasoning tasks. |
| **CO4** | Accurately solve problems on percentages, profit-loss, interest, ratios and partnerships. |
| **CO5** | Utilize aptitude and reasoning skills to excel in competitive exams and improve employability. |

| **Text Books** | |
|---|---|
| **1** | **Quantitative Aptitude for Competitive Examinations** by R.S. Aggarwal Chand Publishing.–2023. |
| **2** | **Vedic Mathematics** by Bharati Krishna Tirthaji(ISBN-978-8120801639),Sixteenth Reprint, Published by Motilal Banarsidass Publishers,- 1985 |

| | |
|---|---|
| **3** | **Logical and Analytical Reasoning** by A.K. Gupta (ISBN-978-9350127766), 39th Edition, Ramesh Publishing House - 2024 |

| **Reference Books** | |
|---|---|
| **1** | **Puzzle Test & Seating Arrangements** by K. Kundan (ISBN: 9789394666023),1st Edition, BSC Publishing Company Pvt Ltd. - 2023 |
| **2** | **Logical Reasoning and Data Interpretation for the CAT** by Nishit K. Sinha,(ISBN: 978-9353946616) 7th Edition, Pearson Education -2020 |

| **Web links and Video Lectures ( e – Resources )** | |
|---|---|
| **1** | https://www.youtube.com/watch?v=ZXcULvjpQlM |
| **2** | https://www.youtube.com/watch?v=ZXcULvjpQlM |
| **3** | https://www.youtube.com/watch?v=OHZ40sOT7mk |
| **4** | https://www.youtube.com/watch?v=9UtPPSX_vnk |
| **5** | https://www.youtube.com/watch?v=DIbjA3b21ow |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | | | | | | | | 2 | 1 |
| **CO2** | 3 | 3 | | | | | | | | | | 2 | 1 |
| **CO3** | 2 | 3 | | | | | | | | | | 2 | 1 |
| **CO4** | 3 | 2 | | | | | | | | | | 2 | 1 |
| **CO5** | 2 | 2 | | | 1 | | | | 2 | | 2 | 2 | 1 |

| **Semester: III** | | | | | |
|---|---|---|---|---|---|
| **Additional Mathematics-I (For Lateral Entry Students of all the Branches)** | | | | | |
| **Course Code** | **:** | 1BMATDIP311 | **Credits** | **:** | 0 |
| **Hours/Semester (L:T:P:SL)** | **:** | 14:0:0:14 | **CIE** | **:** | 100 Marks |
| **Total Hours** | **:** | 28 | **SEE** | **:** | 0 |
| **Course Type** | **:** | NCMC | **SEE Duration** | **:** | - |

| **Prerequisites:** | |
|---|---|
| **Courses** | Basic Mathematics |
| **Knowledge on Fundamental Concepts** | Basic differentiation and integration |
| **Knowledge on Connected Tools (If any)** | Basic computer knowledge. |

| **Course Learning Objectives: This course will enable the students to** | |
|---|---|
| **CLO1** | Investigate the concepts of linear algebrato solve systems of linear equations and to determine eigenvalues and eigenvectors. |
| **CLO2** | Describe the vector differentiation and integration techniques to analyze scalar and vectorFields. |
| **CLO3** | Implement numerical techniques to solve algebraic and transcendental equations, performinterpolation using finite differences and compute numerical integration. |

| **Module – 1** | **05 Hrs.** |
|---|---|
| **Linear Algebra:** Introduction, Rank of a matrix by elementary row operations, Consistency of system of linear equations, Solution by Gauss Elimination method. Eigenvalues and eigenvectors of a square matrix. Problems. | |
| **Module – 2** | **05 Hrs.** |
| **Vector Differentiation:** Differentiation of vector functions. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems. | |
| **Module – 3** | **05 Hrs.** |
| **Numerical Methods-I:** Finite differences, Interpolation/extrapolation using Newton's Forward and Backward difference formulae (No derivation), Problems. Solution of polynomial and transcendental equations by Newton–Raphson and Regula–Falsi methods (no derivation), Problems. Numerical Integration: Simpson's 1/3rd rule and 3/8th rule, problems. | |

| **Topics for Self-learning** | |
|---|---|
| **Module – 1** | **Applications:** Analyze real-world problems such as traffic flow. |
| | **Self-study:** Inverse of a square matrix by Caley- Hamilton theorem. |
| **Module – 2** | **Applications**: Velocity and Acceleration in scalar and vector fields. |
| | **Self-Study:** Conservation of laws, Analysis of streamlines. |
| **Module – 3** | **Applications:** Area, Velocity and population. |
| | **Self-Study:** Bisection method, Lagrange's inverse Interpolation**.** |

| **Course Outcomes: After completing the course, the students will be able to** | |
|---|---|
| **CO1** | Solve the systems of linear equations, determine eigen values and eigenvectors and analyze real-world problems such as traffic flow. |
| **CO2** | Apply differentiation to solve the vector differentiation and integration techniques to analyze scalar and vector Fields. |
| **CO3** | Analyze the numerical techniques to solve algebraic and transcendental equations, perform interpolation using finite differences and compute numerical integration. |

| **Text Books** | |
|---|---|
| **1** | Higher Engineering Mathematics", B. S. Grewal,44thEdition, 2021, Khanna Publishers, ISBN:978-81-933284-9-1.<br>Chapter. 2, 28,8,29. |

| **Reference Books** | |
|---|---|
| **1** | Advanced Engineering Mathematics", Kreyszig, E., Kreyszig, H.&Norminton, E. J. (2025). 11th Edition, Wiley India Pvt. Ltd. ISBN: 9789373329949 |
| **2** | Higher Engineering Mathematics", Ramana, B. V. (2025). 1st Edition, McGraw Hill Education (India) Pvt. Ltd., ISBN: 9780070634190. |

**CO – PO MAPPING**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | | | | | | | | 1 |
| **CO2** | 3 | 3 | 3 | | | | | | | | 1 |
| **CO3** | 3 | 3 | 2 | | | | | | | | 1 |

| | **CSE Stream** | | **ECE Stream** | | **CIVIL Stream** | | **Mechanical Stream** | |
|---|---|---|---|---|---|---|---|---|
| | **PSO1** | **PSO2** | **PSO1** | **PSO2** | **PSO1** | **PSO2** | **PSO1** | **PSO2** |
| **CO1** | 1 | | | 1 | | 1 | 1 | 1 |
| **CO2** | 1 | | | 1 | | 1 | 1 | 1 |
| **CO3** | 1 | | | 1 | | 1 | 1 | 1 |

| **Web links and Video Lectures (e – Resources)** | |
|---|---|
| **1** | http://nptel.ac.in/courses.php?disciplineID=111 |
| **2** | http://www.class-central.com/subject/math(MOOCs) |
| **3** | http://academicearth.org/ |

## Institute Vision

**Preparing Competent Engineering and Management Professionals to Serve the Society**

## Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

## Department Vision

**Preparing Competent Aeronautical Engineers To Serve the Society**

## Department Mission

- Strengthening the Fundamental concepts in Aeronautical Engineering.
- Building Analytical ability among students with innovative problem-solving techniques.
- Training students in multidisciplinary research areas in collaboration with Industries embedding the culture of continuous learning.
- Imparting skillset in line with emerging industrial needs with leadership qualities
- Making students responsible citizens to serve society with ethics and values.


# SJC INSTITUTE OF TECHNOLOGY

**An Autonomous Institution under VTU from 2024-25**

**P.B. No.20, B.B Road,**

**Chikkaballapur - 562 101, Karnataka**