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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
Aerospace Engineering
(2025 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NAAC A+

QS I-GAUGE GOLD

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

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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
Post Box #20, B.B. Road, Chikkaballapur - 562 101, Karnataka
Estd.:1986

B.E. in Aerospace 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) and Question Paper Setting Board (PSB)	Teaching and Learning Scheme					Examination				Credits
					CI		LI	TW & SL	Total Hours per sem	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	SL						
1	ASC	1BMATM301	Applied and Computational Engineering Mathematics	Mathematics	42	28	0	50	120	3	50	50	100	4
2	IPCC	1BAS302	Aerothermodynamics	AS	42	0	28	50	120	3	50	50	100	4
3	IPCC	1BAS/AE 303	Fluid Mechanics	AS	42	0	28	50	120	3	50	50	100	4
4	PCC	1BAS304	Introduction to Space Technology	AS	42	0	0	48	90	3	50	50	100	3
5	PCC	1BAS305	Aerospace Materials and Metallurgy	AS	42	0	0	48	90	3	50	50	100	3
6	PCCL	1BASL306	Computer Aided Aerospace Drawing	AS	0	0	28	02	30	3	50	50	100	1
7	AEC	1BASL307x	**Ability Enhancement Course Laboratory****	AS	0	0	28	02	30	2	50	50	100	1
8	SDC	1BCP308	Community Project	Any Department/ Respective Engineering Dept.	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 Education Director										
		1BYO309	Yoga		Yoga Teacher										
		1BMU309	Music		Music Teacher										
		1BNC309	National Cadet Corps-1		NCC coordinator										
10	NCMC	1BCE310	Competency Enhancement Course-1	CDCAC		14	0	0	14	28	--	100	---	100	PP
11	NCMC	1BMATDIP311	Additional Mathematics – I	Maths Dept.		14	0	0	14	28	-	100	---	100	PP
Total												**700**	**400**	**1100**	**21**

Ability Enhancement Course (Laboratory) 1BASL307x

1BASL307A	Measurements and Instrumentation Lab	**1BASL307C**	GenAI Enabled Python Programming
1BASL307B	Spreadsheet for Engineers with VBA Basics	**1BASL307D**	Technical writing using LATEX

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	:	120	**SEE**	:	50 Marks
Course Type	:	PCC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Differential Calculus and linear algebra, 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	**10Hrs**
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	**10Hrs**
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	**10Hrs**
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	10Hrs
Fourier series and practical harmonic analysis: Fourier series expansion of functions Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: Half-range Fourier series. Practical harmonic analysis.	
Module – 5	**10Hrs**
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. **Self-Study:** Angle between regression lines.
Module – 2	**Applications:** Analyze the performance of the algorithms. **Self-Study**: Exponential distribution
Module – 3	**Applications:** Modeling mass-spring-damper systems, Transient response of Mechanical systems. **Self-Study**: Unit step function.
Module – 4	**Applications:** Aircraft autopilot sampling systems. **Self-Study**: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave
Module – 5	**Applications:** Vibration analysis (wave equation) – in structures like aircraft fuselage and turbine blades. **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, 45th Edition, 2023, Khanna Publishers, ISBN:978-81-933284-9-1. Ch 4: 4.1-7.4.1 & Ch 5: 5.1 - 5.4 Ch 21: 21.1 to 21.5, 21.7 to 21.12, 21.15. Ch 10: 10.2, 10.3, 10.5, 10.6, 10.7, 10.11. Ch 18: 18.1 to 18.4, 18.9.

2	Advanced Engineering Mathematics, E. Kreyszig, 11th Ed, 2026, John Wiley & Sons.ISBN-13 978-9373329949 Ch 4: 4.1 to 4.7, 4.9, 4.10, 4.13. Ch 5: 5.2 to 5.7, 5.9, 5.11, 5.12, 5.15. Ch 6: 6.6 to 6.9, 6.11, 6.12. Ch 11: 11.1 - 11.3.

Reference Books	
1	Higher Engineering Mathematics, B. V. Ramana, 11th Ed., 2017, McGraw-Hill Education ISBN 9780070634190
2	A Textbook of Engineering Mathematics, N.P Bali and Manish Goyal, 10th Ed, 2022, Laxmi Publications.ISBN-13: 978-9352743766

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**
CO1	3	3	2	1							1
CO2	3	3	2	1							1
CO3	3	3	2	1							1
CO4	3	3	2	1							1
CO5	3	3	2	1	1						1

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

Semester: III					
Fluid Mechanics **(Common to the Branches: AE & AS)**					
Course Code	:	1BAE302	**Credits**	:	4
Hours/Semester (L:T:P:SL)	:	42:0:28:50	**CIE**	:	50Marks
Total Hours	:	120	**SEE**	:	50Marks
Course Type	:	IPCC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Differential Calculus and Linear Algebra & Applied Physics.
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 to describe fluid motion using kinematics and conservation equations to various flow types.
CLO3	Apply Bernoulli's equation to fluid dynamics and create scaled models for engineering problems.
CLO4	Study the development of boundary layers and calculate 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	**08Hrs**
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. **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	**08Hrs**
Fluid Kinematics: Introduction, Conservation Equation, Differential form- Continuity equation, Navier's stokes equation and Energy equation, Continuity equation in Cartesian coordinates, Circulation and vorticity. 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. **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. **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. **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	Determination of the viscosity of the given lubricating oil using a Redwood viscometer.
	Determination of the viscosity of the given lubricating oil using a Torsion viscometer.
Module – 2	Determination of Coefficient of discharge of a given Pipe Flow using Venturi meter.
	Determination of Coefficient of discharge of a given Pipe Flow using Orifice meter.
Module – 3	Verification of Bernoulli's equation.
	Calibration of contracted Rectangular Notch and Determine the Coefficient of Discharge.
	Calibration of contracted Triangular Notch and Determine the Coefficient of Discharge.
Module – 4	Determination of Major Head Loss Due to Friction in a Pipe.
	Determination of Minor Head Losses in Pipe Fittings.
	Boundary layer over a flat plate (Virtual Lab Experiment)
Module – 5	Impact of jet (Virtual Lab Experiment)
	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	Apply fluid properties like viscosity and determine pressure or stability for floating bodies using lab tools like viscometers.
CO2	Solve continuity equations for real-world piping and motion scenarios
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 calculate 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 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. 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 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		2					2	1	1	3	1
CO2	3	3	1									3	1
CO3	3	3	2	3					3	2		3	1
CO4	3	3	2	2			1			1	1	3	1
CO5	3	3	3	2	1					1		3	1

Semester: III						
Aero Thermodynamics						
Course Code	:	1BAS303		**Credits**	:	4
Hours/Semester (L:T:P:SL)	:	42:0:28:50		**CIE**	:	50 Marks
Total Hours	:	120		**SEE**	:	50 Marks
Course Type	:	PCC		**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Physics, chemistry and Mathematics
Knowledge on Fundamental Concepts	Energy, work, heat, temperature, and basic chemical principles
Knowledge on Connected Tools (If any)	--

Course Learning Objectives: This course will enable the students to	
CLO1	Understand various concepts and definitions of Basic of thermodynamics.
CLO2	Comprehend the I-law of thermodynamics
CLO3	Discuss II-law of thermodynamics and Interpret change in entropy
CLO4	Analyze the thermodynamic properties of pure substance
CLO5	Acquire the knowledge of various types of gas cycles.

Module – 1	**08Hrs**
Fundamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and Modules, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium. Zeroth law of thermodynamics, Numerical Problems **Work and Heat:** Mechanics-definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat. Numerical Problems	
Module – 2	**08Hrs**
First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat at constant pressure. Numerical Problems **Steady flow energy equation**: Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer. Numerical Problems	
Module – 3	**08Hrs**

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and Irreversible processes; factors that make a process irreversible, reversible heat engine, Carnot cycle, Carnot principles. Numerical Problems

Entropy: Clausius theorem, entropy a property of system, clausius inequality, principle of increase of entropy, change in entropy of ideal gas, Numerical Problems

Module – 4	**08Hrs**

Pure Substances: P-T and P-V diagrams, triple point and critical points. Sub- cooled liquid, Saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Numerical Problems

Module – 5	**08Hrs**

Gas Power Cycles: Efficiency of air standard cycles, Carnot, Otto, Diesel and Dual cycles, P-V & T-S diagram, calculation of efficiency. Comparison of Otto, Diesel and Dual cycle. Numerical Problems

Practical Component of IPCC	
Sl. No.	**Experiments**
1	Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Pensky Martin (closed) Apparatus.
2	Determination of Calorific value of solid, liquid and gaseous fuels..
3	Determination of Viscosity of lubricating oil using Redwood and Saybolt Viscometers.
4	Valve Timing diagram of an I.C. Engine.
5	Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP. Four stroke Diesel Engine
6	Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies, Volumetric efficiency, Mechanical efficiency, SFC, FP. Four stroke Petrol Engine
7	Determination of Thermal Conductivity of Metal Rod
8	Determination of Overall Heat Transfer Coefficient of a Composite wall.
9	Determination of Heat Transfer Coefficient in a Forced Convention Flow through a Pipe.
10	Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.

Topics for Self learning	
Module – 1	Eulerian and Lagrangian approaches in thermodynamics and fluid systems
	Applications of thermodynamics in aerospace, automotive, and power generation industries
Module – 2	Energy conservation and energy auditing in industries
	Real-life applications of the Steady Flow Energy Equation in turbines, compressors, and nozzles
Module – 3	Entropy generation and its significance in engineering systems
	Comparison of reversible and irreversible processes in practical devices
Module – 4	Applications of steam tables and Mollier (H–S) charts in power plants
	Critical point, triple point, and phase-change phenomena of pure substances
Module – 5	Performance comparison of Otto, Diesel, and Dual cycles in modern engines
	Alternative fuels (hydrogen, biofuels, CNG) and their impact on engine cycles

Course Outcomes: After completing the course, the students will be able to	
CO1	**Understand** and remember the basic concepts and definition of thermodynamics
CO2	**Empathize** the first law of thermodynamics, change in internal energy, enthalpy and work output.
CO3	**Apply** second law of thermodynamics to heat engine, heat pump and **interpret** change in entropy
CO4	**Analyze** the thermodynamic properties of pure substances
CO5	**Evaluate** the principles and power output of various gas power cycles

Text Books	
1	Basic and Applied Thermodynamics, P.K. Nag, 2nd Edition. 2002, Tata McGraw Hill Pub, ISBN-13: 978- 0070151314.
2	Basic Thermodynamics by M.K. Muralidhar, 6th edition,2017, Subhas stores, Bangalore, ISBN-13: 978-9383214181

Reference Books	
1	Fundamentals of Classical Thermodynamics, G.J.Van Wylen and R.E.Sonntag, 3rd Edition, 1986, Wiley Eastern, ISBN-13: 978-0-471-61075-5
2	Thermodynamics: An Engineering Approach, Yunus A.Cengal and Michael A.Boles, 8th Edition, 2016, Tata McGraw Hill publications, ISBN: 9780070495036

Web links and Video Lectures (e – Resources)	
1	https://archive.nptel.ac.in/courses/112/105/112105123/
2	https://archive.nptel.ac.in/courses/112/105/112105266/

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PSO2
CO1	3	3	2	2							2	3	1
CO2	3	3	2	2							2	3	2
CO3	3	2	3	3							2	3	2
CO4	3	2	2								2	3	2
CO5	2	2	3								2	3	2

Semester: III					
Introduction to Space Technology					
Course Code	:	1BAS304	**Credits**	:	3
Hours/Semester (L:T:P:SL)	:	42:0:0:48	**CIE**	:	50 Marks
Total Hours	:	90 Hrs	**SEE**	:	50 Marks
Course Type	:	PCC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Physics , Thermodynamics and Fluid Mechanics
Knowledge on Fundamental Concepts	Differential Calculus, vector algebra, Cartesian and polar coordinates, trigonometry
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamentals of aerospace propulsion.
CLO2	Understand the orbit mechanics and orbit maneuvers.
CLO3	Acquire the knowledge of satellite attitude dynamics and space mission operations.
CLO4	Explain the Yo-Yo design mechanism and its role in stabilizing spinning satellites.
CLO5	Describe ground segment architecture, including tracking stations and mission control centres.

Module – 1	**08 Hrs**
Introduction: Space Environment-The atmosphere, Light and spacecraft Temperature, Charged particle Motion, Magnetic Mirrors, The Van Allen Belts, Radiation Effects, Meteors, Meteorites .	
Module – 2	**08 Hrs**
Rocket Performance- Fundamentals of Aerospace Propulsion, Ideal Thrust Equation ,Tsiolkovsky Rocket equation, The Multistage Rockets , The Optimal Multistage Rockets ,The Sounding Rocket , Gravity -Turn Trajectories.	
Module – 3	**08 Hrs**
Re-entry Dynamics: Introduction- Ballistic Re-entry, Skip Re-entry, "Double-Dip" Re-entry, Aerobraking, Lifting-Body Reentry. **Fundamentals of Orbit Mechanics, Orbit Manoeuvre**: Two-body Problem, The Classical Orbital Elements, The Orbit Equation, Hohmann Transfer, Low-Thrust Orbit Transfer.	
Module – 4	**08 Hrs**
Satellite Attitude Dynamics: Attitude Control for Spinning Spacecraft, Attitude Control for Non-spinning Spacecraft, The Yo-Yo Mechanism, Gravity – Gradient Satellite.	

Module – 5	08 Hrs
Space Mission Operations: Supporting Ground Systems Architecture and Team interfaces, Mission phases and Core operations, Command, Planning, Tracking, Telemetry.	

Topics for Self learning	
Module – 1	Comparison between Aircraft Propulsion and Space Propulsion.
	Newtons Laws and their application in Propulsion.
Module – 2	Importance of Re-entry in space mission.
	Challenges during re-entry: Aerodynamic heating , Deceleration loads, Communication blackout , Structural stresses
Module – 3	Why Orbit Maneuvers are Needed , Applications of orbital mechanics in satellite mission.
	Types of Earth orbit (LEO, MEO, GEO, Polar ,Sun-Synchronous)
Module – 4	Attitude Control for spinning Spacecraft , Attitude control for Non spinning
	Principle of angular momentum conservation ,mathematical analysis of de-spinning
Module – 5	Roles and Responsibilities of Mission Operation Personnel , Human -machine interfaces in Mission Control.
	Ground System redundancy and reliability , Data processing and distribution systems.

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret and apply the Tsiolkovsky rocket equation and evaluate propulsion system performance
CO2	Analyse different atmospheric re-entry trajectories and their thermal and dynamic challenges.
CO3	Compute orbital parameters and design orbital maneuvers using two-body mechanics.
CO4	Compare attitude control techniques for spinning and non-spinning spacecraft
CO5	Describe space mission operations, including ground system architecture, mission phases, and core functions

Text Books	
1	Rocket Propulsion and Space Dynamics, J.W. Cornelisse, J.W. Freeman and Co., Ltd, London, 1982
2	Spaceflight Dynamics, W.E. Wiesel, McGraw Hill,2nd edition,2014, ISBN-13: 978-9332901650

Reference Books	
1	Fundamentals of Space Systems, Vincet L. Pisacane, Oxford University Press, 2005
2	Understanding Space: An Introduction to Astronautics, J. Sellers, McGraw Hill, 2nd Edition,2000, ISBN13: 978-0072424683
3	Introduction to Space Flight, Francis J Hale, Pearson, 1993, ISBN-13: 978-0134819129

Web links and Video Lectures (e – Resources)	
1	https://youtu.be/bLXDyNbkp08?si=CHwsYKew2eCDzVvL
2	https://www.youtube.com/watch?v=iLUjQAoZhPg&list=PL8f577zRCYcb_JRW1LPRt1uqjfGlrFqv8

CO – PO MAPPING

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

Semester: III					
Aerospace Materials and Metallurgy					
Course Code	:	1BAS305	**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	Engineering Chemistry, Engineering Physics, Basic Mechanical Engineering, Engineering Materials, Manufacturing Processes
Knowledge on Fundamental Concepts	Atomic structure and chemical bonding , Basic concepts of crystal structures and material properties AND Elementary understanding of metals, alloys, polymers, ceramics, and composites
Knowledge on Connected Tools (If any)	Basic use of Microsoft Excel for material property analysis and data representation and Familiarity with material selection charts and databases

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamental concepts of materials science, crystal structures, material properties, and their relevance to aerospace applications.
CLO2	Analyze the characteristics, processing methods, and applications of ferrous and non-ferrous alloys used in aerospace structures and propulsion systems.
CLO3	Evaluate composite materials, smart materials, and advanced aerospace materials for lightweight and high-performance engineering applications.
CLO4	Apply metallurgical principles, material characterization techniques, and non-destructive testing methods for assessing material quality and performance.
CLO5	Investigate material degradation and failure mechanisms such as fatigue, fracture, creep, and corrosion, and recommend suitable materials for aerospace engineering applications

Module 1: Introduction to Aerospace Materials	**08 Hrs**

Introduction to aerospace materials and their significance in aircraft and spacecraft structures, Classification of engineering materials: Metals, polymers, ceramics, composites, and smart materials, Selection criteria for aerospace materials: Strength-to-weight ratio, stiffness, corrosion resistance, thermal stability, fatigue resistance, and cost Structure of materials: Atomic structure, crystal structures (BCC, FCC, HCP) Imperfections in crystals: Point, line, and surface defects, Mechanical properties of materials: Strength, hardness, ductility, toughness, elasticity, plasticity, creep, and fatigue.

Module 2: Ferrous and Non-Ferrous Alloys	**08 Hrs**
Iron-carbon equilibrium diagram and its significance, Heat treatment of steels: Annealing, normalizing, hardening, tempering, and case hardening, Aerospace steels and their applications, Aluminum alloys: Series classification, properties, and aerospace applications, Magnesium alloys and titanium alloys: Characteristics and aerospace applications, Nickel-based super alloys for high-temperature aerospace components and Corrosion mechanisms and corrosion-resistant alloys.	
Module 3: Composite Materials and Advanced Materials	**08 Hrs**
Introduction to composite materials, Constituents of composites: Matrix and reinforcement, Classification of composites: Polymer Matrix Composites (PMC), Metal Matrix Composites (MMC), Ceramic Matrix Composites (CMC), Fiber-reinforced composites: Glass, carbon, aramid fibers, Manufacturing methods of composites: Hand lay-up, filament winding, pultrusion, resin transfer molding, Nanomaterials and nanocomposites and Smart materials: Shape Memory Alloys (SMA), piezoelectric materials, and their aerospace applications	
Module 4: Metallurgical Processes and Material Characterization	**08 Hrs**
Solidification of metals and alloys, Phase transformations and Time-Temperature-Transformation (TTT) diagrams, Powder metallurgy and additive manufacturing for aerospace components, Non-destructive testing (NDT): Ultrasonic, radiographic, eddy current, and dye penetrant testing, Material characterization techniques: Optical microscopy (OM), Scanning Electron Microscopy (SEM) , X-Ray Diffraction (XRD) and Energy Dispersive Spectroscopy (EDS)	
Module 5: Failure Analysis and Emerging Materials	**08 Hrs**
Failure mechanisms in aerospace structures, Fracture mechanics: Brittle and ductile fracture, Fatigue failure and fatigue life prediction, Creep and stress rupture at elevated temperatures, Corrosion and environmental degradation, Failure analysis techniques and case studies from aerospace industries Emerging materials: High-entropy alloys, Ultra-high-temperature ceramics (UHTCs). Graphene-based materials and Sustainable and recyclable aerospace materials.	

Topics for Self learning	
Module – 1	• Evolution of aerospace materials from wood to advanced composites • Material selection in modern aircraft and spacecraft
	• Applications of lightweight materials in aerospace industries • Recent developments in material science for aerospace engineering
Module – 2	• Advanced aluminum-lithium alloys for aircraft structures • Titanium alloy applications in modern aircraft engines
	• Super alloys used in gas turbine blades • Corrosion prevention techniques in aerospace systems
Module – 3	• Carbon fiber reinforced polymer (CFRP) structures in commercial aircraft • Nanocomposites and their aerospace applications
	• Shape Memory Alloys (SMAs) in aerospace actuators • Case studies on composite structures in modern aircraft
Module – 4	• Additive manufacturing (3D printing) of aerospace components • Advanced non-destructive testing techniques

	• Electron microscopy and modern material characterization methods • Digital manufacturing and Industry 4.0 applications in aerospace materials
Module – 5	• Investigation of aerospace structural failures and accident case studies • High-Entropy Alloys (HEAs) for aerospace applications
	• Ultra-High-Temperature Ceramics (UHTCs) for hypersonic vehicles • Sustainable and recyclable materials for future aerospace systems

Course Outcomes: After completing the course, the students will be able to	
CO1	**Explain** the structure, properties, classification, and selection criteria of materials used in aerospace engineering applications.
CO2	**Analyze** the processing, heat treatment, and performance characteristics of ferrous and non-ferrous aerospace alloys
CO3	**Evaluate** composite, smart, and advanced materials for lightweight, high-strength, and high-temperature aerospace applications
CO4	**Apply** metallurgical principles, material characterization techniques, and non-destructive testing methods to assess material quality and reliability
CO5	**Investigate** material failure mechanisms such as fatigue, fracture, creep, and corrosion, and recommend suitable materials for aerospace structures and propulsion systems.

Text Books	
1	a. **Callister, W.D. Jr. and Rethwisch, D.G.**, *Materials Science and Engineering: An Introduction*, **11th Edition**, **John Wiley & Sons**, **2024**. b. **Khanna, O.P.**, *A Textbook ofMaterial Science and Metallurgy*, **9th Edition**, **Dhanpat Rai Publications**, **2014**.
2	c. **Rajput, R.K.**, *Engineering Materials and Metallurgy*, **S. Chand Publishing**, **Revised Edition**, **2021**.

Reference Books	
1	**Mouritz, A.P.**, *Introduction to Aerospace Materials*, **2nd Edition**, **Woodhead Publishing (Elsevier)**, **2021**
2	**V Raghavan**, Material Science & Engg 4th, PHI, 2022
3	**Shackelford, J.F.**, *Introduction to Materials Science for Engineers*, **9th Edition**, **Pearson Education**, **2021**

Web links and Video Lectures (e – Resources)	
1	**https://nptel.ac.in/courses?utm_source=chatgpt.com** Materials Science, Physical Metallurgy, Composite Materials, Mechanical Behaviour of Materials, and Aerospace-related material courses offered by IITs.
2	https://ocw.mit.edu/search/?d=Materials+Science+and+Engineering&utm_source=chatgpt.com Free lecture notes, video lectures, assignments, and study materials on materials science and engineering fundamentals.

3	https://www.asminternational.org/?utm_source=chatgpt.com Technical articles, aerospace material databases, metallurgy resources, case studies, and industry best practices related to aerospace materials.

CO – PO MAPPING

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

Semester: III						
Computer Aided Aerospace Drawing and GD and T (Branch: ASE)						
Course Code	:	BASL305		**Credits**	:	2
Hours/Week (L:T:P:SL)	:	0:0:28:02		**CIE**	:	50Marks
Total Hours	:	12L+24P		**SEE**	:	50Marks
Course Type	:	PCCL		**SEE Duration**	:	3Hours

Prerequisites:	
Courses	Engineering Graphics / Engineering Drawing
Knowledge on Fundamental Concepts	Projection methods (First-angle and Third-angle) Orthographic and isometric drawing techniques 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	
1	Master engineering graphics, limit systems, and Geometric Dimensioning and Tolerance (GD&T) according to ASME Y14.5M and Bureau of Indian Standards (BIS).
2	Model standard mechanical joints, aircraft riveted structures, flush/countersunk riveting, and specialized aerospace fasteners (Hi-Lok, clevis joints).
3	Create complex 3D parametric models and exploded assembly drawings of aircraft, UAV, rocket, and satellite structures using industry-standard CAD suites (CATIA V5 / Siemens NX).

Part-A	**08Hrs**

Fundamentals, GD&T, Blueprint Reading & Model-Based Definition
Introduction to the Software: Interface navigation, sketcher workbenches, constraint management, parametric modeling rules, template configuration, and layer management in enterprise CAD platforms (CATIA V5 / Siemens NX / SolidWorks)
Geometric Dimensioning and Tolerancing (GD&T):

Limit System – Tolerances – Fits – Tolerances of Form and Position – Standards followed in Industry (BIS and **ASME Y14.5M**).
Principles and terminology of GD&T: Types of GD&T Symbols, shape, orientation, location, and runout feature control frames, tolerance zones, and datum systems.
Model-Based Definition (MBD) & Digital Product Definition: Introduction to paperless drafting standards (**ASME Y14.41**); embedding 3D Product and Manufacturing Information (PMI) annotations (dimensions, GD&T, surface finish) directly onto 3D CAD geometry.

Blueprint Reading and Sketching: Blueprints, Technical Sketching, Projections and Views, Machine Drawings, Piping Systems, Electrical and Electronics Prints.

Part-B	**08Hrs**

Orthographic Projections, Standard Joinery & Aerospace Fasteners Orthographic Views: Conversion of pictorial views into orthographic projections of simple machine parts and aircraft components with or without section (Bureau of Indian Standards conventions and ASME standards are to be followed for drawing).

Riveted Joints & Aerospace Fasteners:

Standard Mechanical Rivets: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag configurations using snap head rivets).

Aerospace Fasteners & Joints: Aircraft countersunk/flush head rivets for aerodynamic skin surfaces, blind rivets, Hi-Lok fasteners, clevis joints, and aircraft structural skin-stringer joint layouts.

Mechanical Rod Joints: Cotter joint (socket and spigot) and Knuckle joint (pin joint) for two rods.

Part-C	**08Hrs**

Parametric Modeling & Aerospace Assembly Drawings

3D parametric modeling, assembly constraint management, bill of materials (BOM) generation, and 2D exploded assembly drafting of the following components using CAD software (CATIA V5 / Siemens NX):

1. Design of Propeller and hub assembly
2. Design of Wing assembly
3. Design of Fuselage assembly
4. Design of Landing Gear assembly
5. Design of Rockets assembly
6. Design of Satellite assembly
7. Design of UAV assembly

Course outcome : At the end of the course, the student will be able to

CO1	Apply GD&T symbols, ASME Y14.5 feature control frames, limit systems, and Model-Based Definition (MBD) to engineering drawings and multi-disciplinary blueprints.
CO2	Construct orthographic, sectioned, and detailed drawings of standard mechanical joints, riveted structures, and specialized aerospace fasteners
CO3	Model 3D parametric components and detailed assembly drawings of aircraft, UAV, rocket, and satellite structures using industry CAD suites.
CO4	Evaluate design solutions for complex assemblies to meet design specifications and functional requirements.
CO5	Fabricate a functional physical prototype of an aerospace assembly using 3D printing and Design for Additive Manufacturing (DfAM) guidelines.

Text Book
Machine Drawing – K. R. Gopala Krishna, Subhash Publication, 2005
Dimensioning and Tolerancing Standard (ASME Y14.5M) – American Society of Mechanical Engineers.
Blueprint Reading and Sketching – Navedtra, Mrs. Delphine Jackson, Mrs. Debra Harrison-Youngs & C. Thomas Olivo, 2015
Reference Books
Assignment: Model making of any one assembly from part c using 3D printing. **Textbooks:** 1. Machine Drawing K.R. Gopala Krishna Subhash Publication 2005 **Reference:** 1. A Text Book of Computer Aided Machine Drawing S. Trymbaka Murthy CBS Publishers, New Delhi 2007 2. Engineering drawing P.S.Gill S K Kataria and Sons 2013 3. Blueprint Reading and Sketching Navedtra Mrs. Delphine Jackson Mrs. Debra Harrison-Youngs & C. Thomas Olivo. 2015
Web links and Video Lectures (e-Resources)
https://nptel.ac.in/courses/112105294 https://nptel.ac.in/courses/112104031 https://www.3ds.com/edu/

CO-PO MAPPING

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

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.
   f. 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 Mark	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					
Measurements and Instrumentation Lab					
Course Code	:	1BASL307A	**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	Measurements and Metrology
Knowledge on Fundamental Concepts	Measurements, Calibration of Instruments
Knowledge on Connected Tools (If any)	Basic Calipers like tapes

Course Learning Objectives: This course will enable the students to	
CLO1	Learn to calibrate instruments like pressure gauges, thermocouples, LVDTs, and load cells.
CLO2	Use strain gauges to find material properties like elasticity.
CLO3	Measure accurately using tools like optical projectors, sine bars, protractors, and autocollimators.
CLO4	Check machining forces and surface finish with dynamometers and roughness testers.
CLO5	Inspect sizes and shapes of parts, including threads and gears, using proper instruments.

Experiments	
Sl. No.	**List of problems for which student should Develop C program and execute in the Laboratory**
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 Optical Projector/Toolmaker Microscope.
7.	Measurement of angle using Sine Center/Sine bar/bevel protractor
8.	Measurement of alignment using Autocollimator/Roller set
9.	Measurement of cutting tool forces using a) Lathe tool Dynamometer OR b) Drill tool Dynamometer.
10.	Measurements of Screw thread Parameters using two wire or Three-wire methods.
11.	Measurements of Surface roughness, Using Tally Surf/ Mechanical Comparator

12.	Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer

Open Ended Experiments	
1	Selection, Calibration and Performance Evaluation of Sensors for an Aerospace Measurement System
2	Dimensional Inspection and Tolerance Analysis of an Aerospace Mechanical Component
3	Experimental Determination of Material Properties Using Strain Gauges
4	Measurement Uncertainty Analysis Using Different Precision Measuring Instruments
5	Experimental Investigation of Machining Parameters on Cutting Forces and Surface Finish
6	Measurement of Air Velocity Using Pitot-Static Tube and Digital Manometer

Course Outcomes: After completing the course, the students will be able to	
CO1	Calibrate instruments like pressure gauges, thermocouples, LVDTs, and load cells, and check their accuracy.
CO2	Find mechanical properties of materials using strain gauges.
CO3	Take precise angular, linear, and shape measurements with sine bars, bevel protractors, and optical comparators.
CO4	Measure machining forces and assess cutting tool performance using dynamometers.
CO5	Measure threads, surface finish, and gear tooth profiles using metrology tools.

Text Books	
1	Engineering Metrology, R K Jain, 22nd edition, Khanna Publishers,2022, ISBN-13: 978-81-7409-153-6, ISBN-10 / ASIN: 81-7409-153-X
2	Engineering Metrology, I C Gupta, Dhanpat Rai Publishing Co. Pvt. Ltd., 2013, ISBN10: 8189928457, ISBN-13: 978-8189928452

Reference Books	
1	Industrial Instrumentation, Jerry Faulk and Al Sutko, Delmar Cengage Learning Publisher, 1996, ISBN-10: 0827361254, ISBN-13: 978-0827361256

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=8DTt-f6wQxE&list=PL41FA714195562989

CO – PO MAPPING

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

Semester: III					
Spreadsheet for Engineers with VBA Basics					
Course Code	:	1BASL307B	**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	Fundamental mathematics
Knowledge on Fundamental Concepts	Logical thinking
Knowledge on Connected Tools (If any)	MS Excel

Course Learning Objectives: This course will enable the students to	
CLO1	Learn to make and read professional charts for engineering data.
CLO2	Use Excel functions to do calculations and unit conversions.
CLO3	Build models to analyze, predict, and optimize results.
CLO4	Solve engineering problems using numerical methods in Excel.
CLO5	Automate tasks with VBA macros and custom functions.

Experiments	
Sl. No.	**List of problems for which student should Develop C program and execute in the Laboratory**
1.	Charting: Create an XY scatter graph, XY chart with two Y-Axes, add error bars to your plot, and create a combination chart.
2.	Functions: Computing Sum, Average, Count, Max and Min, Computing Weighted Average, Trigonometric Functions, Exponential Functions, Using the CONVERT Function to Convert Units.
3.	Conditional Functions: Logical Expressions, Boolean Functions, IF Function, Creating a Quadratic Equation Solver, Table VLOOKUP Function, AND, OR and XOR functions.
4.	Regression Analysis: Trend line, Slope and Intercept, Interpolation and Forecast, The LINEST Function, Multi linear Regression, Polynomial Fit Functions, Residuals Plot, Slope and Tangent, Analysis Tool Pack.
5.	Iterative Solutions Using Excel: Using Goal Seek in Excel, Using the Solver to Find Roots, Finding Multiple Roots, Optimization Using the Solver, Minimization Analysis, Non-Linear Regression Analysis
6.	Matrix Operations Using Excel: Adding Two Matrices, multiplying a Matrix by a Scalar, Multiplying Two Matrices, transposing a Matrix, inverting a Matrix and Solving System of Linear Equations.
7.	VBA User-Defined Functions (UDF): The Visual Basic Editor (VBE), The IF Structure, The Select Case Structure, The for Next Structure, The Do Loop Structure, Declaring Variables and Data Types, An Array Function the Excel Object Model, For Each Next Structure.

8.	VBA Subroutines or Macros: Recording a Macro, coding a Macro Finding Roots by Bisection, Using Arrays, adding a Control and Creating User Forms
9.	Numerical Integration Using Rectangle Rule and Trapezoidal Rule
10.	Numerical Integration Using Simpson's Rule and Development of a VBA User-Defined Function (UDF)
11.	Solution of First-Order Differential Equations Using Euler's and Modified Euler's Methods
12.	Solution of Differential Equations Using the Runge–Kutta Method and Second-Order Differential Equations

Open Ended Experiments	
1	Design and Optimize the Trajectory of a Water Rocket Using Excel Solver
2	Develop an Aircraft Performance Calculator Using VBA
3	Design an Engineering Data Analysis Dashboard for Aerospace Applications

Course Outcomes: After completing the course, the students will be able to	
CO1	Create different plots and charts
CO2	Compute different functions, conditional functions and make regression analysis
CO3	Carryout iterative solutions for roots, multiple roots, optimization and nonlinear regression analysis.
CO4	Understand VBA and UDF, VBA subroutines and Macros and Carryout matrix operations
CO5	Carryout numerical integration and solving differential equations using different methods

Text Books	
1	Mc Fedries Paul Microsoft Excel 2019 Formulas and Functions Microsoft Press, U.S, 2019 Edition

Reference Books	
1	Excel Resources - 600+ Self Study Guides, Articles & Tools (wallstreetmojo.com).

Web links and Video Lectures (e – Resources)	
1	https://www.ictlounge.com/html/year_7/esafety_part7.htm.

CO – PO MAPPING

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

Semester: III					
GenAI Enabled Python Programming					
Course Code	:	1BASL307CA	**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	Basic Engineering Mathematics, Engineering Physics, Introduction to Aerospace Engineering, and Fundamentals of Computers
Knowledge on Fundamental Concepts	Basic mathematical operations, algebra, trigonometry, vectors and matrices, elementary programming logic, and fundamental aerospace engineering concepts such as forces, motion, lift, drag, and atmospheric properties
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamentals of Python programming and apply programming constructs to solve aerospace engineering problems.
CLO2	Perform scientific and numerical computations using Python libraries such as NumPy, Pandas, and Matplotlib for aerospace data analysis and visualization.
CLO3	Develop Python programs for modeling, simulation, and analysis of aerospace systems including aircraft performance, atmospheric properties, UAVs, and satellite applications.
CLO4	Utilize Generative AI tools for code generation, debugging, optimization, documentation, and engineering report preparation in aerospace applications.
CLO5	Design and implement AI-assisted Python solutions for aerospace engineering applications through laboratory experiments and mini-projects.

Experiments	
Sl. No.	**List of problems for which student should Develop C program and execute in the Laboratory**
1.	Python basics for aerospace engineering calculations
2.	Numerical computation using NumPy
3.	Matrix operations for aerospace applications
4.	Visualization of aerodynamic data using Matplotlib
5.	International Standard Atmosphere (ISA) calculator
6.	Aircraft performance parameter estimation
7.	Rocket trajectory simulation
8.	UAV flight endurance and range analysis
9.	Flight data analysis using Pandas

10.	Sensor data filtering and processing
11.	AI-assisted aerospace data visualization dashboard
12.	Mini project: GenAI-enabled aerospace engineering application

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop Python programs using fundamental programming concepts, functions, and modular programming techniques for engineering applications
CO2	Apply Python libraries such as NumPy, Pandas, Matplotlib, and SciPy for numerical computation, data analysis, and visualization of aerospace engineering data.
CO3	Model and simulate aerospace engineering problems including atmospheric calculations, aircraft performance, UAV analysis, rocket trajectories, and satellite orbit visualization using Python.
CO4	Utilize Generative AI tools for AI-assisted code generation, debugging, optimization, documentation, and automated engineering report generation.
CO5	Design and implement integrated GenAI-enabled Python solutions for aerospace applications through laboratory experiments and mini-projects, demonstrating problem-solving and computational thinking skills.

Text Books	
1	Al Sweigart, Automate the Boring Stuff with Python, 2nd Edition, No Starch Press, 2019.
2	Charles R. Severance, Python for Everybody: Exploring Data in Python 3, University of Michigan, 2023.

Reference Books	
1	Eric Matthes, Python Crash Course, 3rd Edition, No Starch Press, 202.

Web links and Video Lectures (e – Resources)	
1	Python Official Documentation: https://docs.python.org/3/

CO – PO MAPPING

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

Semester: III					
Technical Writing Using Latex					
Course Code	:	1BASL307D	**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	
Knowledge on Fundamental Concepts	Basic knowledge of text editing and document preparation in Computer, Familiarity with file handling and typesetting concepts
Knowledge on Connected Tools (If any)	MS Word

Course Learning Objectives: This course will enable the students to	
CLO1	Create well-structured LaTeX documents using sections, headers, footers, title pages, abstracts, and certificate pages.
CLO2	Format and present tables, figures, subfigures, mathematical equations, and other technical content using appropriate LaTeX environments.
CLO3	Develop technical documents containing theorems, definitions, lemmas, corollaries, algorithms, and hierarchical diagrams using suitable LaTeX packages.
CLO4	Prepare research-oriented documents by incorporating citations, references, bibliographies, and cross-referencing techniques in LaTeX.
CLO5	Design complete technical reports and journal-style articles that comply with academic and professional documentation standards using LaTeX

Experiments	
Sl. No.	**List of problems for which student should Develop C program and execute in the Laboratory**
1.	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.
2.	Develop a LaTeX script to create a document that displays the sample Abstract/Summary
3.	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]
4.	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry
5.	Develop a LaTeX script to create a document that contains the following table with proper labels.

S.No	USN	Student Name	Marks		
			Subject1	Subject2	Subject3
1	4XX22XX001	Name 1	89	60	90
2	4XX22XX002	Name 2	78	45	98
3	4XX22XX003	Name 3	67	55	59

6.	Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the sub graph concept
7.	Develop a LaTeX script to create a document that consists of the following two mathematical equations. $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2-4*(1)*(-8)}}{2*1}$ $= \frac{-2 \pm \sqrt{4+32}}{2}$ $\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \operatorname{sgn}(\pi)\varphi_\sigma^\lambda \varphi_\pi^\lambda$ $= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma)\varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda$ $= A_{\sigma t}\varphi_\sigma^\lambda$
8.	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document
9.	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section
10.	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library
11.	Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library
12.	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.

Open Ended Experiments	
1	Design and develop a complete technical report on an engineering topic of your choice using LaTeX.
2	Prepare a research article on a selected engineering problem using an appropriate LaTeX document class
3	Create a technical document that explains an engineering system using TikZ diagrams and related LaTeX packages.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply basic LaTeX command to develop simple document
CO2	Develop LaTeX script to present the tables and figures in the document
CO3	Illustrate LaTeX script to present theorems and mathematical equations in the document
CO4	Develop programs to generate the complete report with citations and a bibliography
CO5	Illustrate the use of Tikz and algorithm libraries to design graphics and algorithms in the document

Text Books	
1	A Short Introduction to LaTeX BY FIRUZA KARMALI (AIBARA), A book for beginners, 2019

Reference Books

1	Formatting Information: A Beginner's Introduction to Typesetting with LaTeX, BY PETER FLYNN, Comprehensive TeX Archive Network (2005)

Web links and Video Lectures (e – Resources)	
1	LaTeX TUTORIAL: [https://latex-tutorial.com/tutorials/]
2	LaTeX TUTORIAL: [https://www.javatpoint.com/latex]

CO – PO MAPPING

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

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 stakeholders.
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 (WhatsApp, Facebook, 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 design a 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,	SDG 11, SDG 12, SDG 13

			PO7, PO8, PO10	
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 programmes	Deliver a structured mentoring activity and measure participation, engagement, and skill/awareness improvement.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 17
18	Adult education	Conduct learner-needs assessment, prepare instructional content, and measure improvement in basic literacy or numeracy indicators.	PO6, PO8, PO9,	SDG 4, SDG 10, SDG 17

			PO10, PO11	
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 and role assignment	Help teams organize tasks, timeline, and responsibilities	Plan activities, divide roles, and prepare schedule	Work plan / 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 /	Monitor progress and correct	Develop the	Working model / draft

	app development	technical issues	selected output	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) – 50 marks

- 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/ co mmunity	8	Problem is clearly identified with strong evidence of societal relevance	Problem is Relevant and scope is clear with adequate supporting evidence.	Problem defined but justificatio n or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.

		and well-defined scope.			
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& Presentation skills	6	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; weak responses.	Presentation poor or absent; unable to 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;		Problem statement is	Approach is technically sound and	Approach basic; limited	No viable engineering

Engineering approach, innovation & feasibility	20	precise; approach demonstrates engineering depth, novelty and feasibility.	Feasible with minor limitations.	technical depth or feasibility concerns.	approach or infeasible plan.
Interaction with stakeholders; 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.
Contribution & Benefit to society; Impact assessment & sustainability	16	Clear, evidence-based assessment of social impact and Sustainability with scaling recommendations	Reasonable 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**
CO1	2	3				3					
CO2	3		3		2	2					
CO3	3			2	2					3	
CO4						3	3				2
CO5								3	3		2

Semester: III						
Physical Education (PE) (Sports & Athletics) **Common to All Branches**						
Course Code	**:**	1BPE309		**Credits**	**:**	0
Hours/Week(L:T:P:SL)	**:**	24:0:0:16		**CIE**	**:**	**100 Marks**
Total Hours	**:**	24		**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 A. Lifestyle. B. Health & Wellness. C. Pre-Fitness test.	
Module – 2	**4 Hrs**
General Fitness & Components of Fitness A. Warming up (Free Hand exercises). B. Strength – Push-up / Pull-ups. C. Speed – 30 Mtr Dash.	
Module-3	**16 Hrs**
Specific games (Any one to be selected by the student) A. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. 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 15 marks.	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**
CO1						3	2				2
CO2						3	2	3	3		2
CO3						3	3	2	2	2	3

Semester: III					
Yoga **Streams: CSE/ECE/CV/ME**					
Course Code	:	1BYO309	**Credit**	:	0
Hours/Semester (L:T:P:SL)	:	14:0:0:16	**CIE**	:	100 Marks
Total Hours	:	30	**SEE**	:	---
Course Type	:	NCMC	**SEE Duration**	:	---

Prerequisites:	
Courses	**--**
Knowledge on Fundamental Concepts	• Basic understanding of physical fitness, health and personal hygiene. • 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. **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. **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. **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**
CO1						2	1				2
CO2						3	2	1			2
CO3						3	2	2			3

Semester: III					
Music **Stream: CSE/ECE/ME/CV**					
Course Code	**:**	1BMU309	**Credit**	**:**	0
Hours/Semester (L:T:P:SL)	**:**	14:0:0:16	**CIE**	**:**	100Marks
Total Hours	**:**	30	**SEE**	**:**	NA
Course Type	**:**	NCMC	**SEE Duration**	**:**	NA

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	**05 Hrs**
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. **T-1** V-1 Ch. 1-3	
Module – 2	**05 Hrs**
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. **T-1** V-1 Ch. 3-4	
Module – 3	**04 Hrs**
Compositions Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. **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 Outcomes: 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.

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

ReferenceBooks	
1	History of South Indian (Carnatic) Music (From Vedic Times to the Present) , R Rangaramanuja ayyangar ,2019 edition ,Vipanchi charitable trust publisher ISBN: 9788187723158.
2	Music of India, B. Chaitanya Deva, 2nd edition , 1995 Munshiram Manoharlal 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_cSboZo8?si=55M6QAC2T8VqZN39
2	https://www.youtube.com/live/RfM4lAJQgCc?si=xfKob6exvkBujugr
3	https://youtu.be/DZA_cSboZo8?si=55M6QAC2T8VqZN39

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
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 (NCC) – I **(General Awareness – Common Subjects) (Common to all Branches)**					
Course Code	:	1BNC309	**Credit**	:	0 (NCMC)
Hours/Semester (L:T:P:SL)	:	14:0:0:16	**CIE**	:	100 Marks
Total Hours	:	30	**SEE**	:	NA
Course Type	:	NCMC	**SEE Duration**	:	NA

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 organisation 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 organisation
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, organisation 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**
CO1						3		2	2		
CO2						3	2	2			
CO3						3		2	2		

Semester: III						
Competency Enhancement Course-1 **Stream: CSE/ECE/ME/CV**						
Course Code	:	**BCE311**		**Credits**	:	0
Hours/Week(L:T:P:SL)	:	14:0:0:14		**CIE**	:	**100 Marks**
Total Hours	:	40		**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	**NA**

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	**8 Hrs**
Fundamentals of Industrial Robotics & Spatial Kinematics **Robotic Anatomy & Architecture:** Degrees of Freedom (DOF), arm configurations (Cartesian, Cylindrical, Spherical, Articulated/Jointed-arm, SCARA, Delta). **Kinematic Modeling:** Introduction to Forward and Inverse Kinematics, Denavit-Hartenberg (D-H) parameters, and transformation matrices. **Actuators & End Effectors:** Electric (Servo/Stepper), Pneumatic, and Hydraulic drives; Mechanical, Vacuum, Magnetic grippers, and specialized end-effectors for aerospace assembly (e.g., automated riveting and drilling heads).	
Module – 2	**8 Hrs**

Smart Manufacturing & Industry 4.0 Integration

Concepts of Smart Manufacturing: Principles of Cyber-Physical Systems (CPS), Industrial Internet of Things (IIoT), and cloud-connected factory floors.

Sensors & Data Acquisition: Vibration, ultrasonic, tactile, and thermal sensor integration for real-time machine health and predictive maintenance.

Digital Twins & Simulation: Modeling physical aerospace manufacturing lines, robotic cells, and workflow simulations using tools like RoboDK, Gazebo, or ROS.

Module-3	**8 Hrs**

Robotic Path Planning & Simulation

Motion & Trajectory Planning: Joint-space and Cartesian-space trajectory generation (cubic and polynomial path planning).

Robotic Offline Programming (OLP): Simulation of automated pick-and-place, arc/spot welding, laser cutting, and composite material layup.

Collision Avoidance: Obstacle detection and real-time path correction algorithms in automated work cells.

Module-4	**8 Hrs**

Additive Manufacturing & Automated Quality Inspection

3D Printing in Robotics: Prototyping lightweight robotic components, end-effectors, and aerospace brackets using FDM, SLA, and Metal Additive Manufacturing.

Machine Vision Systems: Image processing, edge detection, and AI-assisted defect detection for precision aerospace component inspection.

Cobots & Autonomous Material Handling: Use of Collaborative Robots (Cobots), Automated Guided Vehicles (AGVs), and Autonomous Mobile Robots (AMRs) in aerospace hangar and factory transport.

Module-5	**8 Hrs**

CNC Programming, Machining and Advanced Robotic Applications

CAD/CAM Fundamentals: Principles of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) integration in modern smart factories.

Material Handling: Automated pick-and-place operations, palletizing, and depalletizing in manufacturing lines.

Machine Tending & Assembly: Automated loading and unloading of CNC machines, robotic arc/spot welding, riveting, and component assembly.

Computer Integrated Manufacturing (CIM): Role of industrial manipulators and automated work cells in CIM and flexible manufacturing systems (FMS).

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,** R.S. Aggarwal Chand Publishing. – 2023.
2	**Vedic Mathematics,** Bharati Krishna Tirthaji, Sixteenth Reprint, Published by Motilal Banarsidass Publishers, - 1985, (ISBN- 978-8120801639)
3	**Logical and Analytical Reasoning,** A.K. Gupta, 39th Edition, Ramesh Publishing House – 2024, (ISBN- 978-9350127766)
GReference Books	
1	**Puzzle Test & Seating Arrangements,** K. Kundan (ISBN: 9789394666023),1st Edition, BSC Publishing Company Pvt Ltd. - 2023
2	**Logical Reasoning and Data Interpretation for the CAT**, Nishit K. Sinha, 7th Edition, Pearson Education -2020, (ISBN: 978-9353946616)
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

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

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

Building Competent Aerospace Engineers with a blend of Research, Innovation and Entrepreneurship Centre for the Real world

Department Mission

- Imparting knowledge in basic and applied areas of Aerospace Engineering.
- Providing hands on training on state-of-the-art technologies related to Aerospace Engineering.
- Creating a learning atmosphere for higher studies and research blossom both amongst the students and the faculty.
- Developing teamwork, interdisciplinary research, internship and entrepreneur skills through industry-institute interface.
- Inculcating Technical, leadership skills and life-long learning embedded with ethical values and social relevance.

SJC INSTITUTE OF TECHNOLOGY

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