

||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

www.sjcit.ac.in

Estd : 1986

III Semester

Scheme & Syllabus of B.E. Programme

Mechanical Engineering

(2025 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



AICTE

nirf NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NBA

NAAC A+

QS I-GAUGE INDIAN UNIVERSITY RATING GOLD

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

||श्री हरि गुरुदेव||
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 Mechanical 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	1BME302	Manufacturing Technology	ME	42	0	28	50	120	3	50	50	100	4
3	IPCC	1BME303	Material Science and Metallurgy	ME	42	0	28	50	120	3	50	50	100	4
4	PCC	1BME304	Mechanics of Materials	ME	42	0	0	48	90	3	50	50	100	3
5	PCC	1BME305	Engineering Thermodynamics	ME	42	0	0	48	90	3	50	50	100	3
6	PCCL	1BMEL306	Computer Aided Machine Drawing and GDT	ME	0	0	28	02	30	3	50	50	100	1
7	AEC	1BMEL307x	Ability Enhancement Course Laboratory**	ME	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 – I		NCC coordinator										
10	NCMC	1BCE310	Competency Enhancement Course-1	CDCAC		14	0	0	14	28	--	100	---	100	PP
11	NCMC	1BMATDIP311	Additional Mathematics - I	Mathematics		14	0	0	14	28	--	100	---	100	PP
Total												**700**	**400**	**1100**	**21**

Ability Enhancement Course (Laboratory) 1BMEL307x			
1BMEL307A	Energy Conversion Lab	1BMEL307C	Data Science for Mechanical Engineers
1BMEL307B	Spread Sheet for Engineers	1BMEL307D	Virtual Reality

Semester: III					
Applied and Computational Engineering Mathematics **Stream: ME**					
Course Code	:	1BMATM301	**Credits**	:	4
Hours/Semester (L:T:P:SL)	:	30:20:0:0	**CIE**	:	50 Marks
Total Hours	:	50	**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, 45thEdition, 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					
Manufacturing Technology					
Course Code	**:**	1BME302	**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:0:28:50	**CIE**	**:**	50 Marks
Total Hours	**:**	120	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Elements of Mechanical Engineering**
Knowledge on Fundamental Concepts	**Foundry and Characterization Techniques**
Knowledge on Connected Tools (If any)	**-**

Course Learning Objectives: This course will enable the students to	
CLO1	Gain knowledge of various casting process in manufacturing.
CLO2	Understand the metallurgical aspects involved in solidification of metals and alloys. Explain metallurgical aspects involved in solidification of metals and alloys.
CLO3	Explore the knowledge of various joining process and welding process used in manufacturing.
CLO4	Gain the knowledge about metal working processes.
CLO5	Understand the fundamentals, history, and evolution of AI related manufacturing industries.

Module – 1	**08 Hrs**
Introduction & basic materials used in foundry: Introduction: Definition, Classification of manufacturing processes. Metals cast in the foundry-classification, factors that determine the selection of a casting alloy. **Patterns:** Definition, classification, materials used for pattern, various pattern allowances and their importance. **Sand moulding:** Types of base sand, requirement of base sand. Binder, Additive's definition, need and types; preparation of sand moulds. Molding machines- Jolt type, squeeze type and Sand slinger. **Cores:** Definition, need, types. Method of making cores, Concept of gating (top, bottom, parting line, horn gate) and risers (open, blind) Functions and types. **Textbook :1 Chapter 2.1 Textbook: 1 Chapter 2**	
Module – 2	**08 Hrs**
Casting using metal moulds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixo casting, and continuous casting processes. Casting defects, their causes and remedies. **Melting furnaces:** Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace. **Textbook: 1 Chapter 2.7 ,Textbook: 1 Chapter 2.3**	
Module – 3	**08 Hrs**
Joining Processes: Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding. Modern brazing and soldering techniques **Recent trends in welding:** Friction stir welding, Explosive welding, Ultrasonic welding, Electron beam welding, Laser beam welding **Textbook 4: Chapter 1**	

Module – 4	**08 Hrs**
Metal Working Processes: Fundamentals of metal working, Analysis of bulk forming processes like forging, rolling, extrusion **Sheet metal processes:** Sheet metal forming processes (Die and punch assembly, Blanking, piercing, bending etc., Compound and Progressive die), High Energy rate forming processes. **Textbook: 1 chapter 3.5 Textbook :1 Chapter 3**	
Module – 5	**08 Hrs**
Smart Manufacturing: Definition, objectives, benefits of Smart Manufacturing, Evolution of manufacturing systems, Key components and technologies in Smart Manufacturing, Industrial Automation and Control Systems. **Machine Learning** - Role of AI, Conceptual Learning, AI & Augmented reality in Manufacturing. ANN in Manufacturing-Biological Neuron, Artificial Neuron, ML Applications in Manufacturing. **Textbook: 5 Chapter 1, 2 and 3**	

Practical component	
Module – 1	Prepare the sand specimens and perform a compression test using a Universal Sand Testing Machine.
	Preparation of sand specimens followed by the determination of shear strength using a Universal Sand Testing Machine.
Module – 2	Preparation of green sand molds kept ready for pouring using single molding box (hand cut molds).
	Preparation of green sand molds kept ready for pouring using two molding boxes Solid pattern Using patterns Split pattern.
Module – 3	Preparation of butt joint using arc welding equipment on mild steel (M.S.) flats
	Preparation of lap joint using arc welding equipment on mild steel (M.S.) flats.
Module – 4	Preparation of at least one forged component using the upsetting process.
	Preparation of a forged specimen using the drawing process.
Module – 5	Simple Casting Process using Python Program.
	Python Programming for Smart Manufacturing Process.

Topics for Self learning	
Module – 1	Understand different pattern allowances used in casting.
	Study the effect of moisture content on moulding sand properties.
Module – 2	Compare various metal mould casting techniques.
	Study different melting furnaces used in foundries.
Module – 3	Study weld bead characteristics produced by different welding processes
	Investigate advanced welding techniques.
Module – 4	Study material deformation during forging.
	Demonstrate blanking and piercing operations.
Module – 5	Understand smart manufacturing concepts.
	Apply basic machine learning concepts to manufacturing

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the significance of casting techniques and classify the metals used in foundry industry.
CO2	Interpret various casting processes used in metal mould sand and identify common casting defects along with their causes and remedies.
CO3	Apply the principles of joining techniques for appropriate material joining applications.
CO4	Elucidate the modern metal working and bulk deformation processes.
CO5	Describe the fundamental concept of smart manufacturing and Role of AI in manufacturing.

Text Books	
1	Manufacturing Science, Ghosh, A. and Mallik, A. K., (2017), Second Edition, East-West Press.
2	Welding Processes and Technology, Parmar R. S., (2007), Khanna Publishers
3	Metallurgical Modelling of Welding, Grong O, 2nd Edition (1997), The Institute of Materials
4	Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmid, 4th Edition (2013), Prentice Hall.
5	Smart Manufacturing Innovation and Transformation: Interconnection and Intelligence Luo, Z. ed., IGI Global, 2014

Reference Books	
1	Advanced Welding Processes technology and process control, John Norrish, 2006, Wood Head Publishing.
2	Anand Pandey, “Modern Machining Processes”, Ane Books Pvt. Ltd., New Delhi, 2019.
3	Kalpakjian S., and Schmid S.R., “Manufacturing Processes for Engineering Materials”,6th edition, Pearson, New Delhi, 2018.
4	Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002
5	Artificial Intelligence: Concepts and Applications, Lavika Goel, Kindle Edition, Wiley, 2021.

Web links and Video Lectures (e – Resources)	
1	https://onlinecourses.nptel.ac.in/noc25_me51/preview
2	https://www.youtube.com/watch?v=i4CH7tfQGr4&t=15s
3	http://acl.digimat.in/nptel/courses/video/112103280/L01.html

CO – PO MAPPING

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

Semester: III					
Material Science and Metallurgy					
Course Code	**:**	1BME303	**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:0:28:50	**CIE**	**:**	50 Marks
Total Hours	**:**	120	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Engineering Physics, Elements of Mechanical Engineering**
Knowledge on Fundamental Concepts	**Crystal Structures in metals, Engineering Materials.**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	Gain the Knowledge of Engineering materials and their detailed classifications, properties and apply the method of materials selection.
CLO2	Know the basic concepts of geometrical crystallography, crystal structure and imperfections in Solids.
CLO3	Construct the phase diagrams to know the phase transformations and concept of diffusion in solids.
CLO4	Identify the heat treatment, cooling methods for controlling the microstructure and plastic deformation to modify their properties.
CLO5	Explore the powder metallurgy process, types and surface modifications.

Module – 1	**08 Hrs**
Engineering Materials, and Applications: Classification, **Ferrous materials:** Properties, Compositions and uses of Grey cast iron and steel. **Non-Ferrous materials:** Properties, Compositions and uses of Copper, Brass, Bronze. **Organic and Inorganic materials:** Properties and their applications, **Composite materials** - Definition, classification, types of matrix materials & reinforcements, Metal Matrix Composites (MMCs), Ceramic Matrix Composites (CMCs) and Polymer Matrix Composites (PMCs), Particulate-reinforced and fiber-reinforced composites, Applications of composite materials. Smart materials, Functional Graded Materials (FGM). **Text book 1: Ch 1 and Text book 2: Ch 1**	
Module – 2	**08 Hrs**
Structure of Materials Introduction: Classification of materials, crystalline and non-crystalline solids, atomic bonding: Ionic Bonding and Metallic bonding. **Crystal Structure:** Crystal Lattice, Unit Cell, Planes and directions in a lattice, Planar Atomic Density, Coordination number, atomic Packing Factor of all the Cubic structures and Hexagonal Close Packed structure. Classification and Coordination of voids, Bragg's Law. **Imperfections in Solids:** Types of imperfections, Point defects: vacancies, interstitials, line defects, 2-D and 3D-defects, Concept of free volume in amorphous solids. Slip, Twinning. **Text book 1: Ch 3, Ch4 and Text book 2: Ch 5**	
Module – 3	**08 Hrs**
Physical Metallurgy **Alloy Systems:** Classification of Solid solutions, Hume- Rothery Rules **Diffusion:** Diffusion Mechanisms: Vacancy Diffusion and Interstitial Diffusion, Fick's laws of diffusion, Factors affecting diffusion.	

Phase Diagrams: Gibbs Phase Rule, Solubility limit, phase equilibrium and Phase Diagrams: Isomorphous systems, Invariant Binary Reactions: Eutectic reaction, Eutectoid reaction and Peritectic reaction, Lever Rule, Iron-Carbon Diagram. Effect of common alloying elements in steel. Numerical on Lever rule.

Text book 3: Ch 9, Text book 1: Ch5, Ch 9

Module – 4	**08 Hrs**

Powder metallurgy: Introduction, Powder Production Techniques: Different Mechanical methods: Chopping or Cutting, Abrasion methods, Machining methods, Ball Milling and Chemical method: Chemical reduction method. **Characterization of powders (Particle Size & Shape Distribution), Powder Shaping:** Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process, Sintering and Application of Powder Metallurgy.

Text book 4: Ch 1, 2, 3, 4 and 7

Module – 5	**08 Hrs**

Heat treatment: Annealing, Normalizing, hardening, Tempering, Nitriding, Cyaniding, Induction Hardening and Flame Hardening, Recent advances in heat treat technology. TTT diagram, Recovery-Recrystallization-Grain Growth. Strengthening mechanisms: Strain hardening, Precipitation hardening (Solid-Solution Strengthening), Grain refinement.

Role of AI&ML in Selection of Engineering Materials: Introduction, Concept of Data Processing, Modeling and Validation, Material Property analysis, Molecular Property prediction and discovering new materials by Structure-oriented design and Element-oriented design.

Text book 3: Ch 4

Practical component	
Module – 1	Determine the hardness values of Mild Steel/ Aluminium by Rockwell Hardness/Vickers Hardness.
	Determine the hardness values of Copper/ Brass by Brinell's Hardness testing machine.
Module – 2	Determine the tensile strength, modulus of elasticity, yield stress, % of elongation and % of reduction in area of Mild Steel/Brass/ Aluminium and to observe the necking.
	Determine the Impact strength of the mild steel using Izod test and Charpy test.
Module – 3	Determine the Shear strength (Single and Double Shear) of Mild Steel/Brass/ Aluminium.
	Determine the Compressive strength, modulus of elasticity, yield stress, % of reduction and % of increase in area of Cast Iron.
Module – 4	Conduct a wear test on Mild steel/ Cast Iron/Aluminium/ Copper to find the Volumetric wear rate and coefficient of friction.
Module – 5	Study the heat treatment processes (Hardening and tempering) of steel/Aluminium specimens.

Topics for Self learning	
Module – 1	Classification of Complete Engineering Materials
	Properties of Engineering Materials
Module – 2	Calculate APF for HCP crystal Structure
	Casting process
Module – 3	Copper-Nickel Phase Diagram

	Iron-Carbon Equilibrium Diagram
Module – 4	Advanced Casting Technique
Module – 5	Any one Material Characterization Tool like optical microscope, SEM etc

Course Outcomes: After completing the course, the students will be able to	
CO1	Elucidate the basics of Engineering materials and their detailed classifications, properties and the method of materials selection.
CO2	Illustrate the basic concepts of geometrical crystallography, crystal structure and imperfections in Solids.
CO3	Construct the phase diagrams to know the phase transformations and concept of diffusion in solids.
CO4	Apply the suitable heat treatment process, cooling method for controlling the microstructure and plastic deformation to modify their properties.
CO5	Analyse the powder metallurgy process, types and surface modifications.

Text Books	
1	Materials Science and Engineering: An Introduction, Callister Jr, W.D., Rethwisch, D.G., 10th Edition, 2018, Hoboken, NJ: Wiley. ISBN-13: 9781119321590
2	Engineering Materials 1: An Introduction to Properties, Application and Design, Jones, D.R.H., and Ashby,M.F., 4th Edition, 2011, Butterworth-Heinemann, ISBN: 978-0-08-096665-6
3	Introduction to Physical Metallurgy, Avner, S.H., 2nd Edition, 2017, McG aw Hill Education. ISBN: 0-07-y85018-6
4	Powder Metallurgy- Science, Technology and Applications, P. C. Angelo and R. Subramanian, 2008, PHI, New Delhi, ISBN : 9789391818487

Reference Books	
1	Physical Metallurgy Principles, Abbaschian, R., Abbaschian, L., Reed-Hill, R. E., 4th Edition, 2009, Cengate Learning. ISBN-13: 978-0-495-08254-5
2	Introduction to Solids, Azaroff, L V, 1st Editions, 2001, McGraw Hill Book Company.

Web links and Video Lectures (e – Resources)	
1	http://nptel.ac.in/courses/112104122/
2	https://nptel.ac.in/courses/113102080
3	https://www.researchgate.net/publication/335717921_Machine_learning_in_materials_science

CO – PO MAPPING

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

Semester: III					
Mechanics of Materials					
Course Code	**:**	1BME304	**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	Engg. Physics and Fundamentals of Civil Engg.
Knowledge on Fundamental Concepts	Concepts like force, moment, equilibrium, and stress-strain relationships.
Knowledge on Connected Tools (If any)	---

Course Learning Objectives: This course will enable the students to	
CLO1	Summarize the basic concepts of stress, strain and relations based on linear elasticity and also the material behavior due to different types of loading.
CLO2	Identify the different types of beams and able to calculate SF & BM and draw the SFD & BMD for various applications and also calculate the bending stresses for different cross-sectional beams.
CLO3	Understand the structural behavior of member subjected to torque, calculate twist and stress induced in shafts subjected to bending and torsion.
CLO4	Interpret the stability and buckling phenomena and design the columns using Euler's formula.
CLO5	Understand the concepts of failure theories and FOS in structural members.

Module – 1	**08 Hrs**
Simple stress and strain: Definition/Introduction of normal stress, shear stress, and normal strain and shear strain – Stress strain diagram for brittle and ductile materials - Poisson's ratio & volumetric strain of a rectangular bar and cylindrical bar subjected to axial load– Elastic constants – relationship between elastic constants and Poisson's ratio – Deformation of simple and compound bars, Resilience, Gradual, sudden, impact and shock loadings – thermal stresses in simple bars. **Text Book 1: Ch 1, Ch 2, Text Book 2: Ch 1, Text Book 3: Ch 1**	
Module – 2	**08 Hrs**
Bi-axial Stress system: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, graphical method - Mohr's circle for plane stress. **Theory of columns** – Long column and short column - Euler's formula. **Text Book 1: Ch 7, Text Book 2: Ch 2, Text Book 3: Ch 3, Text Book 3: Ch 19**	
Module – 3	**08 Hrs**
Bending moment and Shear forces in beams: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads – Point of contra flexure. **Text Book 1: Ch 6, Ch 8, Text Book 2: Ch 4, Text Book 3: Ch 6**	

Module – 4	08 Hrs
Theory of simple bending: Assumptions – Derivation of bending equation - Neutral axis – Determination of bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), Derivation of formula – Shear stress distribution across various beams sections. Numerical's only on determination of stresses in I and T section. **Torsion of circular shafts:** Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts and simple numericals. **Text Book 1: Ch 3, Ch 4, Text Book 2: Ch 5, Text Book 3: Ch 7, Ch 16**	
Module – 5	**08 Hrs**
Theories of Failure: FOS, Maximum Principal stress theory, Maximum shear stress theory, Maximum Strain theory, Simple numerical. **Thick and Thin cylinders:** Stresses in thin cylinders, Lame's equation for thick cylinders subjected to internal and external pressures, Simple numerical. **Text Book 1: Ch 7 – 7.5, Ch 10, Text Book 2: Ch 3, Text Book 3: Ch 17, Ch 18, Ch 19, Ch 24**	

Topics for Self learning	
Module – 1	Elastic constants – relationship between elastic constants and Poisson's ratio.
Module – 2	Euler's formula.
Module – 3	Definition of beam – Types of beams.
Module – 4	Assumptions of pure bending equation and Assumptions of pure torsion equation.
Module – 5	Factor of Safety, Lame's Assumptions.

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the mechanical behavior and elastic constants of materials and stress-strain relationships, and various components.
CO2	Determine the simple, compound, thermal stresses and strains induced on Mechanical elements such as bars, beams, cylinders, columns and shafts.
CO3	Analyze the SFD and BMD for different types of beams subjected to different loads.
CO4	Apply the basic equation of simple torsion in designing of circular shafts & Columns.
CO5	Evaluate stresses induced in different cross-sectional members subjected to shear loads and Suitability of failure theories.

Text Books	
1	Mechanics of Materials, S.I. Units, Ferdinand Beer & Russell Johnstan, 7th Edition, TATA McGrawHill-2014, ISBN 978-0-07-339823-5.
2	Mechanics of Materials, K.V.Rao, G.C.Raju, Subhash Stores, First Edition, 2007.
3	Strength of Materials by Dr. R.K. Bansal, Laxmi Publications 2010.

Reference Books	
1	Strength of Materials by S S Ratan, Tata McGraw Hill, 2nd Edition, 2008.
2	Mechanics of Materials by R C Hibbeler, Pearson, Latest Edition.

Web links and Video Lectures (e-Resources)	
1	Statics and Strength of Materials, Shehata, 2nd edition, 1994. http://www.astm.org/DIGITAL_LIBRARY/JOURNALS/TESTEVAL/PAGES/JTE12637J.%20htm
2	https://www.youtube.com/playlist?list=PL1LjPgjWt_IYJxqopL3fDi4bvI0f48RHK

CO – PO MAPPING

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

Semester: III					
Engineering Thermodynamics					
Course Code	:	1BME305	**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	**Physics, Mathematics and Chemistry**
Knowledge on Fundamental Concepts	**Fundamentals on Calculus**
Knowledge on Connected Tools (If any)	**-**

Course Learning Objectives: This course will enable the students to	
CLO1	Learn about thermodynamic system and its equilibrium, Understand various forms of energy, work and heat transfer
CLO2	Understand the applications of the first and second laws of Thermodynamics to various gas processes and cycles
CLO3	Understand the various Air standard and Gas power cycles and their Performance
CLO4	Understand the concepts related to Refrigeration.
CLO5	Know the basics of Air conditioning system.

Module – 1	**08 Hrs**
Basics of Thermodynamic: definition and scope, Microscopic and Macroscopic approaches., Thermodynamic System, Open, closed and Isolated System with examples Intensive, extensive properties, specific properties, pressure, specific volume, 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, Temperature; concepts, scales, international fixed points and measurement of temperature. Constant volume gas thermometer, mercury in glass thermometer. Numerical on temperature scales. **Textbook-1: Chapter1.1,12,1.4,1.5**	
Module – 2	**08 Hrs**
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; definition, units and sign convention. No numerical. **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, Extension of the First law to control volume, steady flow energy equation (SFEE), important applications (No numerical) **Textbook-1: Chapter2-2.1,2.2,2.3,2.4, Chapter-3-3.1,3.2,3.4,3.6**	
Module – 3	**08 Hrs**
Second Law of Thermodynamics: Limitations of first law of thermodynamics, Thermal reservoir, heat engine and heat pump: Schematic representation, efficiency and COP. Reversed heat engine, schematic representation, importance and superiority of a reversible heat engine and irreversible processes, internal and external reversibility. 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; Carnot cycle, Carnot principles. Problems Entropy: Clausius inequality, Statement- proof, Entropy- definition, a property, change of entropy, entropy as a quantitative test for irreversibility, principle of increase in entropy, entropy as a coordinate. (Simple Problems)

Textbook-2: Chapter3-3.1,3.2,3.4,3.5 & Chapter 4-4.1.1,4.2,4.3

Module – 4	**08 Hrs**

Gas Power Cycles: Air standard cycles; Carnot, Otto, Diesel, Dual cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles.

Gas turbine (Brayton) cycle; description and analysis. Regenerative gas turbine cycle.

Inter-cooling and reheating in gas turbine cycles. Jet propulsion: Introduction to the principles of jet propulsion. Simple problems

Textbook-2: Chapter 21-21.1,21.2,21.3,21.4,21.5,21.6 and

Chapter-25 -25.1,25.5,25.8.1,25.8.2

Module – 5	**08 Hrs**

Refrigeration Cycles: Vapor compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Any one case study on cold storage or industrial refrigerator.

Psychometrics and Air-conditioning Systems: Properties of Atmospheric air, and Psychometric properties of Air, Psychometric Chart, Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling. Adiabatic mixing of two moist air streams.

Textbook-2: Chapter 26-26.1,26.3,26.3.5,26.14 and Chapter 27-27.1,27.2,27.2.3

Topics for Self learning	
Module – 1	Various types of Temperature Measuring devices.
	Practical Examples of Thermodynamic systems (Open, Closed and Isolated system)
Module – 2	Practical Examples of Work producing and Absorbing devices.
	Different forms of Stored Energy.
Module – 3	Applications of Heat pump with reference to space heating, heat recovery systems, Water heating systems.
	Applications of Heat engine with reference to I C engine and E C Engine
Module – 4	Applications of Otto cycle and Diesel cycle with reference to Petrol and Diesel Engine respectively
	Applications of Gas turbines with reference to Aircraft Engines.
Module – 5	Domestic and Industrial applications of Refrigerator
	Applications of Air-conditioning for Human comfort and Processing Industry

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore the fundamentals of thermodynamics and evaluate energy interactions across the boundary of thermodynamic systems.
CO2	Evaluate the feasibility of cyclic and non-cyclic processes using First and second law of thermodynamics
CO3	Apply the knowledge of entropy, to solve numerical problems related to thermal devices.
CO4	Analyze the performance of Air standard cycles and gas turbine cycles.
CO5	Interpret the principles, applications of refrigeration and air conditioning systems.

Text Books	
1	Basic and Applied Thermodynamics, P K Nag, 2nd Ed., Tata McGraw Hill Publications, 2023.
2	A textbook of Engineering Thermal Engineering by, R K Rajput, Sixth edition, Laxmi Publications, 2023.
3	Fundamentals of Thermodynamics by Claus Borgnakke and Richard E Sonntag, 8th edition, Wiley India Edition, 2020
4	Thermodynamics, An Engineering Approach, by Yunus A Cenegal, Michael A Boles, and Mehmet Kanoglu, 9th Edition, Tata McGraw Hill publications, 2023

Reference Books	
1	Engineering Thermodynamics, J B Jones and G A Hawkins, John Wiley and sons, 1986.
2	An Introduction to Thermodynamics, Y V C Rao, Wiley Eastern, 2003
3	Applications of Thermodynamics, Dr V Kadambi and Dr T R Seetharam, Wiley Publications, 2018

Web links and Video Lectures (e – Resources)	
1	https://youtu.be/EVrlxzyL9BQ?si=ez1B25FDoCW9mccM,
2	https://youtu.be/mmQ7AcJ3pPA?si=wKrmwfEk_kBh3yM5
3	https://youtu.be/5a-XeyPHfmw?si=qvi59I_EYgmK1k5W, https://youtu.be/tI5F80fOtmg?si=9eegcFIwmSJk9gdw
4	https://youtu.be/9JU7tFWzoBo?si=D_2vNgrrmD9rrY8,
5	https://youtu.be/ZBrRfryASfI?si=34aNLgsI0L7ZWgmd

CO – PO MAPPING

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

Semester: III					
Computer Aided Machine Drawing and GD&T					
Course Code	:	1BMEL306	**Credit**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02	**CIE**	**:**	50 Marks
Total Hours	**:**	30	**SEE**	**:**	50 Marks
Course Type	**:**	PCCL	**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	**Engineering Drawing**
Knowledge on Fundamental Concepts	• **Projection methods (First-angle and Third-angle)** • **Orthographic and isometric drawing techniques**
Knowledge on Connected Tools (If any)	**Solid Edge Software, Autodesk Fusion 360**

Course Learning Objectives: This course will enable the students to	
CLO1	Demonstrate the ability to use industry-standard symbols for limits, fits, and geometrical tolerances (GD&T) to create technically accurate engineering drawings.
CLO2	Create constrained 3D solid models and photo-realistic renderings of mechanical parts using parametric modeling software.
CLO3	Illustrate and detail various types of fasteners, joints (Cotter, Knuckle), and couplings (Universal, Flanged) through 3D and sectional views.
CLO4	Construct full assembly drawings from individual components for industrial devices like Screw Jacks, Plumber Blocks, and Machine Vices, including a comprehensive Bill of Materials (BOM).
CLO5	Interpret the functional design and assembly requirements of critical engine parts (Piston, Connecting Rod) and safety devices like the Ram's Bottom Safety Valve.

Experiments	
Sl. No.	**PART - A**
1.	**Introduction:** Review of 2D Sketching, Parametric Solid Modeling, Assembly creation and product rendering. **Limits, Fits and Tolerances:** Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, Types of fits with symbols and applications, Geometrical tolerances on drawings, Industry Standards, Tolerance stack up analysis with an example. **Geometrical Dimensioning and Tolerances (GD&T):** Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.
	PART - B
2.	**Fasteners:** 3D & Section views - Hexagonal headed bolt and nut with washer
3.	**Fasteners:** Square headed bolt and nut with washer.
4.	**Joints:** Cotter joint (socket and spigot)
5.	**Joints:** Knuckle joint (pin joint)
6.	**Couplings:** Flanged coupling

7.	**Couplings:** Universal coupling
	PART - C
8.	Assembly drawing of Lifting Device (Screw Jack)
9.	Assembly drawing of Bearings (Plumber Block)
10.	Assembly drawing of Machine Tool Component (Machine Vice)
11.	Assembly drawing of I C Engine Components (Piston)

Open Ended Experiments	
1	Assembly drawing of Valves (Ram's Bottom Safety Valve)
2	Assembly drawing of Machine Tool Component (Tailstock)
3	Assembly drawing of IC Engine Components (Connecting Rod)

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the principles of limits, fits, and tolerances, along with Geometrical Dimensioning and Tolerancing (GD&T) symbols, to technical drawings in accordance with ISO/BSI industry standards.
CO2	Develop parametric 3D solid models and generate high-fidelity product renderings for virtual prototyping and visualization using CAD Software.
CO3	Construct detailed 3D models and sectional views of standard fasteners (bolts/nuts), joints (Cotter/Knuckle) and power transmission couplings (Universal/Flange).
CO4	Synthesize individual mechanical components into functional assemblies—such as the Screw Jack, Plumber Block, and Machine Vice—ensuring proper spatial constraints and interference checks.
CO5	Evaluate the design and assembly logic of internal combustion engine parts (Piston/Connecting Rod) and specialized machine tool components (Tailstock/Safety Valves) for manufacturing readiness.

Text Books	
1	'Machine Drawing', N.D.Bhat & V.M.Panchal, Published by Charotar Publishing House, 51st Edition, 2022, ISBN – 9385039563.
2	'Machine Drawing', K.R. Gopala Krishna, Subhash publication, 2017.

Reference Books	
1	A Text Book of Computer Aided Machine Drawing, S. Trymbakaa Murthy, CBS Publishers, New Delhi, 2019.
2	Machine Drawing, N.Siddeshwar, P.Kannaih, V.V.S. Sastri, published by Tata McGraw-Hill, 2017.
3	Machine Drawing, K L Narayana, P Kannaiah, K Venkata Reddy, New Age International, 3rd Edition. ISBN-13: 978-8122440546, 2016
4	Machine Drawing, Ajeet Singh, Tata McGraw-Hill Education, ISBN: 0071072942, 2017

Web links and Video Lectures (e – Resources)	
1	https://www.autodesk.com/learn/ondemand/course/learn-fusion-360-in-90-minutes
2	https://www.autodesk.com/certification/learn/course/fusion360-intro-modeling-designprofessional

CO – PO MAPPING

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

Semester: III					
Energy Conversion Lab					
Course Code	:	1BMEL307A	**Credit**	:	1
Hours/Semester (L:T:P:SL)	:	0:0:28:02	**CIE**	:	50 Marks
Total Hours	:	30	**SEE**	:	50 Marks
Course Type	:	AEC	**SEE Duration**	:	2 Hours

Prerequisites:	
Courses	Elements of Mechanical Engineering
Knowledge on Fundamental Concepts	Properties of Oils and IC Engines
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Gain the Knowledge of fuel properties and its measurements using various types of measuring devices.
CLO2	Understand the energy conversion principles, analysis and working of I C Engines.
CLO3	Carryout the performance analysis of IC engines characteristic curves.
CLO4	Analyse the Exhaust emissions of I C Engines will be measured and compared with the standards.

Experiments	
Sl. No.	**List of problems for which student should conduct and execute in the Laboratory**
	PART- A
1.	Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (Closed) / Cleveland's (Open Cup) Apparatus.
2.	Determination of Calorific value of Solid, Liquid and Gaseous fuels
3.	Determination of Viscosity of lubricating oil using a) Redwood Viscometer b) Saybolt Viscometers.
4.	Valve Timing/Port opening diagram of an I.C. Engine.
	PART- B
5.	Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for a. Four stroke Diesel Engine b. Two stroke Petrol Engine
6.	Multi Cylinder Diesel/Petrol Engine (Morse test).
7.	Measurements of Exhaust Emissions of Petrol engine.
8.	Measurements of Exhaust Emissions of Diesel engine.

Open Ended Experiments	
1	Demonstration of pθ, pV plots using Computerized IC engine test rig
2	Visit to Automobile Industry/Service stations.

Course Outcomes: After completing the course, the students will be able to	
CO1	Conduct tests and determine the properties of fuels and oils.
CO2	Demonstrate and Conduct performance tests on IC engines and draw characteristics plots.
CO3	Test basic performance parameters of I.C. Engine and implement the knowledge in industry.
CO4	Identify exhaust emission, factors affecting them and exhibit his competency towards preventive maintenance of IC engines.

Text Books	
1	Basic & Applied Thermodynamics, P K Nag, 2nd Edition, 2017, McGraw Hill Education, ISBN10-0070151318, 13-978-0070151314
2	Thermodynamics - An Engineering Approach, Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu, 9th Edition, 2019, McGraw Hill Education, ISBN 10-9353165741, 13-978-9353165741

Reference Books	
1	Principles of Engineering Thermodynamics, Moran, Shapiro, Boettner, Bailey, 8th Edition, 2015, Wiley Publications, ISBN 10-8126556722, 13-978 8126556724
2	Thermal Engineering, R.K. Rajput, 10th Edition, 2020, Laxmi Publications, ISBN 10-8131808041, 13-978-8131808047

Web links and Video Lectures (e – Resources)	
1	www.nptel.ac.in
2	www.matlab.in

CO – PO MAPPING

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

Semester: III					
Spreadsheet for Engineers					
Course Code	**:**	1BME307B	**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	Mathematics
Knowledge on Fundamental Concepts	Basic Mathematical Operations
Knowledge on Connected Tools (If any)	Microsoft Office

Course Learning Objectives: This course will enable the students to	
CLO1	Apply spreadsheet tools to visualize data using charts such as XY scatter plots, combination charts, and error bars.
CLO2	Use Excel functions to perform basic statistical and mathematical computations, including sum, average, weighted average, trigonometric, and exponential functions.
CLO3	Implement logical and lookup functions (IF, AND, OR, XOR, VLOOKUP) to solve engineering-related problems.
CLO4	Perform matrix operations such as addition, multiplication, transposition, inversion, and solve systems of linear equations using Excel.
CLO5	Analyze data using trend analysis, including interpolation, forecasting.

Experiments	
Sl. No.	**List of problems for which student should use Microsoft Excel and execute in the Laboratory**
1.	Create an XY scatter graph, XY chart with two Y-Axes, add error bars to your plot, create a combination chart for the given problem.
2.	Computing Sum, Average, Count, Max and Min, Computing Weighted Average for the given problem.
3.	Trigonometric Functions, Exponential Functions, Using the CONVERT Function to Convert Units for the given problem.
4.	Solve the given problem using Logical Expressions, Boolean Functions, IF Function.
5.	Creating a Quadratic Equation Solver, Table VLOOKUP Function, AND, OR and XOR functions for a given problem.
6.	Adding Two Matrices, multiplying a Matrix by a Scalar, Multiplying Two Matrices in Excel.
7.	Transposing a Matrix, Inverting a Matrix and Solving System of Linear Equations using Matrix Operations in Excel.
8.	Develop a Trendline, Slope and Intercept, Interpolation and Forecast, Slope and Tangent in Excel.

Open Ended Experiments	
1	Numerical Integration Using Excel: The Rectangle Rule, The Trapezoid Rule, The Simpson's Rule, creating a User-Defined Function Using the Simpson's Rule.
2	Differential Equations: Euler's Method, Modified Euler's Method, The Runge, Kutta Method, Solving a Second Order Differential Equation

Course Outcomes: After completing the course, the students will be able to	
CO1	Create and customize various charts (XY scatter, dual-axis, combination charts) to represent engineering data effectively.
CO2	Apply basic statistical and mathematical functions in Excel to compute sum, average, weighted average, trigonometric, and exponential values.
CO3	Analyse logical and lookup functions (IF, AND, OR, XOR, VLOOKUP) to solve data-driven problems.
CO4	Perform matrix operations including addition, multiplication, transposition, inversion, and solve systems of linear equations using Excel tools.
CO5	Analyze and interpret data using trendlines, interpolation, forecasting.

Text Books	
1	Ronald W. Larsen, Engineering with Excel, 5th Edition, Pearson/Prentice Hall, 2018.
2	Bernard Liengme and Keith Hekman, Liengme's Guide to Excel 2016 for Scientists and Engineers (Windows and Mac), Elsevier, 2019.

Reference Books	
1	E. Joseph Billo, Excel for Scientists and Engineers: Numerical Methods, John Wiley & Sons, 2007.
2	Eklas Hossain, Excel Crash Course for Engineers, Springer, 2021.
3	Thomas J. Quirk, Excel 2019 for Engineering Statistics: A Guide to Solving Practical Problems, Springer, 2020.

Web links and Video Lectures (e – Resources)	
1	Excel Resources - 600+ Self Study Guides, Articles & Tools (wallstreetmojo.com)
2	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	3	3	2		3					2	1		1
CO2	3	3			3					2			
CO3	3	3	2		3					2			
CO4	3	3	1	2	3					2			2
CO5	3	2		2	3					1	1		3

Semester: III					
Data Science for Mechanical Engineers					
Course Code	**:**	1BMEL307C	**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	Python
Knowledge on Fundamental Concepts	Math operations and Python Libraries
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Introduce basic data science tools relevant to mechanical engineering
CLO2	Enable students to analyze experimental and industrial data
CLO3	Develop skills in Python programming for engineering applications
CLO4	Apply data visualization and basic analytics techniques

Experiments	
Sl. No.	**List of problems for which student should conduct and execute in the Laboratory**
1.	**Python Fundamentals:** • Write programs for basic operations (arithmetic, loops, functions) • Implementation of arrays using **NumPy** • Matrix operations relevant to engineering problems
2.	**Data Handling** • Reading and writing datasets (CSV files) using **Pandas** • Data cleaning (handling missing values, filtering data) • Statistical analysis (Mean, Median, Standard deviation) Working with Arrays/Matrices
3.	**Data Visualization** • Plotting graphs (line, bar, histogram, scatter) using **Matplotlib** • Visualization of experimental data (stress-strain, temperature variation)
4.	**Mechanical Engineering Applications:** • Analysis of stress-strain data • Regression analysis for engineering data • Predictive analysis (basic trend forecasting)

Open Ended Experiments	
1	Case study: Predictive maintenance / manufacturing data

Course Outcomes: After completing the course, the students will be able to	
CO1	Use Python for basic engineering computations
CO2	Analyze and process mechanical engineering datasets
CO3	Visualize experimental data effectively
CO4	Apply basic data analytics to real-world problems

Text Books	
1	Python Programming for Mechanical Engineers, by Abdellatif M Sadeq, DOI: 10.13980/RG.2.2.33942.85972
2	Python for Programmers, Paul Deitel and Harvey Deitel, 1st Edition, 2021, Pearson Education,
3	Python Crash Course, A Hands – on Project Based Introduction to Programming", 2nd Edition, 2019, No Starch Press.
4	Python: The Complete Reference", 4th Edition, 2018, Mc-Graw Hill.

Reference Books	
1	Python Data Analytics, Fabio Nelli, A Press Publishing,1st Edition, 2015 .
2	Zero To Mastery in Python Programming, U Dinesh Kumar, Willey Publications First Edition: 2019.
3	Automate the Boring Stuff with Python, Al Sweigart 1 st Edition, No Starch Press, 2015.

Web links and Video Lectures (e – Resources)	
1	https://www.udemy.com/course/python-for-mechanical-engineers/?couponCode=IND21PM
2	https://lms.decibelslab.com/courses/take/Python-for-Mechanical-Engineers/lessons/19476411-1-introduction
3	https://www.learnpython.org/
4	https://dineshkvs.wordpress.com/class-xics/

CO – PO MAPPING

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

Semester: III					
Virtual Reality					
Course Code	:	1BMEL307D	**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	Computer-Aided Design (CAD), 3D modelling and visualization
Knowledge on Fundamental Concepts	Basics of 3D geometry, modelling, rendering, and visualization
Knowledge on Connected Tools (If any)	AutoCAD / SolidWorks / Fusion 360 / Creo

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamentals of Virtual Reality (VR) systems, including VR hardware, navigation, and immersive environments.
CLO2	Import, optimize, and visualize mechanical CAD models using suitable VR and visualization platforms.
CLO3	Develop interactive VR environments by applying materials, lighting, animation, scene creation, and basic interaction techniques.
CLO4	Apply VR tools for product visualization, mechanical assembly simulation, design communication, and interactive model development.

Experiments	
Sl. No.	**List of problems for which student should conduct and execute in the Laboratory**
1.	Introduction to VR systems, hardware, and navigation
2.	Importing CAD models (from AutoCAD / SolidWorks / Fusion 360) into VR platforms and optimizing
3.	Lights, Material application and visualization
4.	Scene creation and basic interaction in VR
5.	Blueprint creation
6.	Animation and walkthrough experience in VR
7.	VR-based assembly simulation 1
8.	VR-based assembly simulation 2
9.	Product visualization project
10.	Interactive mechanical model

Open Ended Experiments	
1	Mini Project Part 1: Design a mechanical component/s and develop the interactive VR environment for the mechanical component
2	Mini Project Part 2: Design a mechanical component/s and develop the interactive VR environment for the mechanical component

Course Outcomes: After completing the course, the students will be able to	
CO1	Import and visualize CAD models in VR environments.
CO2	Apply VR tools for product visualization, manipulation and assembly.
CO3	Develop simple interactive VR environments for mechanical components.
CO4	Evaluate VR as a tool for design communication and simulation.

Text Books	
1	Steven M LaValle , "Virtual Reality", Cambridge University Press, 2023
2	William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application, and Design", 2nd Ed., Morgan Kaufmann, 2018

Reference Books	
1	https://dev.epicgames.com/documentation/ • Unreal Engine Documentation • Twinmotion Learning Guides

Web links and Video Lectures (e – Resources)	
1	https://dev.epicgames.com/community/unreal-engine/learning
2	https://docs.unrealengine.com
3	https://developer.oculus.com
4	https://www.blender.org/support/tutorials/

CO – PO MAPPING

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

Software Required:

1. CAD SOFTWARE (PREREQUISITE)

- AutoCAD/ SolidWorks / Fusion 360 / Creo

2. VR & VISUALIZATION SOFTWARE

- Twin motion
- Unreal Engine
- Unity

3. FILE PIPELINE / CONNECTORS

- Data smith Plugin (for CAD → Unreal workflow)
- FBX / OBJ exporters

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

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

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

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

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

Activity – 3	Women empowerment, digital literacy, and community leadership.
	Rural outreach, public awareness campaigns, social responsibility, and volunteerism.

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

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

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

Sl. No.	Practice Session Description
1.	Lecture session by NSS Officer
2.	Selection of topic, Commencement of activity and its progress
3.	Execution of Activity
4.	Case study based Assessment, Individual performance
5.	Sector wise study and its consolidation
6.	Video based seminar for 10 minutes by each student At the end of semester with Report.
➢ In the 3rd semester, each student should do activities according to the scheme and syllabus.	

- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 3rd semester, consolidated report of all activities compiled report should be submitted as per the instructions.

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

Assessment Details for CIE (100 Marks)

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

Suggested Learning Resources:

Books:

1	NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2	Government of Karnataka, NSS cell, activities reports and its manual.
3	Government of India, NSS cell, Activities reports and its manual.

CO – PO MAPPING

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

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_cSb0Zo8?si=55M6QAC2T8VqZN39
2	https://www.youtube.com/live/RfM4lAJQgCc?si=xfK0b6exvkBujugr
3	https://youtu.be/DZA_cSb0Zo8?si=55M6QAC2T8VqZN39

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
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	:	1BCE310		**Credits**	:	0
Hours/Week (L:T:P:SL)	:	36:0:0:24		**CIE**	:	**100 Marks**
Total Hours	:	36		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Prerequisites:	
Courses	Fundamentals of Mathematics & English
Knowledge on Fundamental Concepts	Arithmetic operations, fractions, decimals, and elementary algebra. comprehension of basic English
Knowledge on Connected Tools (If any)	**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	**6 Hrs**

Introduction to Aptitude and Vedic Mathematics

Understanding Aptitude

Overview of aptitude skills and their significance in problem-solving and decision-making. Types of aptitude skills commonly assessed in competitive exams and professional settings.

Vedic Mathematics Techniques

Introduction to Vedic Mathematics for faster and more efficient calculations. Key techniques and shortcuts to improve speed and accuracy in quantitative problems.

Importance of Aptitude Skills

The role of aptitude in career development and academic success. How strong aptitude skills enhance analytical thinking, logical reasoning, and performance in assessments.

Number System

Divisibility & Remainder, Multiples & Factors, Integers, LCM & HCF, Complete a number Series, Find the Missing Term and Wrong Term, Simplification, BODMAS Rule, Approximation, Decimals, Fractions, Surds & Indices

Percentage

Calculation-oriented basic percentage, Profit and Loss, Successive Selling type, Discount & MP, Dishonest Dealings

T-1,C1-11

Module – 2	**6 Hrs**

Coding Decoding: Letter Coding, Number Coding, symbol coding Clocks and Calendar **Reasoning -** Blood Relation, Sense of Direction, Arithmetic & Alphabet. Visual Sequence, Visual analogy and classification. **Analytical Reasoning -** Single & Multiple comparisons, Linear Sequencing. **T-3-C2,3,4,6,7,10,12**
Module-3 **6 Hrs**
Logical Aptitude - Syllogism, Venn-diagram method, Three statement syllogism, Deductive and inductive reasoning. Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions. **Linear Seating Arrangement** Single or Double rows facing each other or away from each other in the same direction **Circular Seating Arrangement** Uni- & Bi-directional problems on Circular, Square, Rectangular, Hexagonal tables **T2-C2,5. R-1- C1-3**
Module-4 **6 Hrs**
Ratio and Proportion Simple Ratios, Compound Ratios, Comprehend and Dividend, Direct & Indirect Proportions, Problems on ages, Mixtures & Allegation **T-1,C12,13&16**
Module-5 **6 Hrs**
Partnerships Interest Simple Interest, Compound Interest, Mixed Interest, Installments. **T-1,C14,15,17&29**

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

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

Text Books	
1	**Quantitative Aptitude for Competitive Examinations** by R.S. Aggarwal Chand Publishing. – 2023.
2	**Vedic Mathematics** by Bharati Krishna Tirthaji (ISBN- 978-8120801639), Sixteenth Reprint, Published by Motilal Banarsidass Publishers, - 1985
3	**Logical and Analytical Reasoning** by A.K. Gupta (ISBN- 978-9350127766), 39th Edition, Ramesh Publishing House - 2024

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

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

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**3**	**2**									
CO2	**3**	**3**									
CO3	**2**	**3**									
CO4	**3**	**2**									
CO5	**2**	**2**			**1**				**2**		**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 Technically Competent Engineers to Serve the Society

Department Mission

- Imparting strong fundamental knowledge in Mechanical Engineering and allied fields.
- Fostering a culture of collaboration and propagating Industry institute interactions to enhance advances in latest technologies.
- Creating State-of-Art facilities benefitting students and faculty to carryout Research, Innovation and Consultancy.
- Providing conducive environment for both students and faculty to engage in lifelong learning activities.
- Inculcating Professional ethics, Leadership qualities and Entrepreneurial skills among students.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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