AC: 01/25
Item No: 06

The Bombay Salesian Society's

Don Bosco Institute of Technology, Mumbai

(An Autonomous Institute affiliated to University of Mumbai)

Department of Mechanical Engineering

CURRICULUM STRUCTURE FOR SECOND YEAR ENGINEERING SEMESTER III

(As per NEP 2020)

(Scheme: DB25-V1)

Effective from Academic Year 2025 – 2026

1. Preamble

Don Bosco Institute of Technology, Kurla, Mumbai, proudly celebrates the achievement of autonomous status—an academic milestone that reaffirms our steadfast commitment to excellence, holistic development, and student-centric learning. This autonomy empowers us to craft and implement a curriculum that is forward-looking, contextually relevant, and deeply rooted in our institutional values and the aspirations of our nation.

As an autonomous institution affiliated with the University of Mumbai, DBIT embraces the opportunity to restructure its academic framework in alignment with the University Grants Commission (UGC) guidelines and the National Education Policy (NEP) 2020. This curriculum framework outlines the undergraduate engineering programs for the EXTC, COMP, IT, and MECH branches. It reflects NEP's emphasis on multidisciplinary learning, flexibility, and outcome-based education, while staying true to the Don Bosco educational philosophy.

The curriculum adopts a top-down approach, beginning with the institutional Vision and Mission, which guides the definition of Program Educational Objectives (PEOs) and Program Outcomes (POs). These outcomes are used to shape Course Outcomes (COs) and the content and assessment methods of each course. This ensures that all academic efforts remain aligned with the broader goals of transforming learners into technically sound, ethically responsible and socially aware citizens. Importantly, this curriculum has been shaped through extensive consultations with stakeholders, including industry experts, academic peers, alumni, and students—to ensure that it remains aligned with contemporary industry requirements and societal expectations. Their inputs have been instrumental in designing a framework that bridges the gap between academic learning and practical applicability.

Key Objectives in developing syllabus are:

1. **Develop Strong Technical Foundations:** Equip students with robust knowledge and skills in core engineering domains to solve real-world problems through design, analysis, and innovation.
2. **Foster Research, Innovation, and Entrepreneurship:** Cultivate a spirit of inquiry, critical thinking, and entrepreneurial mindset to promote research-based problem-solving and startup culture.
3. **Enhance Interdisciplinary and Industry-Ready Competencies:** Integrate emerging technologies, multidisciplinary learning, and practical exposure to prepare students for dynamic industry requirements and lifelong learning.
4. **Promote Ethical, Sustainable, and Socially Responsible Engineering Practice:** Inculcate ethics, human values, and environmental consciousness to enable students to contribute meaningfully to society and sustainable development.
5. **Empower Communication, Leadership, and Teamwork Abilities:** Strengthen students' soft skills, collaboration, and leadership to perform effectively in diverse professional and global environments

Academic design includes:

- A Choice-Based Credit System (CBCS) for flexibility
- A range of Minor and Honors options to encourage specialization and research
- Opportunities for field engagement, internships, and experiential learning
- Emphasis on skill enhancement and future workforce needs
- Integration of ethical reasoning, social awareness, and environmental consciousness

As an institution inspired by the values of Saint John Bosco, we strive to create a joyful and inclusive learning environment that fosters creativity, curiosity, and compassion. Through this curriculum framework, we renew our pledge to produce graduates who are not only professionally competent but also committed to the greater good of society.

2. Vision and Mission

Vision:

DBIT will be known to have an innovative, enjoyable, and holistic learning environment that transforms individuals into socially conscious citizens the Don Bosco way, and will lead in research and entrepreneurship in the area of sustainable technologies.

Mission:

1. To create future engineers who work with honesty and integrity and excel in the use of technology for the benefit of the underprivileged.
2. To train engineers to be innovative problem-solvers and entrepreneurs who engage in research and lifelong learning.
3. To provide a diverse and stimulating environment for staff and students to grow holistically.

3. Curriculum Design Philosophy

The curriculum is structured in alignment with the National Education Policy (NEP) 2020 and UGC guidelines. It follows a top-down approach wherein the institutional Vision and Mission guide the Program Educational Objectives (PEOs) and Program Outcomes (POs). These shapes the Course Outcomes (COs) and form the foundation for the course structure, the delivery, and the assessments.

Key design principles include:

- Emphasis on Outcome-Based Education (OBE) with clear mappings of COs to POs
- Integration of core technical knowledge with interdisciplinary electives
- Inclusion of vocational skills, internships, and community engagement
- Development of entrepreneurship and research aptitude through minor and honors pathways
- Encouragement of ethical, sustainable, and socially responsible engineering practices

This approach ensures that the curriculum remains academically rigorous, industry-relevant, and value-driven.

4. Credit Guidelines and Allocation

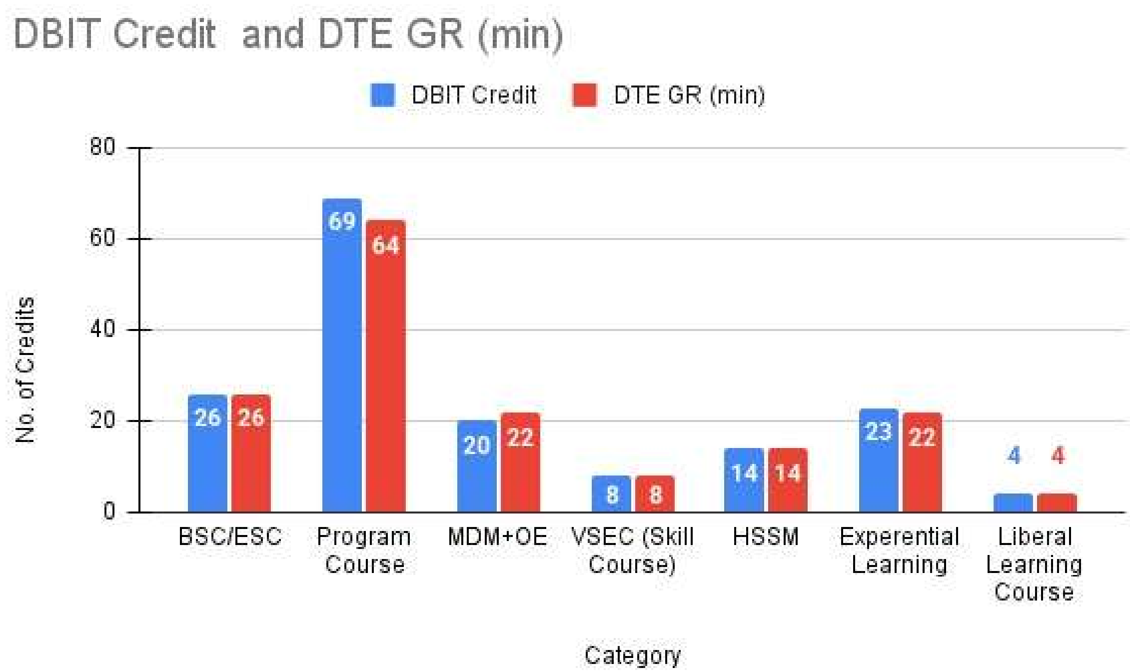
The curriculum is delivered through a structured credit system as follows:

Activity Type	Credit Definition
Theory Course	1 Credit = 15 Contact Hours
Laboratory / Studio / Workshop	1 Credit = 30 Contact Hours
Internship / Field Work	1 Credit = 40 Hours or 02 weeks
Seminar / Group Discussions	1 Credit = 15 Hours
Community Engagement / Field Project	1 Credit = 30 Hours

DBIT Curriculum Credit Structure: (FE to BE)

	Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits	DTE Credits
Basic Science Course	**BSC/ESC**	9	6							15	14-18
Engineering Science Course		7	4							11	12 - 16
Programme Core Course (PCC)	**Program Courses**		3	16	14	6	6	6		51	44-56
Programme Elective Course (PEC)						3	3	6	6	18	20
Multidisciplinary Minor (MDM)	**Multidisciplinary Courses**				3	4	4	3		14	14
Open Elective (OE) Other than a particular program					2	2		2		6	8
Vocational and Skill Enhancement Course (VSEC)	**Skill Courses**	3	3	2						8	8
Ability Enhancement Course (AEC -01, AEC-02)	**Humanities Social Science and Management (HSSM)**		2			2				4	4
Entrepreneurship/Economics/ Management Courses					2		2			4	4
Indian Knowledge System (IKS)			2							2	2
Value Education Course (VEC)		2		2						4	4
Research Methodology	**Experiential Learning Courses**					2				2	4
Community. Engagement. Project (CEP)/ Field Project				1	1	1				3	2
Project							3	3		6	4
Internship/ OJT									12	12	12
Co-curricular Courses (CC)	**Liberal Learning Courses**		1		1		1		1	4	4
	Total Credits (Major)	21	21	21	23	20	19	20	19	164	160- 176

Graphical Representation:



5. Degree Options and Exit Pathways

Students are offered flexible learning pathways through the following options:

Undergraduate Degree Options:

- B.E. –164 credits
- B.E. with Minor/Honors – 182 credits
- B.E. Honors with Research – 182 credits

Multiple Entry-Exit Options (Aligned with NEP 2020):

Exit Options	Credits Structure
Certificate after Year 1:	42 Credits + 08 credits (04 credit Exit course + 04 Summer internship).
Diploma after Year 2:	86 credits + 08 credits (04 credit Exit course + 04 Summer internship).
B. Vocational Degree after Year 3:	125 credits + + 08 credits (04 credit Exit course + 04 Summer internship).

Credits earned are banked in the **Academic Bank of Credits (ABC)** for lifelong learning flexibility.

Abbreviations Used:

AEC	Ability Enhancement Course
AEL	Ability Enhancement Laboratory
BSC	Basic Science Course
BSL	Basic Science Laboratory
CEP	Community Engagement Project
CC	Co-curricular Courses
CIE	Continuous Internal Evaluation
EEM	Entrepreneurship, Economics and Management
ELC	Experiential Learning Courses
ESC	Engineering Science Course
ESE	End Semester Examination
ESL	Engineering Science Laboratory
FP	Field Project
HSSM	Humanities Social Science and Management
IKS	Indian Knowledge System
L	Lecture
LLC	Liberal Learning Courses
MDM	Multidisciplinary Minor
MSE	Mid Semester Exam
OE	Open Elective
OJT	On Job Training
P	Practical
PCC	Program Core Course
PCL	Program Core Laboratory
PEC	Program Elective Course
T	Tutorial
VEC	Value Education Course
VSEC	Vocational and Skill Enhancement Course

UG Second Year Mechanical Engineering Program

Curriculum Scheme and Structure: Semester III

Course Code	Course Vertical	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
			L	P	T	L	P	T	Total
25ME3PCC01	**PCC**	Mathematics for Mechanical Applications	3	-	1	3	-	1	**4**
25ME3PCC02	**PCC**	Strength of Materials	3	2	-	3	1	-	**4**
25ME3PCC03	**PCC**	Manufacturing Processes	3	2	-	3	1	-	**4**
25ME3PCC04	**PCC**	Thermodynamics	3	-	1	3	-	1	**4**
25ME3VSEC01	**VSEC**	CAD Modeling and GD&T	-	2* + 2	-	-	2	-	**2**
25IL3VEC01	**VEC**	Sustainable Development	2	-	-	2	-	-	**2**
25ME3CEP01	**CEP**	Community Engagement Project – 1	-	2	-	-	1	-	**1**
		Total	**14**	**10**	**2**	**14**	**5**	**2**	**21**

* Two hours of demo/discussion for entire class

Examination Scheme & Assessment Structure

Examination Marking Scheme: Semester III

Course Code	Course Vertical	Course Name	Examination Marks						
			CA	MSE	ESE	TW	OR	PR	Total
25ME3PCC01	**PCC**	Mathematics for Mechanical Applications	20	30	50	25	-	-	125
25ME3PCC02	**PCC**	Strength of Materials	20	30	50	25	25	-	150
25ME3PCC03	**PCC**	Manufacturing Processes	20	30	50	25	-	-	125
25ME3PCC04	**PCC**	Thermodynamics	20	30	50	25	25	-	150
25ME3VSEC01	**VSEC**	CAD Modeling and GD&T	-	-	-	25	-	25	50
25IL3VEC01	**VEC**	Sustainable Development	50	-	-	-	-	-	50
25ME3CEP01	**CEP**	Community Engagement Project – 1	-	-	-	25	25	-	50
		Total	**130**	**120**	**200**	**150**	**75**	**25**	**700**

UG Second Year Mechanical Engineering Program
Assessment Methodology

Type of Courses	Assessment Tools	Marks Distribution
Theory	**CA-20**	Certification: NPTEL (20 Marks) (Approved by instructor) OR Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / simulation of a course-based concept.
Theory (VEC)	**CA-50**	• Active Participation = 5 marks • MCQ /Class Test= 10 marks • Assessment of the activity carried out by student = 25 marks • Assignment = 10 marks
Workshop	**CA-50**	• Active Participation = 5 marks • Trade 1# = 15 marks • Trade 2# = 15 marks • Trade 3# = 15 marks # Based on the performance and satisfactory completion of trade wise tasks.
Liberal Learning Courses (LLC)	**CA-50**	• Active Participation = 5 marks • Assessment of the Activity carried out by student = 25 marks • Cultural Event Participation = 10 marks • Technical Event Participation = 10 marks
Theory	**MSE**	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • For each question, A and B should be based on the same CO. • MSE should be based on 50% syllabus. • Time: 90 minutes (1 hour 30 minutes) • Total Marks: 30
Theory	**ESE**	Question Paper Pattern is as follows: All Questions are compulsory. • Q1 A or B - 10 marks • Q2 A or B - 10 marks • Q3 A or B - 10 marks • Q4 A or B - 10 marks • Q5 A or B - 10 marks • For each question, A and B should be based on the same CO.

		• ESE should be based on 30% syllabus of MSE and 70% syllabus after MSE. • Time: 120 minutes (2 hours) • Total Marks: 50
Course - Laboratory	**TW- 25**	• Active Participation (Lab) = 5 marks • Laboratory Report = 10 marks • Laboratory performance = 10 marks Based on the performance and satisfactory completion of assigned laboratory work.
Community Engagement project	**TW-25**	• Active Participation = 05 marks • Project Report = 10 marks • Progress presentations (min 02) & demonstration = 10 marks
Tutorial	**TW-25**	• Active Participation = 5 marks • Tutorial Submission = 20 marks Tutorials should cover the entire syllabus.
Laboratory	**OR-25**	Oral examination will be based on the entire syllabus.
Laboratory	**PR-25**	Practical examination will be based on the experiments performed by the students during laboratory sessions.

Weightage of COs across all assessments*:

Course Outcomes	Weightage (Percentage)
CO-1, CO-2	**20-30**
CO-3, CO-4	**40-50**
CO-5, CO-6	**20-30**

***Note: Total weightage of all COs should be 100%**

Heads of Passing:

a. **Passing Criteria for Theory Course:** 40% of maximum marks in CA, MSE, ESE taken together

b. **Passing Criteria for Laboratory/Tutorial (Term Work):** 40% of maximum marks

c. **Passing Criteria for Oral/Practical:** 40% of maximum marks

<table>
<tr><th>Course Code</th><th>Course Name</th><th colspan="3">Teaching Scheme
(Hrs. / Week)</th><th colspan="5">Credits Assigned</th></tr>
<tr><td rowspan="7">25ME3PCC01</td><td rowspan="7">Mathematics for Mechanical Applications</td><td>L</td><td>P</td><td>T</td><td>L</td><td>P</td><td>T</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td>-</td><td>1</td><td>3</td><td>-</td><td>1</td><td colspan="2">4</td></tr>
<tr><td colspan="8">Examination Scheme</td></tr>
<tr><td></td><td>CA</td><td>MSE</td><td>ESE</td><td>TW</td><td>OR</td><td>PR</td><td>Total</td></tr>
<tr><td>Theory</td><td>20</td><td>30</td><td>50</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Lab / Tut</td><td>-</td><td>-</td><td>-</td><td>25</td><td>-</td><td>-</td><td>25</td></tr>
<tr><td>Total</td><td colspan="7">125</td></tr>
</table>

Pre-Requisite Courses:	1. 25FE1BSC01 - Fundamentals of Engineering Mathematics -I 2. 25FE2BSC02 - Fundamentals of Engineering Mathematics –II

Course Objectives:

1) To equip students with analytical and numerical mathematical tools such as Laplace transforms, matrix algebra, and vector calculus to model and solve mechanical engineering problems.
2) To introduce complex integration techniques and numerical solutions of partial differential equations relevant to heat transfer, vibrations, and fluid flow.
3) To develop students' ability to analyze and interpret engineering data using probability distributions, statistical methods, and curve fitting techniques.
4) To foster self-directed learning through applied problem-solving and real-world engineering applications.

<table>
<tr><td rowspan="7">Course Outcomes</td><td colspan="2">After successful completion of the course, the students will be able to</td></tr>
<tr><td>CO1</td><td>Recall fundamental mathematical concepts, formulae, and properties relevant to Mechanical Engineering applications. (Remembering)</td></tr>
<tr><td>CO2</td><td>Describe key principles and theoretical foundations of mathematical methods used in Mechanical Engineering analysis (Understanding)</td></tr>
<tr><td>CO3</td><td>Apply appropriate analytical and computational techniques to formulate and solve Mechanical Engineering problems (Applying)</td></tr>
<tr><td>CO4</td><td>Analyze mathematical models to interpret mechanical system behavior, trends, and responses. (Analyzing)</td></tr>
<tr><td>CO5</td><td>Evaluate and compare various mathematical and statistical methods for interpreting and modeling Mechanical Engineering problems (Evaluating)</td></tr>
<tr><td>CO6</td><td>Design and develop empirical models using statistical and computational methods to address real-world problems in Mechanical Engineering. (Creating)</td></tr>
</table>

Syllabus:

Module No.	Unit No.	Topics	Hours
1		**Laplace Transforms**	08
	1.1	Laplace Transforms of Standard Functions: Definition of Laplace Transform, Laplace of constants, exponential, sine, cosine, and polynomials	
	1.2	Properties of Laplace Transforms: Linearity, first and second shifting theorems, Differentiation and integration in time domain, Laplace of derivatives and integrals, Heaviside function and its Laplace transform, Dirac delta function.	
	1.3	Inverse Laplace using Partial Fractions: Method of partial fractions, Convolution theorem (basic)	
	1.4	Application of Laplace Transform: Solving Ordinary Differential Equations	
	Self-Learning Topics: Applications of Laplace in Mechanical Vibrations (Case study examples only)		
2		**Complex Functions and Integration**	08
	2.1	Analytic Functions, Cauchy-Riemann Conditions, Integral Formula: Definition of analytic function, Necessary and sufficient conditions for analyticity, Harmonic functions and their physical significance, Orthogonal Trajectories	
	2.2	Contour Integration and Residue Theorem: Cauchy's integral Theorem, Cauchy's integral formula for derivatives, Zeros and Poles, Residues at poles, Residue theorem for evaluating real integrals	
	2.3	Taylor and Laurent Series: Taylor and Laurent series expansions in ROC.	
	Self-Learning Topics: Real-life Applications of Residue Theorem in Engineering		
3		**Matrix Algebra and Eigenvalue Problems**	07
	3.1	Eigenvalues and Eigenvectors: Characteristic equation, Computation and properties of eigenvalues and eigenvectors, Use of eigenvalues in free vibrations of mechanical systems, Natural frequencies and mode shapes	
	3.2	Diagonalization and Cayley-Hamilton Theorem: Conditions for diagonalizability, Statement and verification of Cayley-Hamilton theorem, Using the theorem to find matrix powers	
	Self-Learning Topics: Modal Analysis in Mechanical Systems using Eigenvalues (case study example)		
4		**Vector Calculus**	06
	4.1	Line, Surface, and Volume Integrals: Line integrals in scalar and vector fields, Surface integrals for flux, Volume integrals for mass or charge distributions	
	4.2	Vector Integral Theorems: Green's theorem in plane with verification, Stokes' theorem, Gauss' divergence theorem	
	Self-Learning Topics: Fluid Flow Analysis using Vector Calculus		
5		**Numerical Methods for PDEs**	07
	5.1	Classification of PDEs: Parabolic, elliptic, and hyperbolic equations, General and canonical forms	

	5.2	Numerical Methods: Crank Nicholson method and Bender Schmidt method	
	5.3	Finite Difference Method (FDM) for 1D Equations: Discretization Techniques, Forward, backward, and central difference schemes, Grid generation, Discretization of the heat equation, Discretization of the wave equation	
	Self-Learning Topics: Introduction to Finite Element Methods		
6		**Probability Distributions and Curve Fitting**	**09**
	6.1	Probability Distributions: Binomial distribution: definition and applications, Poisson distribution: properties and mean/variance, Normal distribution: bell curve, standard normal table	
	6.2	Statistical Measures and Curve Fitting: Mean, variance, standard deviation for grouped and ungrouped data, fitting a straight line (regression line), Fitting exponential and power curves by method of least squares	
	Self-Learning Topics: Pareto charts, Control Charts and Quality Control Using Normal Distribution		
		TOTAL	**45**

Text Books:

1) Shanti Narayan and P K Mittal, Text book of Matrices, S. Chand Publication
2) Brown and Churchill, Complex Variables and Applications, McGraw-Hill education
3) Murray R. Spiegel, Laplace transforms, Schaum's Outline Series

Reference Books:

1) Dr. B. S. Grewal, Engineering Mathematics, Khanna Publication
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Limited,
3) R. K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa publication
4) H.K. Das, Advanced Engineering Mathematics, S. Chand Publication
5) B.V. Ramana, Higher Engineering Mathematics McGraw Hill Education

Useful Links:

1) https://nptel.ac.in/courses/111105134
2) https://nptel.ac.in/courses/122103012
3) https://nptel.ac.in/courses/122107037

Tutorials:

Tut. No.	Suggested Tutorial Topics
1	Laplace Transform: Linearity, first and second shifting theorems
2	Laplace Transform: Differentiation and integration in time domain, Laplace of derivatives and integrals
3	Inverse Laplace Transform: Method of partial fractions, Convolution theorem (basic)
4	Application of Laplace Transform
5	Complex Functions: Analytic function, Harmonic functions
6	Complex Integration: Cauchy's integral formula for derivatives, Zeros and Poles, Residues at poles,

Tut. No.	Suggested Tutorial Topics
7	Complex Integration: Residue theorem, Taylor and Laurent series
8	Matrix Algebra: Eigenvalues and Eigenvectors
9	Matrix Algebra: Diagonalization
10	Probability Distributions: Binomial distribution and Poisson distribution
11	Probability Distributions: Normal distribution
12	Curve Fitting: Fitting a straight line(regression line), Fitting exponential and power curves by method of least squares
13	Vector Calculus: Line Integral and Green's theorem
14	Numerical Methods for PDEs: Crank Nicholson method and Bender Schmidt method

Assessment Methodology:

Assessment Tools	Marks Distribution
Continuous Assessment (CA) 20 marks	Certification: NPTEL (20 Marks) (Approved by instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / simulation of a course-based concept.
Term Work (TW) 25 Marks	• Active Participation = 5 marks • Tutorial Submission = 20 marks Tutorials should cover the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned					
25ME3PCC02	Strength of Materials	L	P	T	L	P	T	Total		
		3	2	-	3	1	-	4		
		Examination Scheme								
			CA	MSE	ESE	TW	OR	PR	Total	
		Theory	20	30	50	-	-	-	100	
		Lab/Tut	-	-	-	25	25	-	50	
		Total	150							

Pre-Requisite Course:	25FE2ESC01 - Engineering Mechanics

Course Objectives:

1) To introduce fundamental concepts of stress, strain, and deformation in materials.
2) To apply analytical and graphical methods to determine stresses and strains under combined loading
3) To develop the ability to analyze effects of various loadings on structural members.
4) To understand the mechanical behaviour of materials and cross-sectional response under various loading conditions.

Course Outcomes	After successful completion of the course, the students will be able to	
	CO1	Know fundamental concepts and terminology related to induced stresses in the solids when subjected to external loading. (Remembering)
	CO2	Explain the behaviour of materials and structural members under various loading conditions using standard theories and concepts. (Understanding)
	CO3	Solve basic engineering problems involving variety of external loadings using suitable methods. (Applying)
	CO4	Analyze the internal responses of structural members to different types of loads using graphical and analytical techniques. (Analyzing)
	CO5	Evaluate the mechanical properties of materials by interpreting data from standard tests. (Evaluating)
	CO6	Design and simulate structural models under different loading and boundary conditions using FEA tools to predict deflection and stresses. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1		**Introduction - Concept of Stress and Strain**	13
	1.1	Stresses and Strains: Definition – Stress, Strain, Hooke's law, Elastic limit, Yield stress, Ultimate stress, Modulus of elasticity, Tensile & compressive stresses, Shear stress, Factor of safety Stress & strain in compound bars, deformation of tapering members, deformation due to self –weight, composite sections, Modular ratio, Thermal stresses in composite bars	
	1.2	Elastic Constants: Lateral strain, Volumetric strain, Poisson's ratio, Modulus of rigidity, Bulk Modulus, Relation between elastic constants, Volumetric strain for uniaxial, biaxial and tri-axial loading	
	1.3	Principal Planes & Stresses: Principal Planes (Major & Minor), Principal Stress (Major & Minor), Simple shear or complementary shear (Tangential), Normal and tangential (Shear) stresses on inclined /oblique plane at an angle θ, Mohr's Circle Method	
	Self-Learning Topic: Problems on Stresses in Composite bars		
2		**Shear Force and Bending Moment Diagrams in Beams**	06
	2.1	Concept of Shear force and bending moment, Nature of Shear force and bending moment diagrams	
	2.2	Relationship between load intensity, shear force and bending moment	
	2.3	Shear force and bending moment diagrams for statically determinate beams subjected to point loads, uniformly distributed loads, uniformly varying loads, couple and their combinations	
	Self-Learning Topic: Shear force and bending moment diagrams for statically determinate beams subjected to uniformly Varying loads		
3		**Stresses in Beams**	08
	3.1	Area Moment of Inertia, Parallel Axes theorem, Polar Moment of Inertia.	
	3.2	Concept of Pure Bending, Theory of Pure bending, Assumptions made in theory of pure bending, Flexural formula, Bending stress distribution in beams, Section Modulus	
	3.3	Theory of Shear stress during bending, Expression for shear stress, Shear stress distribution diagrams for standard sections, Shear stress distribution in beams when subjected to point and distributed loading	
	Self-Learning Topic: Section modulus of standard shapes		
4		**Slope and Deflection in Beams**	05
	4.1	Differential equation for deflection, Assumptions, Double Integration method, Macaulay's method to determine Slope and Deflection in beams subjected to point load, UDL and couple,	
	Self-Learning Topic: Double Integration method for simply supported beam subjected to point load, UDL, UVL to calculate deflection and slope in beams		
5		**Torsion and Strain Energy**	07

	5.1	Difference between bending moment & torque, Assumptions made in theory of torsion, Torsional equation, Shear stress variation in shaft, Torsional strength, Torsional rigidity, Torsional flexibility, Polar MOI of solid and hollow shaft, Power transmitted by a shaft	
	5.2	Strain Energy: Resilience, Proof Resilience, strain energy stored in the member due to gradual, sudden and impact loads, Strain energy due to shear, bending and torsion.	
	Self-Learning Topic: Case study to understand the importance of strain energy calculations		
6		**Columns and Thin Shells**	**06**
	6.1	Columns: Classification of columns, Buckling and Bending, Crushing and Buckling, Euler's theory for long columns with assumptions, Slenderness ratio, Buckling load, Types of end conditions for column, Equivalent of Effective length, Limitations of Euler's formula and Rankine formula.	
	6.1	Stresses and failure in thin wall cylinders, Circumferential and longitudinal stresses in thin cylindrical shells, change in dimensions & volume of thin Cylindrical, Stresses and strains in Spherical Shells subjected to internal pressure.	
	Self-Learning Topic: Real-world Applications of Column Buckling		
		TOTAL	**45**

Text Books:

1) James M. Gere and Barry J. Goodno: Mechanics of Materials, 2nd Edition, Cengage Learning (2009)
2) Ferdinand P Beer, E. Russell Johnston, John DeWolf and David mazurek: Mechanics of Materials, 5th Editon, McGraw Hill higher Education (2009)
3) S. Ramamrutham: Strength of Materials, 14th Edition, Dhanpat Rai Pvt. Ltd. (2014)

Reference Books:

1) W. Nash, Schaum's Outline Series: Strength of Materials, 5th Edition, McGraw Hill Publication, Special Indian Edition. (2015)
2) S. S. Ratan: Mechanics of Materials, 2nd Edition, Tata McGraw Hill Pvt. Ltd. (2011)
3) Irwin H. Shames: Introduction to Solid Mechanics, 3rd Edition, Pearson Publisher (2015)

Useful Links:

1) https://swayam.gov.in/nd1_noc20_ce34 – Swayam Course Material.
2) https://nptel.ac.in/courses/112107146 – NPTEL Course Material.
3) https://archive.nptel.ac.in/courses/105/105/105105108 – NPTEL Course Material.

List of Experiments:

Sr. no.	Title of the Experiment
1	Tensile test on Mild Steel
2	Tensile tests on Aluminium or Cast iron
3	Torsion test on mild steel
4	Effect of Heat Treatment on Torsional Strength

Sr. no.	Title of the Experiment
5	Impact tests: Izod tests and Charpy tests
6	Hardness tests: Rockwell and Brinell hardness tests
7	Effect of Heat treatment on hardness of mild steel using Impact and hardness tests
8	Flexural tests
9	Simulation of Cantilever Beam under loaded under UDL & Point load
10	Simulation of Simply Supported Beam under loaded under UDL & Point load
11	Simulation of Three-Point Bending Test of a Rectangular Beam Lamina or 3D Solid)
12	Simulation of Thin Cylinder under Internal Pressure (Hoop & Longitudinal Stress)
13	Simulation for Critical buckling load of a slender column with pinned–pinned ends.

List of Assignments:

(Minimum 3 problems on at least 6 topics from the following topics)

Assignment No.	Topics
1	Deformation of bars, Thermal Stresses, Volumetric stresses
2	Mohr's Circle
3	Shear force and bending moment diagrams
4	Bending and shear stresses
5	Torsion
6	Deflection of Beams
7	Strain Energy
8	Columns and Thin Shells

Assessment Criteria:

Assessment Tools	Marks Distribution
Continuous Assessment (CA) (20 marks)	Certification: NPTEL (20 Marks) (Approved by instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / simulation of a course-based concept.
Term Work (25 Marks)	• Active Participation (Lab) = 5 marks • Laboratory Report = 10 marks • Laboratory performance = 10 marks Based on the performance and satisfactory completion of assigned laboratory work.
Oral (25 Marks)	• Oral examination will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
		L	P	T	L	P	T	Total
25ME3PCC03	Manufacturing Processes	3	2	-	3	1	-	4

Examination Scheme							
	CA	MSE	ESE	TW	OR	PR	Total
Theory	20	30	50	-	-	-	100
Lab/Tut	-	-	-	25	-	-	25
Total	125						

Pre-Requisite Course:	25FE2PCC01 - Materials & Metallurgy

Course Objectives:

1) To introduce various manufacturing processes, machine tools for various applications
2) To understand working principle of non-traditional manufacturing processes
3) To introduce emerging technologies for Intelligent Manufacturing

Course Outcomes	After successful completion of this course the students will be able to	
	CO1	Know various traditional & non-traditional manufacturing processes and machine tools. (Remembering)
	CO2	Explain the working principles and applications of traditional and non-traditional machining processes. (Understanding)
	CO3	Apply traditional and non-traditional manufacturing processes for given application. (Applying)
	CO4	Analyze the effects of process parameters on quality of the product. (Analyzing)
	CO5	Evaluate and select suitable process for given applications. (Evaluating)
	CO6	Design a process flow for manufacturing a product for given specifications using intelligent manufacturing concepts. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1		**Introduction to Production Processes and Metal Casting**	10
	1.1	Classification of Production Processes and applications areas	
	1.2	Pattern making materials, Types of pattern and allowances. Sand molding and Machine molding, Gating system :Types of riser, types of gates, solidification	
	1.3	Key process parameters in casting and their effect on the process	
	1.4	Special casting processes : CO2 and shell molding, Investment casting, Die casting, Vacuum casting, Inspection & casting defects and remedies	
	1.5	Case studies on Key process parameters in casting and their effect on the process	
	Self-Learning Topics: Advantages of casting processes over other manufacturing processes and limitations, Typical applications of all types of casting processes.		
2		**Forming Processes**	8
	2.1	Introduction and classification of metalworking processes, hot and cold working processes Introduction, classification and analysis of forging and rolling operations, Defects in rolled and forged components, Extrusion process, Classification and analysis of wire and tube drawing processes	
	2.2	Sheet metal working processes Classification of Sheet metal operations, types of Presses used in sheet metal operations, types of dies	
	2.3	Case studies on Key process parameters in forging and rolling and their effect on the process	
	Self-Learning Topic: Practical life examples of forging, extrusion, and sheet metal operation		
3		**Joining Processes**	6
	3.1	Classification of various joining processes; Applicability, advantages and limitations of Adhesive bonding, Mechanical Fastening; Welding and allied processes, Hybrid joining processes	
	3.2	Classification and working of various welding methods: Gas, Arc, Chemical, Radiant, Solid State etc. Welding Joints, Welding Positions, Welding defects and their remedies	
	3.3	Case studies on Key process parameters in welding and their effect on the process	
	Self-Learning Topics: Practical examples of metal joining processes, their selection and applications		
4		**Machine Tools, Machining Processes**	8
	4.1	Machine Tools and Machining Processes: Lathe Machines, Milling Machines, Drilling Machines, and Grinding Machines and selection of grinding wheel (Dressing and Truing), Broaching machines, Lapping/Honing machines (Super Finishing Operations) and shaping/slotting/planning Machines, Gear Manufacturing	

	4.2	Tool Engineering Geometry and nomenclature of single point cutting tool, Speed, feed, depth of cut, Taylor's tool life equation,	
	4.3	Introduction to Jigs and Fixtures and types. Classification and types of Jigs and Fixtures and their applications	
	4.4	Case studies on Key process parameters in machining processes and their effect on the process.	
	Self-Learning Topics: Concept of chip formation and types of chips, Testing of grinding wheels		
5		**Non-Traditional Machining Processes**	**6**
	5.1	Electro-chemical machining (ECM), Electric-discharge machining (EDM), Ultrasonic machining (USM), Laser Beam Machining (LBM), Abrasive Jet Machining (AJM)	
	Self-Learning Topics: Water Jet Machining (WJM)		
6		**Polymer & Powder Processing and Intelligent Manufacturing**	**7**
	6.1	Powder Metallurgy: Introduction to PM, Powder making processes, Steps in PM. Compaction and Sintering processes. Secondary and finishing operations in PM.	
	6.2	Manufacturing processes used for polymers, Ceramics and composite materials.	
	6.3	Intelligent manufacturing: Lean Manufacturing, Agile Manufacturing, Cyber-Physical systems (CPS), Internet of Things (IoT) enabled manufacturing, Cloud Manufacturing	
	Self-Learning Topics: Applications, advantages and limitations of polymers, Ceramics and composite materials		
		TOTAL	**45**

Text Books:

1) A Textbook of Production Technology, P. C. Sharma, 2022, S Chand Publication
2) Production Technology, R. K. Jain, 2022, Dnyaandeep Publication.
3) Manufacturing Science, A. Ghosh and A. K. Malik, Second edition, 2010, Affiliated East-West Press.

Reference Books:

1) Tool Design, Donaldson, 5th Edition, 2017, McGraw Hill Education.
2) Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist, 2016, Apress.
3) Cyber-Physical Systems: From Theory to Practice by Danda B. Rawat, Joel Rodrigues, Ivan Stojmenovic, 2015, C.R.C. Press.
4) Optimization of Manufacturing Systems using Internet of Things by Yingfeng Zhang, Fei Tao, 2017, Academic Press (AP), Elsevier

Useful Links:

Links for online NPTEL/SWAYAM courses:

1) https://nptel.ac.in/courses/112/107/112107219/
2) https://nptel.ac.in/courses/112/107/112107215/
3) https://nptel.ac.in/courses/112/107/112107084/

Laboratory work:

1) One composite job consisting minimum two parts employing operations performed on Lathe machine
   a) Turning
   b) Facing
   c) Taper turning
   d) Parting
   e) Threading
2) Tool Grinding – To know basic tool Nomenclature and prepare basic single point cutting tool
3) One Job on Milling machine consisting of different milling operations
   a) Face milling
   b) End milling
4) Creating a process sequence and detailed drawing of each job.

Assessment Criteria:

Assessment Tool	Marks Distribution
Continuous Assessment (CA) (20 Marks)	Certification: NPTEL (20 Marks) (Approved by instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / simulation of a course-based concept.
Term Work (25 Marks)	• Active Participation (Lab) = 5 marks • Laboratory Report = 10 marks • Laboratory performance = 10 marks Based on the performance and satisfactory completion of assigned laboratory work

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned			
25ME3PCC04	Thermodynamics	L	P	T	L	P	T	Total
		3	-	1	3	-	1	4

Examination Scheme							
	CA	MSE	ESE	TW	OR	PR	Total
Theory	20	30	50	-	-	-	100
Lab/Tut	-	-	-	25	25	-	50
Total	150						

Pre-Requisite Courses:	25DBFE1BSC02 - Applied Physics

Course Objectives:

1) To impart the concepts of Energy, Heat and Work.
2) To familiarize with the fundamentals of quantification and the grade of energy.
3) To understand the effect of energy transfer on the properties of substances in the form of charts and diagrams.
4) To explore the application of the thermodynamics in vapour power and gas power cycles.

Course Outcomes	After successful completion of this course, the students will be able to	
	CO1	Know basic terminologies of thermodynamics. (Remembering)
	CO2	Explain the laws and concepts of Thermodynamics. (Understanding)
	CO3	Apply the thermodynamic laws to compute thermodynamic properties of a given system. (Applying)
	CO4	Analyze the impact of input parameters on thermodynamic properties on the performance of a given system. (Analyzing)
	CO5	Evaluate the performance of vapour and gas power cycles using thermodynamic parameters. (Evaluating)
	CO6	Design an ideal thermodynamic cycle or conceptual energy system component for improved efficiency. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1		**Basic Concepts of Thermodynamics and First Law of Thermodynamics**	10
	1.1	Basic Concepts: Definition of Thermodynamics, Microscopic and Macroscopic approach, Thermodynamic properties of the system, state, path, process and cycle, Point and Path functions, Thermodynamics system and types, Boundary and Surrounding, Thermodynamic equilibrium, Quasi-static process, Characteristic gas equation, Heat and Work, Concept of non-flow work - PdV work, Zeroth Law of Thermodynamics, Internal Energy, Concept of Enthalpy and Entropy	
	1.2	First Law of Thermodynamics: Statement & Equation, First law for Cyclic process (Joule's experiment), Perpetual Motion Machine of the First Kind, Application of first law to non-flow systems.	
	1.3	First law applied to flow system: Concept of flow process and flow energy, Concept of the steady flow process, Energy balance in a steady flow, Application of steady flow energy equation to nozzle, diffuser, turbine, compressor, pump, boiler, condenser, heat exchanger, throttling device.	
	1.4	Steady flow work Vdp, Significance of – VdP work, Relation between steady flow and non-flow work.	
	Self-Learning Topics: Applications of Thermodynamics, Specific Heat, Application of steady flow energy equation to diffuser, pump, condenser.		
2		**Second Law of Thermodynamics and Entropy**	8
	2.1	Second Law of Thermodynamics: Limitation of the first law of thermodynamics, Thermal reservoir, Concept, construction and working of heat engine, Heat pump and Refrigerator, Efficiency of heat engine and Coefficient of Performance of heat pump and refrigerator, Relation between COP of heat pump and refrigerator.	
	2.2	Statement of the second law of thermodynamics, Reversible and irreversible Process, Causes of irreversibility, Perpetual Motion Machine of the second kind, Carnot cycle, Carnot theorem	
	2.3	Entropy: Clausius theorem, Entropy is property of a system, Temperature-Entropy diagram, Clausius inequality, increase of entropy principle, T- ds relations, Entropy change during a process.	
	Self-Learning Topic: Carnot cycle		
3		**Availability and Thermodynamic Relations**	6
	3.1	Availability: High grade and low - grade energy, Available and unavailable energy, Dead State, Useful work, Irreversibility.	
	3.2	Availability of closed system & steady flow process, Helmholtz & Gibbs function.	
	3.3	Thermodynamic Relations: Maxwell relations, Clausis - Clapeyron Equation, Mayer relation, Joule-Thomson coefficient	

	3.4	Case study: Real Life examples of High grade and low - grade energy	
	Self-Learning Topics: Causes of Irreversibility.		
4		**Properties of Pure Substance**	**6**
	4.1	Advantages and applications of steam, Phase change process of water, sensible heat and latent heat, Saturation pressure and temperature.	
	4.2	Terminology associated with steam, Different types of steam. Property diagram: T-v diagram, p-v diagram, p-T diagram, Critical and triple point, T-s and an h-s diagram for water.	
	4.3	Calculation of various properties of wet, dry and superheated steam using the steam table and Mollier chart**.**	
	Self-Learning Topics: Applications of wet, dry and superheated steam for different applications		
5		**Vapour Power cycle**	**8**
	5.1	Principal components of a simple steam power plant, Carnot cycle and its limitations as a vapour cycle.	
	5.2	Rankine cycle with different turbine inlet conditions, Mean temperature of heat addition, Reheat Rankine Cycle.	
	5.3	Case Study: Layout an actual steam power plant and its working, Study the different inputs to a steam power plant	
	Self-Learning Topics: Principal components of a simple steam power plant		
6		**Gas Power cycles**	**7**
	6.1	Nomenclature of a reciprocating engine, Mean effective pressure.	
	6.2	Assumptions for Air Standard Cycle, Otto cycle, Diesel Cycle and Dual cycle, Comparison of Otto and Diesel cycle for same compression ratio.	
	6.3	Brayton Cycle, Sterling Cycle, Ericsson Cycle, Lenoir cycle, and Atkinson cycle	
	Self-Learning Topics: Components of an engine, Cooling system for an automobile engine		
		TOTAL	**45**

Text Books:

1) Thermodynamics by P K Nag, 6th Edition, TMH
2) Thermodynamics by Onkar Singh, 4th Edition New Age International
3) Thermodynamics by C P Arora,1st Edition TMH

Reference Books:

1) Thermodynamics: An Engineering Approach by Yunus A. Cengel and Michael A. Boles, 9th edition, TMH
2) Basic Engineering Thermodynamics by Rayner Joel, 5th edition, Longman Publishers
3) Engineering Thermodynamics Through Examples by Y V C Rao, Universities Press (India) Pvt Ltd

Useful Links:

1) https://nptel.ac.in/courses/112105266
2) https://nptel.ac.in/courses/112105220
3) https://nptel.ac.in/courses/112103275

Tutorials:

Tut. No.	Suggested Tutorial Topics
1	Applications of thermodynamics and its working.
2	Understand the Zeroth law of Thermodynamics and the different temperature measuring devices.
3	Apply First law of Thermodynamics to non-flow systems.
4	Introduction to flow devices and their functions.
5	Apply First law of Thermodynamics to flow system.
6	Apply Second law of Thermodynamics to heat engine, heat pump and refrigerator.
7	Apply Second law of thermodynamics to combined system of heat engine, heat pump and refrigerator.
8	Explain Availability - High grade and low - grade energy, Available and unavailable energy with the help of real life examples.
9	Calculate various properties of wet, dry and superheated steam using the steam table and Mollier chart.
10	Calculate the various properties and efficiency of Rankine cycle or Reheat Rankine Cycle with different turbine inlet conditions.
11	Applications: (To be shown in the laboratory): Identify and describe different components of an Internal Combustion engine and types of I. C. Engine.
12	Applications: (To be shown in the laboratory): Different components of Refrigeration and A/C Systems and its working.

Assessment Criteria:

Assessment Tool	Marks Distribution
Continuous Assessment (CA) (20 Marks)	Certification: NPTEL (20 Marks) (Approved by instructor) **OR** Any two Pedagogies (10 marks each) • MCQ /Class Test • Case study/Assignment • GATE based Tutorial • MOOCs Certification (Approved by Instructor) • Open Book Test • Working model / simulation of a course-based concept.
Term Work (25 Marks)	• Active Participation = 5 marks • Tutorial Submission = 20 marks Tutorials should cover the entire syllabus.
Oral (25 Marks)	• Oral examination will be based on the entire syllabus.

<table>
<tr><th rowspan="2">Course Code</th><th rowspan="2">Course Name</th><th colspan="3">Teaching Scheme (Hrs. / Week)</th><th colspan="5">Credits Assigned</th></tr>
<tr><th>L</th><th>P</th><th>T</th><th>L</th><th>P</th><th>T</th><th colspan="2">Total</th></tr>
<tr><td rowspan="6">25ME3VSEC01</td><td rowspan="6">CAD Modeling and GD& T</td><td>-</td><td>2* + 2</td><td>-</td><td>-</td><td>2</td><td>-</td><td colspan="2">2</td></tr>
<tr><td colspan="8">Examination Scheme</td></tr>
<tr><td></td><td>CA</td><td>MSE</td><td>ESE</td><td>TW</td><td>OR</td><td>PR</td><td>Total</td></tr>
<tr><td>Theory</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Lab/Tut</td><td>-</td><td>-</td><td>-</td><td>25</td><td>-</td><td>25</td><td>50</td></tr>
<tr><td>Total</td><td colspan="7">50</td></tr>
</table>

* Two hours of demo/discussion for entire class

Pre-Requisite Course:	25FE1ESC01 - Engineering Graphics

Course Objectives:

1) To familiarize students with the fundamentals of technical drawings, including machine, part, and assembly drawings, and to introduce the standards and symbols used in engineering communication.
2) To develop a strong understanding of limits, fits, tolerances, surface roughness, and GD&T, enabling students to interpret and apply these concepts in creating accurate working and manufacturing drawings.
3) To equip students with practical skills in CAD modelling and drafting, Focusing on 2D and 3D parametric design, application of GD&T, and preparation of production-ready drawings with appropriate data exchange formats.

<table>
<tr><td rowspan="7">Course Outcomes</td><td colspan="2">After successful completion of this course the students will be able to</td></tr>
<tr><td>CO1</td><td>Know key concepts and terminologies related to machine drawings. (Remembering)</td></tr>
<tr><td>CO2</td><td>Explain the principles of working drawings and the fundamentals of GD&T. (Understanding)</td></tr>
<tr><td>CO3</td><td>Use standard CAD tools and commands to create 2D and 3D models of engineering components. (Applying)</td></tr>
<tr><td>CO4</td><td>Differentiate between various types of drawing features to analyze their impact on manufacturing accuracy and function. (Analyzing)</td></tr>
<tr><td>CO5</td><td>Evaluate engineering drawings and CAD models for correctness in terms of GD&T application and manufacturability standards. (Evaluating)</td></tr>
<tr><td>CO6</td><td>Create detailed manufacturing drawings using CAD tools by incorporating principles of GD&T. (Creating)</td></tr>
</table>

Syllabus:

Module No.	Unit No.	Topics	Hours
1		**Introduction**	06
	1.1	Classification of drawings- machine drawing, production, drawing, part drawing, assembly drawing and its types, patent drawing.	
	1.2	Need of working drawing, difference between machine drawing and working drawing	
	1.3	Conventional representation (symbols) of materials, conventional representation of machine components – screw threads, welded joints, springs, gears, shafts bearings, knurling. Standard drafting and material abbreviations	
	Self-Learning Topic: Study and digitally represent typical industrial symbols used for mechanical components such as fasteners, springs, gears, and welds.		
2		**Limits, tolerances and fits**	06
	2.1	Limit systems and terms used – tolerance, limits, deviation, actual deviation, upper deviation, lower deviation, allowance, basic size, design size, actual size.	
	2.2	Tolerances- graphical illustration of tolerance zones, fundamental tolerances, fundamental deviation, calculation of fundamental shaft deviation, calculation of fundamental hole deviation	
	2.3	Fits- types of fits with symbols and applications, hole basis and shaft basis systems	
	Self-Learning Topic: Work out examples of shaft and hole combinations by referring to standard limit systems and tolerance charts.		
3		**Surface roughness, Machining symbols, working drawing**	04
	3.1	Surface roughness representation, indication of surface roughness, symbols specifying direction of lay, indication of machining allowance and surface roughness allowance on drawings.	
	3.2	Reading a working drawing	
	Self-Learning Topic: Mark surface finish indicators and machining-related instructions on technical views of mechanical parts using CAD tools.		
4		**Introduction to GD & T**	04
	4.1	What is GD & T? When to use GD & T, advantages of GD & T over Coordinate Dimensioning and Tolerancing Geometric characteristic symbols like- Form, Profile, Orientation, Run out, Location, etc.	
	Self-Learning Topic: Create a summary chart that explains various geometric control symbols along with their practical use in product design.		
5		**Symbols, Rules and Datum**	06
	5.1	Geometric characteristic Symbols. The feature control frame Rules Material conditions - Regardless of feature size (RFS), Maximum material condition (MMC), Least material condition (LMC), Material condition symbols and abbreviations	

	5.2	Degrees of freedom and immobilization of a part, application of Datum, datum feature selection, datum feature (inclined, cylindrical, etc.) identification, establishing datum, datum targets	
	Self-Learning Topic: Identify key reference surfaces for a given component and suggest suitable datum setups and control frames.		
6		**Form, orientation and position**	**04**
	6.1	Form- flatness, straightness, circularity, cylindricity Orientation- Parallelism, Perpendicularity, Angularity	
	6.2	Position (general) - Specifying the Position Tolerance, Regardless of Feature Size, MMC, Shift Tolerance, LMC	
	Self-Learning Topics: Choose an engineering part and apply appropriate geometric constraints like flatness, alignment, and exact location on the drawing.		
		TOTAL	**30**

Text Books:

1) Narayana KL, Kannaiah P, Reddy VK, Machine Drawing, by New Age International Publishers
2) Bhatt ND, Machine Drawing, Charotar Publishing House Pvt. Ltd., 50th Edition, ISBN-13: 978-9385039232, 2014

Reference Books:

1) Cogorno GR, Geometric Dimensioning and Tolerancing for Mechanical Design: A Self-Teaching Guide to ANSI Y 14.5M1982 and ASME Y 14.5M1994 Standards / Edition 1 by The McGraw-Hill Companies, Inc.
2) Kampbell RG, Roth ES, Integrated Product Design and Manufacturing Using Geometric Dimensioning and Tolerancing, by Marcel Dekker, Inc.
3) Meadows JD, Geometric dimensioning and tolerancing, by B.S Publications.

Useful Links:

1) https://www.gdandtbasics.com/
2) https://www.asme.org/codes-standards/y14-standards
3) http://www.ttc-cogorno.com/Courses/BluePrint.pdf

Laboratory work:

Exp. No.	Suggested Experiments
1	CAD models Creation, Types and uses of models from different perspectives. Parametric modeling
2	Geometric modeling of an Engineering component, demonstrating skills in sketching commands of creation (line, arc, circle etc.) modification (Trim, move, rotate etc.) and viewing using (Pan, Zoom, Rotate etc.)
3	3D Geometric modeling of an Engineering component, demonstrating modeling skills using commands like extrude, revolve, sweep, blend, loft etc.
4	Extrude, Sweep, Trim etc and Mesh of curves, free form surfaces etc. Feature manipulation using Copy, Edit, Pattern, Suppress, History operations etc.
5	Constraints, Exploded views, interference check. Drafting (Layouts, Standard & Sectional Views, Detailing & Plotting)

Exp. No.	Suggested Experiments
6	Creation of manufacturing drawing showing all constraints, symbols and abbreviations. (At least two drawings)
7	CAD data exchange formats Like IGES, PDES, PARASOLID, DXF and STL along with their comparison and applicability.

Assessment Criteria:

Assessment Tool	Marks Distribution
Term Work (25 Marks)	• Active Participation (Lab) = 5 marks • Laboratory Report = 10 marks • Laboratory performance = 10 marks Based on the performance and satisfactory completion of assigned laboratory work
Practical Examination (25 Marks)	Practical examination will be based on the experiments performed by the students during laboratory sessions.

<table>
<tr><th rowspan="1">Course Code</th><th>Course Name</th><th colspan="4">Teaching Scheme (Hrs. / Week)</th><th colspan="4">Credits Assigned</th></tr>
<tr><td rowspan="7">25DBIL1VEC01</td><td rowspan="7">Sustainable Development</td><td colspan="2">L</td><td>P</td><td>T</td><td>L</td><td>P</td><td>T</td><td>TOTAL</td></tr>
<tr><td colspan="2">2</td><td>-</td><td>-</td><td>2</td><td>-</td><td>-</td><td>2</td></tr>
<tr><td colspan="8">Evaluation Scheme</td></tr>
<tr><td></td><td>CA</td><td>MSE</td><td>ESE</td><td>TW</td><td>OR</td><td>PR</td><td>Total</td></tr>
<tr><td>Theory</td><td>50</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>50</td></tr>
<tr><td>Lab/Tut</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td colspan="7">50</td></tr>
</table>

Course Objectives:

1) To introduce students to the role of AI, IoT, and ICT in solving India's pressing socio-economic and environmental challenges.
2) To enable learners to understand and apply these technologies for achieving the UN Sustainable Development Goals (SDGs) in the Indian context.
3) To encourage innovative thinking, problem-solving, and use-case development for sustainable growth.

Course Outcomes	After successful completion of this course the students will be able to	
	CO1	Understand fundamental concepts of AI, IoT, and ICT for sustainable development. (Remembering)
	CO2	Identify key areas of sustainable development in India that can benefit from technology. (Understanding)
	CO3	Work collaboratively on an activity to address a societal or environmental issue. (Applying)
	CO4	Analyse real-world case studies and technology-led development models. (Analyzing)
	CO5	Evaluate the ethical, environmental, and policy implications of digital interventions. (Evaluating)
	CO6	Propose innovative solutions to local and national challenges using AI, IoT, and ICT. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1		**Introduction to Sustainable Development in India.**	05
	1.1	Overview of UN SDGs and India's priorities (poverty, health, education, environment) National Missions: Digital India, Smart Cities, Startup India, Skill India	
	1.2	Technology as an enabler of sustainable growth Tools for sustainability assessment	
	Self-Learning Topics: Study the progress and challenges of India in achieving each UN Sustainable Development Goal (SDG).		
2		**Fundamentals of AI, IoT, and ICT**	05
	2.1	Sustainability enablers using AI: ML, Deep Learning, NLP IoT: Sensors, connectivity, cloud platforms	
	2.2	ICT: Communication networks, mobile platforms, data systems Synergy between AI, IoT, and ICT	
	Self-Learning Topics: Watch beginner-level videos on Machine Learning, Deep Learning, and NLP (e.g., by Google AI, Fast.ai).		
3		**Sectoral Applications in Indian Context**	05
	3.1	Agriculture: Smart farming, crop prediction, irrigation management Healthcare: Telemedicine, diagnostics, health surveillance	
	3.2	Education: Personalized learning, digital classrooms Case studies: eNAM, eSanjeevani, DIKSHA	
	Self-Learning Topics: Explore eSanjeevani and how telemedicine reached rural India during COVID-19. Case Research: Choose a state and explore how AI/ICT helped during a health crisis.		
4		**Environment, Energy and Urban Development**	05
	4.1	AI and IoT in waste management and pollution control Smart grids and renewable energy systems	
	4.2	ICT in climate action and disaster management Case studies: Smart Cities Mission, Jal Shakti, PM-KUSUM	
	Self-Learning Topics: Study how smart bins work using IoT and AI (e.g., Swachh Bharat implementations).		
5		**Innovation, Startups, and Ethical Concerns**	05
	5.1	Role of innovation hubs and social enterprises Frugal innovation for rural and tribal India	
	5.2	Data privacy, algorithmic bias, digital inclusion Policy frameworks: NDCP, IndiaAI Strategy, Data Protection Bill	
	Self-Learning Topics: Analyze the impact of the Digital Personal Data Protection Act 2023 on startups and citizens.		

6		**Sustainable Solutions in India (Case India)**	**05**
	6.1	Students identify a sustainable development challenge Discuss an AI/IoT/ICT-based solutions	
	6.2	Review of Digital Transformation initiatives by Government of India	
	Self-Learning Topics: Explore past Smart India Hackathon or Toycathon projects for inspiration. Watch a tutorial on how to build a simple AI/IoT prototype (e.g., Smart Dustbin, Health Monitor). Learn how to use Canva, Figma, or PowerPoint for visualizing your project idea. Practice a pitch using a simple template: Problem → Solution → Impact → Tech Used.		
		TOTAL	**30**

Text Books:

1) Niti Aayog SDG India Index 2023-24: Towards Viksit Bharat, NITI Aayog, 2023–24, Government of India Publication.
2) Ahlawat, Ajay. Sustainable Development Goals: Directive Principles for Sustainable India by 2030. 8 October 2019, E-Book.
3) Mishra, Ankita, Banerjee, Sourik, & Singh, Brijendra. Deep Learning Techniques for Smart Agriculture Applications. Publishing 26 August 2025, IGI Global Publication.
4) Acharya, Biswaranjan (Ed.), Dey, Satarupa (Ed.), & Zidan, Mohammed (Ed.). IoT-based Smart Waste Management for Environmental Sustainability. 26 August 2024, CRC Press, Taylor & Francis Group.
5) Satsangi, Prem Saran. Role of Communities in Achieving Sustainable Development. 16 May 2024, Academic Foundation India.

Reference Books:

1) "Frugal Innovation: How to Do More with Less" – Navi Radjou, Jaideep Prabhu.
2) "Artificial Intelligence: A Guide for Thinking Humans" – Melanie Mitchell
3) "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" – David Hanes et al.
4) "Information and Communication Technology for Development (ICT4D)" – Tim Unwin
5) "AI and the Future of Humanity" – Rajan Gupta (NIT Rourkela)
6) "Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia" – Anthony M. Townsend

Useful Links:

AI / IoT Learning Platforms

1) Teachable Machine by Google – Train simple AI models visually.
2) ThingSpeak IoT Platform – IoT data collection and analysis.
3) Arduino Project Hub – DIY IoT projects for beginners.
4) Google AI Hub – Demos, guides, and tools.

Sustainability and Indian Development Data

1) NITI Aayog SDG India Index – Dashboard for India's SDG progress.
2) India Smart Cities Dashboard – Real-time data and initiatives.
3) PM-KUSUM – Renewable energy for farmers.

Case Study Portals

1) Digital India Case Studies – Real examples of tech-enabled development.
2) eSanjeevani – India's official telemedicine platform.
3) DIKSHA Portal – Digital Infrastructure for Knowledge Sharing (Education).

Educational Videos

1) Fast.ai YouTube Channel – Friendly introductions to ML & Deep Learning.
2) NPTEL AI & ICT Courses – Free government-certified video courses (search: AI, ICT4D, IoT).
3) AI for Social Good by Google – Examples of AI for environmental and humanitarian use.

Assessment Criteria:

Assessment Tool	Marks Distribution
Continuous Assessment (CA) (50 Marks)	• Active Participation = 5 marks • MCQ /Class Test= 10 marks • Assessment of the activity carried out by student = 25 marks • Assignment = 10 marks

Course Code	Course Name	Teaching Scheme (Hrs. / Week)			Credits Assigned				
25ME3CEP01	Community Engagement Project -1	L	P	T	L	P	T	Total	
		-	2	-	-	1	-	1	
		Examination Scheme							
			CA	MSE	ESE	TW	OR	PR	Total
		Theory	-	-	-	-	-	-	-
		Lab / Tut	-	-	-	25	25	-	50
		Total	50						

Course Objectives:

1) To introduce the foundational concepts and principles of innovation to deliver solutions for community problems.
2) To develop creative and analytical thinking abilities through techniques such as brainstorming, out-of-the-box thinking, mind mapping, and root cause analysis for structured problem solving.
3) To enable students to identify real-life community problems and design innovative solutions using design thinking.

Course Outcomes	After successful completion of this course the students will be able to	
	CO1	Describe fundamental concepts and real-world examples of community engagement and social innovation. (Remembering)
	CO2	Explain the principles and approaches of community engagement that influence idea development for societal benefit. (Understanding)
	CO3	Apply creative thinking techniques to propose innovative ideas addressing community needs. (Applying)
	CO4	Analyze real-life community problems using various tools to identify opportunities for impactful engagement. (Analyzing)
	CO5	Evaluate and prioritize community-focused ideas using mind mapping and structured ideation tools. (Evaluating)
	CO6	Develop and present an innovative, feasible solution to a real-life community problem through engagement. (Creating)

Syllabus:

Module No.	Unit No.	Topics	Hours
1		**Introduction to innovation and community problems**	
	1.1	Definition and types of innovation: Product, Process, Business Model, Social Importance and need for innovation in contemporary society. Case studies of impactful innovations (Indian and global contexts)	4
	1.2	Introduction to community engagement and its importance and examples of simple engineering projects for societal benefit.	
2		**Problem Identification**	5
	2.1	Problem vs. symptom: Root cause analysis, Problem framing using "How Might We" questions, Observation,	
	2.2	Empathy, and field study techniques, Understanding stakeholders their contribution, needs and pain points	
3		**Idea Generation and Development**	
	3.1	Principles of innovation: Combine, Eliminate, Reverse, Adjust, Divide, Substitute, Utilize, Modify, Maximize	5
	3.2	Out-of-the-Box Thinking Techniques, Divergent and convergent thinking, Brainstorming techniques and creative ideation, Reverse engineering and analogical thinking, Creative confidence and overcoming mental blocks, Idea generation techniques	
4		**Idea Structuring and finding solutions**	
	4.1	Introduction to mind mapping: Concept and benefits, Steps in creating effective mind maps, Tools for ideation: 6Ws and 1H etc. Group activity: Mapping ideas for a real-life challenge, Converting mind maps into idea clusters and themes	5
5		**Design and development of the solution**	
	5.1	Applying design thinking: Empathize, Define, Ideate, SWOT analysis and Design problem briefs	5
	5.2	Feasibility analysis: Technical, financial, and social aspects, Communicating ideas through storyboards and pitches	
6		**Modelling, Testing and Presentation**	
	6.1	Modelling of the solution and testing it for practical challenges Prototyping methods: Low-fidelity and digital prototyping	6
	6.2	Preparing a project report with observations and results., Creating presentation slides or demonstration boards. Final demonstration of the project to faculty and peers. Reflection on learning experiences and societal impact.	
		TOTAL	**30**

Text Books:

1) "Jugaad Innovation" by Navi Radjou, Jaideep Prabhu, and Simone Ahuja
2) "The Innovation Engine" by Jatin Desai

Reference Books:

1) "Managing Innovation" by Joe Tidd & John Bessant Manufacturing Science by Ghosh and Malik
2) "Innovation and Entrepreneurship" by Peter F. Drucker Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist, 2016, Apress.

Suggested Online References:

1) AICTE Activity Points for Students – Community Service Guidelines
2) IEEE Humanitarian Activities Committee (HAC) Projects
3) National Service Scheme (NSS) – Student Engagement Models
4) Engineering for Change – Community Projects
5) MIT D-Lab: Development through Engineering Projects

Useful Links:

1. Innovation-Next software: https://www.pearltrees.com/private/id52938256?access=465baf5cd56.327c610.c53760ddfb1a832b46bdd665da540a06

Laboratory work:

Sr. No.	Activity
1	Discussion on case studies on innovation examples, Introduction to community engagement and its importance and examples of simple engineering projects for societal benefit.
2	Discussion on Problems related to community Identifying problem statements.
3	Explore the Principles of innovation and applications based on each principle, and apply to the problems identified from the community
4	Out-of-the-Box Thinking Techniques & Idea Generation: Brainstorming session using divergent and convergent thinking on the identified problems
5	Problem Identification and Opportunity Recognition: Draft a problem brief using SWOT and "How Might We" questions
6	Mind Mapping and Idea Structuring Tools: Develop mind maps individually and in groups on identified problems
7	Apply design thinking: Empathize, Define, Ideate, SWOT analysis and Design problem briefs
8	Feasibility analysis: Technical, financial, and social aspects Communicating ideas through storyboards and pitches
9	Model the solution using Prototyping methods: Low-fidelity and digital prototyping
10	Prepare a project report with observations and results. Make presentation slides or demonstration boards.
11	Discussion on case studies on innovation examples, Introduction to community engagement and its importance and examples of simple engineering projects for societal benefit.

Assessment Criteria:

Assessment Tool	Marks Distribution
Term Work (25 Marks)	• Active Participation = 05 marks • Project Report = 10 marks • Progress presentations (min 02) & demonstration = 10 marks
Oral (25 Marks)	Oral examination will be based on the presentation slides or demonstrating models by the group