Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

CURRICULUM STRUCTURE
SECOND YEAR UG: B. TECH

MECHANICAL ENGINEERING

REVISION: FRCRCE-3-25

Effective from Academic Year 2026-27

Board of Studies Approval: 05/03/2026

Academic Council Approval: 25/06/2026

Dr. Deepak Bhoir	**Dr. Vasim A. Shaikh**	**Dr. Sapna Prabhu**
Dean Academics	**HOD (Mechanical Engg.)**	**Principal**

Preamble

Fr. Conceicao Rodrigues College of Engineering an autonomous institute from the year 2024-25. University Grant Commission vide letter No. F. 2-10/2023(AC-Policy) dated 23rd Nov 2023 conferred the autonomous status to Fr. Conceicao Rodrigues College of Engineering, Fr. Agnel Ashram, Bandstand, Bandra (West), Mumbai 400050 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations,2023. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Learner, Indian Society, and Industries. We commit to ourselves to the effective implementation of UGC Regulations and NEP 2020 in its spirit. Government of Maharashtra has directed Autonomous Colleges to revise their curriculum in line with National Education Policy (NEP) 2020 through Government Resolution dated 4th July 2023. Accordingly, degree options are given to the students admitted from academic year 2024-25 based on UGC circulars and DTE guidelines ref no. 17/DTE/NEP-2020/2024/111 dated 4th June 2024 related to implementation of NEP.

Based on recent recommendations of the GR, we are pleased to offer our holistic curriculum, a "H-Tree Model" of Engineering Education. A unique "H-Tree Model" of Engineering Education Curriculum is carefully designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient) and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an all-rounded personality with holistic approach to education in which learner receives 25% teacher-led learning, 25% peer learning, 25% self-learning and 25% experiential learning. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to leaner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science, and mathematics foundation and program core, sequel of electives, Multidisciplinary Minor courses, humanities & management courses and sufficient experiential learning through projects and semester-long industry / research internship along with employable skill-based courses. Learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Learner also gets additional option to choose the kind of degree i.e. Built in Multidisciplinary minor or Double Minor in emerging field or Honors with Research.

The Mechanical Engineering curriculum is designed to provide a balanced combination of strong fundamentals and practical skills. The initial years focus on mathematics, basic sciences, computing, and engineering principles to develop analytical thinking and systematic problem-solving ability. Core engineering courses help students understand the working of machines, materials, and energy systems used

in real-world applications. Laboratories, workshop practice, and design-based learning ensure that students learn by doing and gain hands-on experience. Elective courses introduce modern technologies and prepare students for evolving industrial requirements. Projects, internships, and experiential activities expose students to real industrial and societal challenges and enhance employability. Overall, the program aims to nurture technical competent, innovative, and responsible engineers ready for careers, entrepreneurship, and higher studies.

Various steps are taken to transform teaching learning process to make learning a joyful experience for students. We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units.

INSTITUTE VISION

To be a leading institution in education, transforming students into globally competent professionals with strong ethical values, innovation capabilities, and a commitment to sustainable societal development.

INSTITUTE MISSION

- Develop industry-ready engineers with strong academic foundations, practical skills, and an entrepreneurial mindset capable of addressing industry and societal needs.
- Cultivate a culture of innovation and research to address real-world challenges through interdisciplinary approaches and sustainable practices.
- Foster a vibrant industry–academia ecosystem by actively engaging faculty and students in knowledge exchange, collaborative learning and professional skill development.

DEPARTMENT VISION

To be a leading department transforming young minds into creative and ethical mechanical engineers committed to engineering excellence and societal well-being.

DEPARTMENT MISSION

- Provide quality education that builds strong engineering fundamentals and technical competence, preparing students for professional excellence.
- Nurture innovation, critical thinking, and problem-solving skills through modern engineering tools and multidisciplinary solutions to real-world challenges.
- Promote research and collaboration with industry and professional bodies to develop sustainable, ethical, and socially responsible engineering solutions.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

Graduates will be able to

1. Build successful careers in engineering and allied fields by applying strong technical knowledge and practical skills.
2. Analyze and solve engineering problems using modern tools and emerging technologies.
3. Demonstrate professional ethics and effective communication in multidisciplinary and team-based environments.
4. Pursue lifelong learning through higher education, research and innovation to adapt to evolving industry needs.

PROGRAM SPECIFIC OUTCOMES (PSO)

Students will be able to:

1. Utilize computational tools and analytical methods to design, simulate, and optimize mechanical systems.
2. Apply manufacturing technologies, materials engineering, intelligent robotics and automation solutions to address industrial challenges.

Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 2026-27

Nomenclature of the courses in the Curriculum

BSESC	Basic Science & Engineering Science Courses
PCPEC	Program Core and Program Elective Courses
MDC	Multidisciplinary Courses
SC	Skill Courses
HSSM	Humanities, Social Sciences and Management
EL	Experiential Learning
LLC	Liberal Learning Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Program Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
VSEC	Vocational and Skill Enhancement Course
VSC	Vocational Skill Courses
SEC	Skill Enhancement Courses
AEC	Ability Enhancement Course
EEMC	Entrepreneurship, Economics and Management Course
IKS	Indian Knowledge System
VEC	Value Education Course
RM	Research Methodologies
CEFP	Community Engagement or Field Project
ELC	Experiential Learning Courses
PRJ	Project
INT	Internship
CC	Cocurricular Courses
DM	Double Minor
HR	Honors with Research

Credit Specification:

- Theory: 1 credit=13 to 15 hrs of teaching
- Lab: 1 Credit=26 to 30 hrs of lab work
- Studio Activities: 1 Credit= 26 to 30 hrs of creative activities
- Workshop Based Activities: 1 Credit=26 to 30 hrs of hands-on activities related to vocation/professional practice/skill based
- Seminar/Group Discussion: 1 Credit=13 to 15 hrs of participation
- Internship: 1 Credit=Per 2 weeks OR 36 to 40 hrs of engagement
- Field Based Learning/Practices: 1 Credit=26 to 30 hrs of learning activities
- Community Engagement Projects: 1 Credit=26 to 30 hrs of contact time along with 13 to 15 hrs of activities preparation, report writing, independent reading etc.
- Notional hours include Theory, practical, tutorials and self-learning for each students per week.

Degree/SEM	I	II	III	IV	V	VI	VII	VIII	Total
B. Tech (Multidisciplinary Minor)	20	20	22	22	22	22	20	20	168
B. Tech with Double Minor (Multidisciplinary & Specialization Minor)	20	20	22 +4*	22 +4*	22 +4*	22 +4*	20 +2$	20	186
B. Tech with Honors with Research (Multidisciplinary Minor)	20	20	22 +4*	22 +4*	22 +4*	22 +4*	20 +2$	20	186

*Optional Credits $ optional 2 credits can be earned either in VII or VIII Semester

1. Learners who earn a minimum of total 168 credits will be awarded "B.Tech in Engg. /Tech. with Multidisciplinary Minor (MDM)" degree.

2. Learners will have the following options to earn B. Tech. in Engg. /Tech. degree in

    a) Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor)
    b) Honors with Research and Multidisciplinary Minor

    a) Major Engg./Tech Discipline with Double Minor (Multidisciplinary and Specialization Minor) (additional 18 credits): 168 +18 =186 Min Credits.

    There will be four courses (4 credits each), one in each semester starting from the 3rd semester which will be from emerging areas of specialisation. In 7th or 8th semester students will complete 2 credits seminar/project.

Admission eligibility min CGPA=7.5 after First year

    b) B. Tech in Engg./ Tech.- Honors with Research and Multidisciplinary Minor (additional 18 credits by research): 168 +18=186 Min Credits. (Admission eligibility min CGPA=7.5 after First and should maintain CGPA=7.5 after Third year)

3. Learner can earn the certificate/Diploma/Degree based on his/her exit from the program as follows. College shall explore feasibility to offer NSDC aligned skill-based courses to the learners:

    a) UG Certificate: After a one-year (40 credits to be earned) and 8-credits summer workshop/vocational courses/internship
    b) UG Diploma: After two-years (80 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project
    c) B. Voc.: After three-years (120 credits to be earned) and 8-credits summer workshop/vocational courses/internship/Project

Salient Features of Curriculum:

- Framed as per Government Resolution dated 4 th July 2023 in line with National Education Policy (NEP) 2020.
- Minimum 168 choice-based credit structure with options of Degrees earning additional credits
- Unique 'H-Tree' Model of Curriculum: Hybrid model for holistic development with happy learning
- environment having bridge connecting verticals providing unique path for each learner for 3-dimensional growth, Life Long Learning, multiple entry-exit, inclusive model indicating equal distribution of central resources
- More emphasis on laboratory based and experiential learning

- More weightage to continuous assessment to reduce examination stress
- Mandatory Semester-long internship, courses with emotional & spiritual learning and skill-based learning aligned with NSDC framework
- Well balanced curriculum to attain Program Outcomes and skills of 21st century learners.

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SEMESTERWISE CURRICULUM STRUCTURE
UG Mechanical Engineering Program:

SEM-III

Course Code	Course Vertical	Sub-Vertical	Course Name	Notional Hours		Examination Marks (1 Credit = 50 Marks)					Credits	
						ISE	MSE	ESE Min	ESE Max	Total	Points	Total
25BSC12ME05	BSESC	BSC	Statistical Techniques and Partial Differential Equations	TH	2	20	30	20	50	100	2	3
				TU	1	50	-	-	-	50	1	
				SS/SL	3							
25PCC12ME05	PCPEC	PCC	Advanced Manufacturing Processes	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25PCC12ME06	PCPEC	PCC	Engineering Mechanics	TH	2	20	30	20	50	100	2	4
				TU	1	50	-	-	-	50	1	
				PR	2	50	-	-	-	50	1	
				SS/SL	3							
25PCC12ME07	PCPEC	PCC	Machine Shop Practice	PR	2	50	-	-	-	50	1	1
25OE1X	MDC	OE	1. Law for Engineers 2. Financial Planning, Taxation and Investment	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25MDMXX1	MDC	MDM	MDM Course-1	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25MDMXX2	MDC	MDM	MDM Course-2	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25AEC12ME02X	HSSM	AEC	Modern Indian Language	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25VEC12ME01	HSSM	VEC	Human Values and Professional Ethics	TH	1	100	-	-	-	100	1	2
				PR	2						1	
				SS/SL	1							
25CEP12ME01	EL	CEFP	Community Engagement Project	PRJ	4	100	-	-	-	100	2	2
25DMX1	DM	DM	Double Minor Course #	TH	2	20	30	20	50	100	2	4*
				TU	2	50	-		-	50	2	
25HR02	HR	HR	Honors with Research #	-	-	-	-		-	-	4	4*
Total					**TH:TU:PR:SL 15:2:10:17=44**				**-**	**1100**	**-**	**22**

SEM-IV

Course Code	Course Vertical	Sub-Vertical	Course Name	Notional Hours		Examination Marks (1 Credit=50 Marks)					Credits	
						ISE	MSE	ESE Min	ESE Max	Total	Points	Total
25BSC12ME06	BSESC	BSC	Thermodynamics	TH	2	20	30	20	50	100	2	3
				TU	1	50	-	-	-	50	1	
				SS/SL	3							
25PCC12ME08	PCPEC	PCC	Mechanics of Solids	TH	2	20	30	20	50	100	2	4
				TU	1	50	-	-	-	50	1	
				PR	2	50	-	-	-	50	1	
				SS/SL	3							
25PCC12ME09	PCPEC	PCC	Materials Science and Engineering	TH	2	20	30	20	50	100	2	3
				TU	1	50	-	-	-	50	1	
				SS/SL	3							
25PCC12ME10	PCPEC	PCC	Materials and Material Testing Lab	PR	2	50	-	-	-	50	1	1
25PCC12ME11	PCPEC	PCC	Thermal Engineering Lab	PR	2	50	-	-	-	50	1	1
25OE2X	MDC	OE	1. Emerging Technology and Law 2. Principles of Management	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25V3VSE12ME03	SC	VSEC	Computer Aided Machine Drawing	PR	4	100	-	-	-	100	2	2
25MDMXX3	MDC	MDM	MDM Course-3	TH	2	20	30	20	50	100	2	2
				SS/SL	2							
25EEM12ME02	HSSM	EEMC	Technology Entrepreneurship	TH	2	100	-	-	-	100	2	2
				SS/SL	2							
25VEC12ME02	HSSM	VEC	Technology Innovation for Sustainable Development	TH	1	100	-		-	100	1	2
				PR	2						1	
				SS/SL	1							
25DMX2	DM	DM	Double Minor Course #	TH	2	20	30	20	50	100	2	4*
				TU	2	50	-	-	-	50	2	
25HR03	HR	HR	Honors with Research #	SS/SL	4	-	-	-	-	-	4	4*
25BC	BC	BC	MOOC	-	-	-	-	-	-	-	-	2$
Total					**TH:TU:PR:SL 13:3:12:16=44**				**-**	**1100**	**-**	**22**

$ Discipline specific additional course to Lateral Entry (Diploma) students from Swayam Plus/Swayam platform
*** Indicates DM/HR course credits # Optional subjects**
Notional Hours = Contact Hours + Self-Learning

B. Tech in Mechanical Engineering with Minor Computer Engineering:

Course Code	Computer Engineering Minor Courses	Credits
25MDMXX1	Data Structures and Algorithms	2
25MDMXX2	Database Management System	2
25MDMXX3	Microcontrollers and Applications	2
MDMXX4	AI and Applications	2
MDMXX5	Human Machine Interface	2

B. Tech in Mechanical Engineering with Minor Electronics Engineering:

Course Code	Electronics Engineering Minor Courses	Credits
25MDMXX1	Signals and System	2
25MDMXX2	Digital Electronics	2
25MDMXX3	Microcontrollers and Applications	2
MDMXX4	Linear Integrated Circuits	2
MDMXX5	Industrial Electronics	2

B. Tech in Mechanical Engineering with Minor Business Management:

Course Code	Business Management Minor Courses	Credits
25MDMXX1	Financial Accounting	2
25MDMXX2	Economics for Business	2
25MDMXX3	Business Administration	2
MDMXX4	Human Resource Management	2
MDMXX5	Digital Marketing	2

B. Tech in Mechanical Engineering with Minor Healthcare Management:

Course Code	Healthcare Management Minor Courses	Credits
25MDMXX1	Biomedical Instrumentation & Imaging	2
25MDMXX2	Hospital Administration Fundamentals	2
25MDMXX3	Operations Management for Healthcare Systems	2
MDMXX4	Digital Transformation in HealthCare	2
MDMXX5	Bioinformatics and Computational Biology	2

B. Tech in Mechanical Engineering with Minor Design:

Course Code	Design Minor Courses	Credits
25MDMXX1	Industrial and Product Design	2
25MDMXX2	Communication Design	2
25MDMXX3	Graphic Design and Animation	2
MDMXX4	Interaction Design	2
MDMXX5	Mobility and Vehicle Design	2

Double Minor Degree in 'Emerging Areas' Offered to Mechanical Engineering Students:

1. **Name: Internet of Things**
    1. **DM21:** Sensors and Actuators
    2. **DM22:** Fundamentals of IoT
    3. **DM23:** Embedded System and RTOS
    4. **DM24:** System Design

2. **Name: Data Science**
    1. **DM51:** Statistics for Data Science
    2. **DM52:** Data Analytics and Visualisation
    3. **DM53:** Game Theory
    4. **DM54:** Web and Social Media Analytics

3. **Name: Artificial Intelligence and Machine Learning**
    1. **DM61:** Statistics for Data Science
    2. **DM62:** Fundamentals of AI & ML
    3. **DM63:** Natural Language Processing
    4. **DM64:** Artificial Intelligence for Mechanical Engineering

4. **Name: Sustainability**
    1. **DM41:** Design Thinking for Sustainability
    2. **DM42:** Green Computing
    3. **DM43:** Emerging Technologies for Sustainability
    4. **DM44:** Sustainable Product Design

List of Modern Indian Language (2 credit) (AEC):

- 25AEC12ME021 Sanskrit for Beginners
- 25AEC12ME022 Telugu for Beginners
- 25AEC12ME023 Kannada for Beginners
- 25AEC12ME024 Tamil for Beginners

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Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25BSC12ME05	Statistical Techniques and Partial Differential Equations	2	1	0	3	2	1	0	3
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	20	30		50		100	
		Tutorial	50	--		--		50	

Pre-requisite Course Codes	At the end of the course students will be able to	
Course Outcomes	CO1	Implement numerical and analytical methods for one dimensional heat and wave equations in solving partial differential equations.
	CO2	Apply probability distributions of Poisson and Normal to some of the real-life situations.
	CO3	Apply the concept of sampling distribution in hypothesis testing of small samples using sampling theory.
	CO4	Apply the concept of Correlation and Regression to engineering problems in data science, machine learning, and AI.
	CO5	Operate Laplace Transform on a piecewise continuous function and its inverse on a bounded function.

Theory:

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Partial Differential Equations**	1,2,3,4	**06**
	1.1	Introduction of Partial Differential equations, method of separation of variables, Vibrations of string, Analytical method for one-Dimensional heat and wave equations. (only problems)		04
	1.2	Crank Nicholson method		01
	1.3	Bender Schmidt method		01
2		**Probability Distribution and Sampling Theory-I**	1,2,3,4	**07**
	2.1	Probability Distribution: Poisson and Normal distribution		03
	2.2	Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom.		02
	2.3	Students't-distribution (Small sample). Test the significance of Single sample mean and two independent sample means and paired t- test)		02
3		**Sampling Theory-II**	1,2,3,4	**04**
	3.1	Chi-square test: Test of goodness of fit and independence Of attributes (Contingency table).		02
	3.2	Analysis of variance: F-test (significant difference between Variances of two samples)		02
4		**Statistical Techniques**	1,2,3,4	**04**
	4.1	Karl Pearson's Coefficient of correlation(r) and related concepts with problems.		02
	4.2	Lines of regression		02
5		**Laplace and Inverse Laplace Transform**	1,2,3,4	**05**

	5.1	Laplace transform of fundamental functions, Properties (without proof): Change of scale, first and second shifting theorem, multiplication and division by t, Laplace transform of derivative and integration.		03
	5.2	Inverse Laplace transform using partial fraction method and convolution method		02
Total				**26**

Tutorial:

Exp. No.	Tutorial Details	Hours
1	Partial differential equations 1	01
2	Partial differential equations 2	01
3	Probability distributions	01
4	Testing of hypothesis	01
5	Chi-square test	01
6	F-Test	01
7	Correlation and Regression	01
8	Laplace and inverse Laplace transform	01
Total Hours	**08**	

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

Theory:

ISE:
ISE activities carry 20 marks. These activities will be conducted throughout the semester.
MSE:
The written summative examination of 30 marks based on 50% syllabus for 90 minutes.
ESE:
The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on the tutorials evaluated through continuous assessment of understanding and application of mathematical and statistical concepts.

Recommended Books:

[1] Dr B. S. Grewal, "*Higher Engineering Mathematics*", Khanna Publications, 4nd Edition.
[2] H. K. Dass, "*Advanced Engineering Mathematics*", S. Chand, 28th Edition.
[3] Erwin Kreysizg, "*Advanced Engineering Mathematics*", John Wiley & Sons, 10th Edition.
[4] Jain and Iyengar, "*Advanced Engineering Mathematics*", Narosa Publications, 4th Edition.

Suggested CO - PO articulation Matrix:

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	-

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level :

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12ME05	Advanced Manufacturing Processes	2	--	--	2	2	--	-	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	20	30		30		100	

Pre-requisite Course Codes	None	
Course Outcomes	CO1	Understand the difference between traditional and additive manufacturing techniques including solid-based, liquid-based, and powder-based techniques.
	CO2	Describe the working principle, material removal mechanism and process parameters for Hybrid machining.
	CO3	Identify and understand the MEMS and Non-MEMS based manufacturing techniques.
	CO4	Understand basic nano finishing techniques.
	CO5	Describe metal joining processes along with their advantages, disadvantages, and applications.
	CO6	Comprehend the composite manufacturing and powder metallurgy process along with its advantages, disadvantages, and applications.

Module No.	Topics	Ref	Hrs.
1	Introduction to Additive Manufacturing (AM), Subtractive manufacturing v/s Additive Manufacturing, Powder-based AM processes: Selective laser sintering (SLS), Electron beam melting. Solid-based AM process: Fused deposition modelling (FDM), Laminated object manufacturing (LOM). Liquid based AM Process: Stereo lithography (SLA).	1	04
2	Introduction to Hybrid machining: Electric discharge grinding (EDG), Electro chemical grinding (ECG), Electro stream drilling (ESD), Electro chemical deburring (ECD), Laser assisted machining (LAM) and Shaped tube electrolytic machining (STEM). Working principle, Material removal mechanism, Identification of process parameters, Advantages, Disadvantages and Applications.	3	05
3	Introduction to Micro Manufacturing Techniques: Challenges in Meso, Micro, and Nano manufacturing. NON – MEMS based - Traditional Micromachining (Micro turning, Micro Milling, Micro grinding, Diamond turning). MEMS based - Overview about micro fabrication methods - Chemical vapor deposition (CVD); Physical vapor deposition (PVD), optical and electron beam lithography; Dry and wet etching.	2	05
4	Introduction to Nano Finishing Techniques: Abrasive Flow Machining (AFM), Magnetic Abrasive Finishing (MAF), Magneto rheological Finishing (MRF), Magneto Rheological Abrasive Flow Finishing (MRAFF), Magnetic Float Polishing (MFP), Elastic Emission Machining (EEM), Chemical Mechanical Polishing (CMP).	2	04

5	Metal Joining Processes: Gas welding, Arc welding, Resistance, Radiation, Solid state and Thermo-chemical welding processes, soldering and brazing processes, welding defects, inspection & testing of welds, Safety in welding.	4	04
6	Polymeric composites manufacturing processes: Thermoset and Thermoplastic composite processing, advantages & disadvantages. Manufacturing process for thermoset composites (applications, basic processing steps, advantages and limitations only) prepreg layup, wet layup, spray up, filament winding, pultrusion and resin transfer molding. Powder Metallurgy: Powder manufacturing methods; Advantages, disadvantages, and applications of powder metallurgy. Case studies like Oil Impregnated Bearings.	5	04
Total			**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Reference Books:

1. Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing, Andreas Gebhardt, Hanser Publishers, 2012.
2. Micro and Nanomanufacturing, Mark J. Jackson, Springer, 2007.
3. A Text Book of Production Technology Vol. II, O. P. Khanna, Dhanpat Rai Publication (2012).
4. Welding Technology, O. P. Khanna, Dhanpat Rai & Co.
5. Composites Manufacturing – Materials, product, and Process Engineering, Sanjay K. Muzumdar, CRC Press (2002).

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3
CO6	3	-	-	-	-	-	-	-	-	-	-	-	3

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	Apply	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25PCC12ME06	Engineering Mechanics	L	T	P	SL	L	T	P	Total
		2	1	2	3	2	1	1	4
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	20	30		50		100	
		Tutorial	50	--		--		50	
		Practical	50	--		--		50	

Part A (Theory)

Pre-requisite Course Codes	-	
Course Outcomes	CO1	Understand concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD.
	CO2	Locate the centroid of two dimensional Lamina.
	CO3	Correlate real life application to specific type of friction and estimate required force to overcome friction.
	CO4	Establish relation between velocity and acceleration of a particle and analyze the motion by plotting the relation.
	CO5	Establish Kinematic relations for a rigid body.
	CO6	Analyze particles in motion using force and acceleration, work-energy.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**System of Coplanar Forces:** Classification of force systems, Principle of transmissibility, composition and resolution of forces	1-8	2
	1.2	**Resultant:** Resultant of coplanar force system (Concurrent forces, parallel forces and non-concurrent Non-parallel system of forces). Moment of force about a point, Couples, Varignon's Theorem. Force couple system. Distributed Forces in plane.	1-8	2
	1.3	**Centroid:** First moment of Area, Centroid of composite plane Laminas	1-8	2
2	2.1	**Equilibrium of System of Coplanar Forces:** Conditions of equilibrium for concurrent forces, parallel forces and nonconcurrent non- parallel general forces and Couples. Equilibrium of rigid bodies free body diagrams.	1-8	4
	2.2	**Equilibrium of Beams:** Types of beams, simple and compound beams, type of supports and reaction: Determination of reactions at supports for various types of loads on beams. (Excluding problems on internal hinges)	1-8	2

3	**3.1**	**Friction:** Revision of Static Friction, Dynamic/ Kinetic Friction, Coefficient of Friction, Angle of Friction, Laws of friction. Concept of Cone of friction. Equilibrium of bodies on inclined plane. Application to problems involving ladders	1-8	3
4	**4.1**	**Kinematics of Particle:** Motion of particle with variable acceleration. Motion curves (a-t, v-t, s-t curves).	1-7, 9	3
5	**5.1**	**Kinematics of Rigid Body:** Translation, Rotation and General Plane motion of Rigid body. The concept of Instantaneous center of rotation (ICR) for the velocity. Location of ICR for 2 link mechanisms. Velocity analysis of rigid body using ICR.	1-7, 9	3
6	**6.1**	**Kinetics of a Particle: Work and Energy:** Work Energy principle for a particle in motion. Application of Work – Energy principle to a system consists of connected masses and Springs.	1-7, 9	3
	6.2	**Kinetics of a Particle: Impulse and Momentum:** Principle of linear impulse and momentum. Impact and collision: Law of conservation of momentum, Coefficient of Restitution. Direct Central Impact	1-7, 9	2
Total				**26**

Tutorial:

Sr. No.	Contents	Hrs
1	Resultant of Coplanar force system	**2**
2	Centroid of Composite plane Laminas	**2**
3	Equilibrium of System of Coplanar Forces	**2**
4	Kinematics of particles (Variable acceleration + Motion Curves)	**2**
5	Kinetics of particles (Work Energy Principle, Impulse momentum Principle, Impact and Collisions.)	**2**
Total		**10**

Lab:

Experiments to be completed in Lab		Hrs.
E1	Verification of Polygon law of coplanar forces	**4**
E2	Verification of Principle of Moments (Bell crank lever.)	**4**
E3	Determination of support reactions of a Simply Supported Beam.	**4**
E4	Determination of coefficient of friction) using inclined plane	**4**
E5	Collision of elastic bodies (Law of conservation of momentum).	**4**
Total		**20**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

Theory:

ISE:
ISE activities carry 20 marks. These activities will be conducted throughout the semester.
MSE:
The written summative examination of 30 marks based on 50% syllabus for 90 minutes.
ESE:
The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:
Assessment shall be based on five tutorials, with each tutorial carrying 10 marks, evaluated through continuous assessment of understanding and application of engineering mechanics principles.

Laboratory Learning:
ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

References:

1. Engineering Mechanics by R. C. Hibbeler.
2. Engineering Mechanics by Beer &Johnston, Tata McGrawHill
3. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
4. Engineering Mechanics by Macklin & Nelson, Tata McGrawHill
5. Engineering Mechanics by Shaum Series
6. Engineering Mechanics by A K Tayal, Umesh Publication.
7. Engineering Mechanics by Kumar, Tata McGrawHill
8. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Bools
9. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Bools

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	1	-	-	-	-	-	-	-	-	1	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-	-
CO3	2	-	1	-	-	-	-	1	-	-	1	1	-
CO4	2	-	1	-	-	-	-	-	-	-	-	1	-
CO5	2	-	1	-	-	-	-	-	-	-	-	1	-
CO6	2	-	1	-	-	-	-	-	-	-	-	1	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25PCC12ME07	Machine Shop Practice	--	--	2	--	--	1	1
		Examination Scheme						
			ISE	MSE	ESE		Total	
		Practical	50	--	--		50	

Pre-requisite Course Codes	None	
Course Outcomes		Learner will be able to…
	CO1	Know the specifications, controls and safety measures related to machines and machining operations.
	CO2	Use the machines for making various engineering jobs.
	CO3	Perform various machining operations.
	CO4	Perform Tool Grinding

Sr. No.	Experiments Details	Ref	Hrs
1	One composite job consisting minimum two parts employing operations performed of various machine tools.	1	21
2	Tool Grinding – To know basic tool Nomenclature	1	5
	Total		**26**

Course Assessment:

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Recommended Books:

1. Production Technology Manufacturing Processes volume-II by O. P. Khanna

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	-	3
CO2	3	-	-	-	3	-	-	-	-	-	-	-	3
CO3	3	-	-	-	3	-	-	-	-	-	-	-	3
CO4	3	-	-	-	3	-	-	-	-	-	-	-	3

Legends:- High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember	Understand	Apply	Analyze	Evaluate	Create

Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
		2	--	--	2	2	--	--	2
25OE11	Law for Engineers	Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		--
Course Outcomes	CO1	To demonstrate awareness of basic structure of Indian Legal System
	CO2	To demonstrate awareness of principles of contract
	CO3	To demonstrate awareness of legal aspects related to establishment of factory and various legislations related to employees, labours, and workmen's welfare
	CO4	To demonstrate awareness about right ot information, intellectual creations from infringement and laws related to energy, food and environment

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Foundation of Legal System**	1,2,3	4
	1.1	Indian Legal System: An Introduction, Human Rights, Fundamental Rights, The Supreme Court of India, Statutory Commissions– NHRC, NCW, NCM, NC-SC/ST etc.,		
	1.2	Representation of Peoples Act 1950, Prevention of Corruption Act, 1988, Understanding the Importance of Stamp Duty		
	1.3	Few Illustrated Cases of Supreme Court of India		
2		**General Principles of Contract: India Contract Act 1872**	2,3	8
	2.1	Contract Law: Agreement and Its Kinds,		
	2.2	Who Can Enter into a Contract, Contract and Its Enforceability, Offer and Acceptance in a Contract,		
	2.3	Essentials of Valid Contract- Lawful Consideration and Lawful Object, Essentials of Valid Contract- Free Consent,		
	2.4	Types of Contract, Contract of Agency, Performance of Contracts, Government Contracts, Standard Form Contracts		
3		**Industrial and Labour Laws**	2,3	8
	3.1	Labour Laws in India: An Overview, Industrial Disputes Act, 1947, Industrial Employment (Standing Orders) Act, 1946		
	3.2	Factories Act, 1948, Industries (Development and Regulation) Act, 1951		
	3.3	Contract Labour (Regulation and Abolition) Act, 1970, Bonded Labour System (Abolition) Act, 1976, Child and Adolescent Labour (Prohibition and Regulation) Act, 1986		
	3.4	Workmens Compensation Act, 1923, Equal Remuneration Act, 1976, Payment of Bonus Act, 1965, Payment of Gratuity Act, 1972, Employees' State Insurance Act, 1948, Employees'		
		Provident Funds and [Miscellaneous Provisions] Act, 1952, Payment of Wages Act, 1936, Minimum Wages Act, 1948,		

		Employees' Pension Scheme 1995		
	3.5	Apprentices Act, 1961, Maternity Benefit Act, 1961, Fatal Accidents Act, 1855, Trade Unions Act, 1926, Sexual Harassment of Women at Workplace Act, 2013, Collective Bargaining		
4		**Right to Information**	2,3	2
	4.1	Official Secret Act, 1923, Indian Evidence Act, 1872		
	4.2	Right to Information Act, 2005, Impact of Right to Information Act		
5		**Intellectual Property Rights**	2,3	2
	5.1	Types of Intellectual Property, Indian Copyright Act 1957, Indian Trademark Act 1999, Indian Patent Act 1970		
6		**Other Important Laws**	2,3	
	6.1	Electricity Act 2003, Atomic Energy Act 1962, Motors Vehicle Act 1988, Food Safety and Standards Act 2006, National Food Security Act 2013, Environment Protection Act 1986		2
			Total	**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. N. S. Nappinai, "*Technology Laws Decoded*," LexisNexis, 2017
2. Vibha Arora and Kunwar Arora, "*Law for Engineers*" Central Law Publications, 2017
3. Vandana Bhatt and Pinky Vyas, "*Laws for Engineers*", ProCare, 2015.
4. Family Law by Paras Diwan, ALLAHABAD LAW AGENCY, 14th Edition, 2025
5. Avtar Singh's Law of Contract & Specific Relief by Rajesh Kapoor, Eastern Book Company.
6. New Labour and Industrial Laws Bare Act with Short Comments, Diglot Edition 2026 (Law Of Prevention Of Money Laundering) by Whitesmann.
7. Law Relating to Intellectual Property by B L Wadehra, Lexis Nexis.

Links:

1. https://www.sci.gov.in.
2. https://www.youtube.com/watch?v=skR6Z6TwdcM.
3. https://www.youtube.com/watch?v=ZaUePaAuZ4Q
4. https://www.youtube.com/watch?v=cQQHv7mzvHU.
5. https://www.youtube.com/watch?v=eLnXaTCbuAo.
6. https://www.legalserviceindia.com/legal/article-9960-5-types-of-writs-in-indian-constitution.
7. https://doe.gov.in/files/inline-documents/DoE_Prevention_sexual_harassment.pdf.

8. https://www.greythr.com/notifications/sexual-harassment-of-women-at-workplace-prevention-prohibition-and-redressal-amen.
9. https://cag.gov.in/uploads/cms_pages_files/Vishkha-Guidelines-against-Sexual-Harassment-in-Workplace-061de8308de91c7-65164897.pdf.
10. https://www.mshrc.gov.in › vishakha-guidelines

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	1	3	3	3	3	3	-	-	-
CO2	2	-	-	-	3	2	3	2	1	1	-	-	-
CO3	3	-	-	-	1	1	1	3	3	3	-	-	-
CO4	2	-	-	-	3	2	3	3	2	2	-	-	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	Apply	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25OE12	Financial Planning, Taxation and Investment	L	T	P	SL	L	T	P	Total
		2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes	None	
Course Outcomes	CO1	To prepare financial plan by understanding owns need
	CO2	To demonstration awareness of taxation policies and show respect towards government norms and regulations
	CO3	To prepare investment plan by understanding owns futuristic needs

Financial Planning: It is possible to manage income more effectively through financial planning. Managing income helps to understand how much money is required for tax payments, other expenditures and savings. It increases cash flows by carefully monitoring the spending patterns and expenses. Knowledge of comprehensive financial planning will help students to make right financial decisions in their life. It gives guidance in helping choose the right types of investments to fit needs, personality, and goals of their life. In this activity students need to prepare the financial plan for their life.

Taxation Policies: Taxes are levied in almost every country of the world, primarily to raise revenue for government expenditures, although they serve other purposes as well. The simple fact in economics is that there are certain common public goods and public needs that require some form of government and regulation to provide or promote. Taxation is the way to pay for these common goods. In this activity student will learn various types of taxes like Income tax, Corporate tax, Capital gains, Property tax, Inheritance and Sales tax.

Investments: Investments are important because in today's world, just earning money is not enough. But that may not be adequate to lead a comfortable lifestyle or fulfil our dreams and goals. Money lying idle in the bank account is an opportunity lost. Therefore, students should have a knowledge to invest money smartly to get good returns out of it. This activity will give insight to the students about investment in the form of Stocks, Mutual Funds, Fixed Deposits, Recurring Deposit, Public Provident Fund, Employee Provident Fund and National Saving Schemes.

Methodology: Guest lectures or workshops by professionals shall be arranged on Financial Planning, Taxation and Investments. Invite guest speakers, such as tax professionals or financial advisors, shall conduct a tax planning workshop for students. The workshop can cover topics such as tax-efficient investment strategies, retirement planning, and tax-saving opportunities for individuals and businesses. Students should be engaged in assessment driven activities throughout the course. For better learning outcomes following methods of content delivery via student engagement can be adopted.

Investment Simulation Game: Divide students into groups and have them participate in a simulated investment game. Each group is given a virtual budget to invest in stocks, bonds, mutual funds, or other investment vehicles. Throughout the course, they track the performance of their investments and make decisions based on real-world market trends and economic indicators.

Financial Planning Board Game: Design a board game that simulates the process of financial planning,

including setting financial goals, creating budgets, managing debt, and making investment decisions. Students play the game in groups, competing or collaborating to achieve their financial objectives.

Stock Market Simulation: Use online stock market simulation platforms that allow students to buy and sell stocks in a virtual trading environment. They can experiment with different investment strategies, track the performance of their portfolios, and compete against their classmates or other teams.

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-

Legends:- High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25AEC12ME021	Sanskrit for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		AEC11ME01
Course Outcomes	CO1	Demonstrate understanding of the Fundamentals of Sansrkit Language
	CO2	Apply Vocabulary and grammar skills for day to day conversation
	CO3	Developing Speaking and Learning skills

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction: Some Unique characteristics of Sanskrit The Sounds of Sanskrit: Its Alphabet Sentence Construction and Its underlying logic Introduction of Self and Others Basic verbs and some conjugations	1-8	6
2	2.1	Introduction to Genitive (6^{th} Case) Counting and Reading the Time Plural of Pronouns and Nouns Conjugation of Basic Verbs in the Plural Introduction to the Locative (7^{th} Case)	1-8	6
3	3.1	Days of the week, Months, Future Tense Past Tense and More Verbs Introduction to the Accusative (2^{nd} Case) Introduction to the Instrumental (3^{rd} Case)	1-8	6
4	4.1	Introduction to the Ablative (5^{th} Case) Introduction to the Dative (4^{th} Case) Introduction to the Vocative (8^{th} Case)	1-8	6
	4.2	Stories and Motivational Shlok with word by word meaning	1-8	2
Total				26

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

[1] Kesav.," A practical course to learn tamil for Absolute beginners (Standard and Colloquial), Notion

Press, 2020
[2] Dr. R. Kalidasan, Dr. S. Velayuthan, "English Grammar-An easy way to learn with Tamil Explanation and key, Shanlax publisher, 2019
[3] Oxford English-English Tamil Dictionary, Oxford.

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	–	–	–	2	–	1	–	–
CO2	–	–	–	–	–	–	–	1	3	–	1	–	–
CO3	–	–	–	–	–	–	–	2	3	–	1	–	–

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25AEC12ME023	Kannada for Beginners	L	T	P	SL	L	T	P	Total
		2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		AEC11ME01
Course Outcomes	CO1	Demonstrate understanding of the Fundamentals of Kannada Language
	CO2	Apply Vocabulary and Grammar skills for day-to-day conversation
	CO3	Developing Speaking and listening skills

Module No.	Unit No.	Topics	Ref	Hrs
1	1.1	**Introduction to Kannada Alphabets and Pronunciation** History of Kannada Language		1
	1.2 1.3 1.4	Learning Kannada Alphabets Pronunciation and visual learning Greetings and Common expressions		1 2 2
2	2.1	**Basic Grammar and Sentence Structure with Subject, Verb, Objective (SVO)** Basics of Sentence Formation		2
	2.2 2.3	Present tense, Past tense, Future tense, and Introduction to Adjectives Common Nouns, Pronouns with negative imperatives		2 2
3	3.1	**Conversation Phrases and Language Vocabulary** Learning Numerals (Cardinal Numbers) 1-20 / 100 -1000		2
	3.2 3.3	Classified Sentences and Useful expressions Learning Days of week, Months of the year, Fruits, Food grains, Parts of the body, Names of common places like Hospitals, markets, shops, saloons, gender, weather , etc.		3 3
4	4.1	**Developing Language fluency and Proficiency.** Day to day usage of Language for daily routine in conversation with Student to Teacher, vegetable vendor, in Railway station, with Auto driver , in Hospitals, etc.		3
	4.2	Role play exercises in common situations		3
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

[1] Upadhaya,U.P & N.K.Krishnamurthy, "Conversational Kannada"Prism Books, 2018
[2] Thomas Hodson, "Grammar of the Kannada or Canarese language", Gyan publishing house, 2020
[3] Ramanja Reddy Merugu , "Learn kannada through English" 2021
[4] Dr. Prabhu sankara & B.V.Sridhar," Oxford English-English-Kannada dictionary", Oxford Publications.

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	2	-	1	-	-
CO2	-	-	-	-	-	-	-	1	3	-	1	-	-
CO3	-	-	-	-	-	-	-	2	3	-	1	-	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25AEC12ME024	Telugu for Beginners	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		AEC11ME01
Course Outcomes	CO1	Demonstrate understanding of the fundamentals of Telugu Language
	CO2	Apply vocabulary and grammar skills for day to day conversation
	CO3	Developing Speaking and Listening skills

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to Telugu Alphabets and Pronunciation** History of Telugu language		1
	1.2	Learning Telugu Alphabets and Symbols		1
	1.3	Basic Pronunciation		2
	1.4	Greetings and Common expressions		2
2	2.1	**Basic Grammar and Sentence Structure** Sentence Structure : Subject , verb, Object (SVO)		2
	2.2	Present tense, Past tense and Future tense		2
	2.3	Common nouns, Pronouns, Adjectives		2
3	3.1	**Conversation Phrases for Daily Situations** Learning numerals (Cardinal Numbers) 1- 20, 100 -1000		2
	3.2	Forming Simple sentences / Listening and Speaking skills		3
	3.3	Days of week, Months of the year, Gender, Fruits, Parts of the body, Names of common places like hospitals, markets, shops, saloons etc.		3
4	4.1	**Common Phrases and Developing Language Fluency and Proficiency** Day to day usage of Telugu language for daily routines in conversation with Student to teacher, Vegetable Shop vendor, Railway passengers, Auto drivers, in Hospitals., etc.		3
	4.2	Role Play Exercises in Common situations, presentation on Telugu culture, Telugu scripts, Telugu classical music, Telugu festivals.		3
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

[1] Sanjay,D, " Spoken Telugu for Absolute Beginners", Notion Press, 2019.
[2] Praveen Ragi, "Learn Telugu Through English .V1" Evincepub Publications, 2020
[3] Oxford compact English-English Telugu Dictionary
[4] English- Telugu Conversation guide / Aarthi Janyavula , 2018

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	–	–	–	–	–	–	–	–	2	–	1	–	–
CO2	–	–	–	–	–	–	–	1	3	–	1	–	–
CO3	–	–	–	–	–	–	–	2	3	–	1	–	–

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25VEC12ME01	Human Values and Professional Ethics	L	T	P	SL	L	T	P	Total
		1	--	2	1	1	--	1	2
			Examination Scheme						
			ISE	MSE		ESE			Total
		Theory	100	--		--			100

Pre-requisite Course Codes		-
Course Outcomes	CO1	Adhere to the core rights and shape one's values.
	CO2	Display the role and responsibility of Engineering professionals
	CO3	Holds moral and Ethical solutions to problems through case studies.
	CO4	Apply the knowledge of human values to contemporary ethical and global issues.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Background and Approach: Fundamental Rights and Duties**		
	1.1	Fundamental Rights and Duties, Right to Compensation for being Illegally Deprived of one's Right to Life or Liberty, Right to Travel Abroad and Return to one's Country		2
	1.2	Promotion of Inter-Religious harmony and inter-faith values, Composite Culture		1
2		**Professional Ethics and Human Values**		
	2.1	Sense of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy, Kohlberg's theory Gilligan's theory, Consensus and Controversy, Profession & Professionalism, Models of professional roles, Theories about right action Codes of Ethics, Plagiarism		3
	2.2	Human Values. Morals, values, and Ethics – Integrity- Academic integrity- Work Ethics- Service Learning- Civic Virtue Respect for others- Living peacefully- Caring and Sharing- Honestly- Cooperation Commitment Empathy-Self Confidence -Social Expectations.		2
	2.3	Managing conflict- Respect for authority- Collective bargaining- Confidentiality, Role of confidentiality in moral integrity-Conflicts of interest		2
3		**Global Ethical Concerns**		
	3.1	Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics		2
	3.2	Engineers as Expert witnesses and advisors-Moral leadership- case studies		1
Total				**13**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

[1] Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014
[2] Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
[3] Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United States,2005.
[4] M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
[5] R S Naagarazan, A textbook on professional ethics and human values, New Age International (P) limited,New Delhi,2006.

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	3	2	2	-	2	-	-
CO2	-	-	-	-	-	2	3	2	2	-	2	-	-
CO3	-	-	-	-	-	2	3	2	2	-	2	-	-
CO4	-	-	-	-	-	-	3	2	2	-	2	-	-

Legends :- High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
25CEP12ME01	Community Engagement Project	Examination Scheme						
			ISE	MSE	ESE		Total	
		Theory	--	--	--		--	
		Practical	100	--	--		100	

Pre-requisite Course Codes		--
Course Outcomes	CO1	Identify and address community needs and challenges which help learners to develop problem-solving skills and creativity in finding innovative solutions.
	CO2	Enhance their cultural competence and ability to work effectively in multicultural settings
	CO3	Critically think on complex issues considering multiple view points
	CO4	Demonstrate collaboration, team work, civic engagement, empathy and compassion while engaging directly with community
	CO5	Develop a lifelong commitment to social justice and making a positive impact in the world

This course requires students to participate in field-based learning/projects generally under the supervision of faculty. The curricular component of 'community engagement and service' involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.

At the end of the course it is expected that students will have valuable learnings in terms of enhanced communication skills, increased cultural competence, improved critical thinking, leadership skills, collaboration skills, empathy & compassion, civic engagement, problem-solving skills, self- reflection & personal growth and long-term commitment to social justice.

It is expected that 26-30 hours of contact time per credit in a semester (52 to 60 hours in a semester for 2 credits) along with 13-15 hours of activities such as preparation for community engagement and service, preparation of reports, etc., and independent reading and study.

Other Guidelines to students for successful Community Engagement:

Community engagement is the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people It is a powerful vehicle for bringing about environmental and behavioral changes that will improve the health of the community and its members. It often involves partnerships and coalitions that help mobilize resources and influence systems, change relationships among partners, and serve as catalysts for changing policies, programs, and practices.

Community engagement project is different as compared to traditional consultation. It is a regular engagement of community for achieving an identified goal or vision. It recognizes the role of community engagement in its broadest sense in the development of local democracy, while noting that the focus of the report is on the practice of community engagement as it relates to local authority activity.
Communication, diplomacy, patience, and flexibility are essential to engage with a community. For a

successful engagement conditions include: Shared and defined purpose. Willingness to collaborate. Commitment to contributing. Participation of the right people. Open and credible process. Involvement of a champion with credibility and clout. Ensure that the engagement process is complex but manageable. Initially the team will: Discuss and define the initiative and its potential impact. Set the purpose and goals for community engagement. Define the community. Know and respect the community's characteristics. Develop a relationship with the community, build trust, work with formal and informal leadership, find the community gatekeeper, identify the project champion, meet with the local organizations, and learn the assets and challenges for that community. Find the common interests.

The following four phases provide broad outline for the community engagement process:
Phase-I: Outreach

Go to the community instead of having the community come to you. Invite the stakeholders to a conversation. Create a constructive environment for dialogue allowing time to get to know the participants remembering that the community's time is valuable and must be respected. Identify the person or the organization that has convened the group and will provide initial leadership and organizational management. Outline the purpose and process for the conversation. Use a facilitator when appropriate. Define the issue and why it is important. Outline what is broken and focus on what is working. Is the issue a people problem or a situation problem? Can the problem be solved with technical expertise or will it require something else? Determine the interest and merit in hosting future discussions.

Phase-II: Gather Facts, Brainstorm and Select

Create an environment for discussion where people are comfortable asking questions, expressing doubts, and brainstorming new ideas. Gather the facts related to the issue and its impact. Use a SWOT, appreciative inquire, asset mapping, and other tools during the factfinding stage. Clarify the issue's alignment with the community's values and ethics. Establish the common ground on which conversations will be based. Brainstorm and gather alternative solutions. Ask the "what if" questions. Spend time discussing the options and the potential impact. Allow the process to equip the participants to see the change, feel the change, and then be prepared to change. Select the best practice/solution. If required use decision-making tools to reduce the number of options.

Phase-III: Plan and Review

Write the implementation action plan. Include the evaluation procedure that will answer the question "What will it look like when the change has happened?". Discuss the proposal with the appropriate stakeholders searching for insight and response. Use the feedback to assess and revise the plan. Stay focused on the solution.

Phase-IV: Implement and Evaluate

Implement the plan. Remember, groups want a rapid success. Identify an action that will provide a "meaningful win" within the "immediate reach." Evaluate the impact. Report the status to the community and gather feedback. Revise the plan and evaluate again.
Keep the participants informed through discussion agendas, written summaries of previous discussions, goals/assignments for the next discussion, and progress reports providing accountability for delivering what was promised.

Course Assessment:

ISE:
Activity: Report Submission: 40 Marks
Activity: Report Presentation: 60 Marks

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3				3						
CO2						3		3	3				
CO3		3					3						
CO4						3		3	3	3			
CO5						3	3	3					

Legends :- High: 03, Medium: 02, Low: 01, No Mapping: -

Blooms level

Remember	Understand	Apply	Analyze	Evaluate	Create

Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
		2	1	--	3	2	1	--	3
25BSC12ME06	Thermodynamics	Examination Scheme							
			ISE	MSE		ESE			Total
		Theory	20	30		50			100
		Tutorial	50	--		--			50

Pre-requisite Course Codes	None	
Course Outcomes	CO1	Understand basic thermodynamic terms, properties, systems, processes, and the Zeroth Law.
	CO2	Explain the First Law and apply it conceptually to non-flow and steady-flow systems.
	CO3	Understand the Second Law, heat engines, refrigerators, and basic entropy concepts.
	CO4	Explain availability, unavailability, and irreversibility in thermodynamic systems.
	CO5	Interpret properties of pure substances using phase-change concepts, steam tables, and Mollier charts.
	CO6	Understand the working principles of vapor and gas power cycles and compare their basic characteristics.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Basic Concepts: Thermodynamics system and types, Macroscopic and Microscopic approach, Thermodynamic properties of the system, state, path, process and cycle, Point and Path functions, Quasi-static process & Equilibrium.	1-5	2
	1.2	Zeroth law of thermodynamics, Characteristic gas equation, Concept of Internal energy, Enthalpy, Heat and Work. Concept of PdV work. (No numericals)	1-5	1
2	2.1	First Law of Thermodynamics: Statement & Equation, First law for Cyclic process (Joule's experiment), Perpetual Motion Machine of the First Kind.	1-5	1
	2.2	Application of first law to nonflow systems executing non-flow processes. (No numericals)	1-5	2
	2.3	First law applied to flow systems: 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 different devices. Steady flow work, Relation between flow and non-flow work. (No numericals)	1-5	2
3	3.1	Second Law of Thermodynamics:	1-5	3
		Limitation of the first law of thermodynamics, Thermal reservoir, Concept of heat engine, Heat pump and Refrigerator, Statement of the second law of thermodynamics. Causes of irreversibility, Perpetual Motion Machine of the second kind, (No numericals)		
	3.2	Entropy: Clausius theorem, Entropy a property of the system, Temperature-Entropy diagram, Clausius inequality, Increase of entropy principle, T- ds relations, Entropy change During a process. (No numericals)	1-5	2

4	**4.1**	Availability: High -grade and low- grade energy, Available and Unavailable energy, Dead State, Useful work, Irreversibility, Availability of closed system& steady flow process, Helmholtz & Gibbs function. . (No numericals)	1-6	3
5	**5**	Properties of Pure Substance: Advantages and applications of steam, Phase change process of water, Saturation pressure and temperature, Terminology associated with steam, Different types of steam. Critical and triple point, T-s and an h-s diagram for water, Calculation of various properties of wet, dry and superheated steam using the steam table and Mollier chart. . (No numericals)	1-6	5
6	**6.1**	Vapour Power cycle: Principal components of a simple steam power plant, Carnot cycle and its limitations as a vapour cycle, Rankine cycle with different turbine inlet conditions, Mean temperature of heat addition, Reheat Rankine Cycle. . (No numericals)	1-6	3
	6.2	Gas Power cycles: Nomenclature of a reciprocating engine, Mean effective pressure, Assumptions of air Standard Cycle, Otto cycle, Diesel Cycle and Dual cycle, Comparison of Otto and Diesel cycle for same compression Ratio. (Only theory. No proofs, No numericals)	1-6	2
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on the tutorials evaluated through continuous assessment of understanding and applications of thermodynamics principles to engineering problems.

Recommended Books:

Text Books:

[1] Thermodynamics by P K Nag, 6 th Edition,TMH
[2] Thermodynamics by Onkar Singh, 4th Edition New AgeInternational
[3] Thermal Engineering By Ajoy Kumar, G. N. Sah, 2nd Edition, Narosa Publishing house

Reference Books:

[4] Fundamentals of Classical Thermodynamics by Van Wylen G.H. & Sonntag R.E., 9th Edition John

Wiley& Sons
[5] Thermodynamics by W.C. Reynolds, McGraw-Hill &Co
[6] Thermodynamics by J P Holman, 4th Edition McGraw-Hill & Co

AICTE Prescribed Textbook:
Basics of Thermodynamics by Dr. Pramod Kumar, Atul Dhar
(https://ekumbh.aicte-india.org/allbook.php#)

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	2	-	-	-	-	-	-	-	2	-
CO2	2	2	-	2	-	-	-	-	-	-	-	2	-
CO3	2	2	-	2	-	-	-	-	-	-	-	2	-
CO4	2	2	-	3	-	-	-	-	-	-	-	2	-
CO5	2	2	-	3	-	-	-	-	-	-	-	2	-
CO6	2	2	-	2	-	-	-	-	-	-	-	2	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	Apply	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12ME08	Mechanics of Solids	2	1	2	3	2	1	1	4
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	20	30		50		100	
		Tutorial	50	--		--		50	
		Practical	50	--		--		50	

Pre-requisite Course Codes	Engineering Mechanics	
Course Outcomes	CO1	Demonstrate fundamental knowledge about various types of loading and stresses induced.
	CO2	Draw the SFD and BMD for different types of loads and support conditions.
	CO3	Analyse the bending and shear stresses induced in beam.
	CO4	Analyse the deflection in beams and stresses in shaft.
	CO5	Estimate the strain energy in mechanical elements and analyse buckling phenomenon in columns.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction-Concept of Stress and strain** Deformation in solids- Hooke's law, stress and strain under tensile, compressive and shear forces, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, Elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus and their relations-volumetric, linear and shear strains, Two-dimensional stress system, Principal Stresses and Strains	1-6	5
	1.2	Thermal stress and strain in single and compound bars	1-6	1
2	2.1	**Shear Force and Bending Moment in Beams:** Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, Relationship between load intensity, bending moment and shear force.	1-6	2
	2.2	Shear force diagrams for statically determinate beams subjected to point loads, uniformly distributed loads, uniformly varying loads, couple and their combinations. Calculation of maximum S.F under different loads	1-6	2
	2.3	Bending moment diagrams for statically determinate beams subjected to point loads, uniformly distributed loads, uniformly varying loads, couple and their combinations, Calculation of maximum B.M. and the point of contra flexure under different loads	1-6	2
3	3.1	**Stresses in Beams:** Theory of bending of beams, Assumptions in the simple bending theory, derivation of formula and its application to beams of rectangular, circular channel, I and T- sections. Combined direct and bending stresses in afore-mentioned sections	1-6	1
	3.2	bending stress distribution for point and distributed loads in simply	1-6	2

		supported beams and cantilevers for common symmetrical sections.		
	3.3	shear stress distribution for point and distributed loads in simply supported beams and cantilevers for common symmetrical sections.	1-6	2
4	**4.1**	**Deflection of Beams:** Introduction to deflection of a beam, Relationship between moment, slope and deflection, Double integration method (no numericals) Maxwell's reciprocal theorem	1-6	1
	4.2	Macaulay's method for computation of deflection and slope	1-6	2
	4.3	**Torsion:** Introduction to Twisting moment or Torque, Theory of Torsion, strength of shaft, Torsional stiffness, flexibility and rigidity, Stresses in solid and hollow circular shafts.	1-6	2
5	**5.1**	**Strain Energy:** Strain energy stored in the member due to gradual, sudden and impact loads, Strain energy due to bending and torsion.	1-6	2
	5.2	**Columns:** Introduction, failure of columns, Buckling load, Types of end conditions for column, Euler's formula and its limitations, Rankine-Gordon's formula, Johnson's empirical formula	1-6	2
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Tutorial:

Sr. No.	Tutorial Details	Hours
1	Stress and Strain	**02**
2	Shear Force and Bending Moment in Beams	**02**
3	Torsion	**01**
4	Stresses in Beams	**01**
5	Deflection and slope of Beams	**01**
6	Strain Energy and Column	**01**
	Total Hours	**08**

Laboratory:

Sr. No.	Experiments Details	Hours
1	Fatigue test on a steel rod.	4
2	Tensile test on a mild steel rod.	4
3	Compression test on a wooden block.	4
4	Bending test on a wooden specimen.	4
5	Prediction of SF and BM using Software	2
6	Prediction of Deflection of Beams using Software	2
	Total	**20**

Course Assessment:

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on five tutorials, each carrying 10 marks. Evaluation will be carried out through continuous assessment of understanding and applications of mechanics of solids principles to engineering problems.

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Recommended Books:

Text Books:

1. Mechanics of Materials by S. S. Ratan, Tata McGraw Hill Pvt. Ltd
2. Strength of Materials by R. K. Rajput, S Chand Publications
3. A textbook of Strength of Materials by R. K. Bansal, Laxmi Publications
4. Strength of Materials by S. Ramamrutham, Dhanpat Rai Pvt. Ltd
5. Strength of Materials by R. Subramanian, Oxford University Press, Third Edition 2016
6. Mechanics of Structures by S. B. Junnarkar, Charotar Publication

Reference Books:

7. Strength of Materials by Ryder, Macmillan
8. Mechanics of Materials by James M. Gere and Barry J. Goodno, Cengage Learning, 6thEd, 2009
9. Mechanics of Materials by Gere and Timoshenko, CBS 2nd Edition
10. Elements of Strength of Materials by Timoshenko and Youngs, Affiliated East -West Press
11. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, TMHPvt Ltd., New Delhi
12. Introduction to Solid Mechanics by Shames, PHI
13. Strength of Materials by W. Nash, Schaum's Outline Series, McGraw Hill Publication, Indian Edition

AICTE Prescribed Textbook:

Strength of Materials by Dr. Uday Shanker Dixit, Nelson Muthu, S.
M. Kamal (https://ekumbh.aicte-india.org/allbook.php#)

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	-	2	-	-	-	-	-	2	-
CO2	3	3	-	-	-	2	-	-	-	-	-	2	-
CO3	3	3	-	-	-	2	-	-	-	-	-	2	-
CO4	3	3	-	-	-	2	-	-	-	-	-	2	-
CO5	3	3	-	-	-	2	-	-	-	-	-	2	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	**Analyze**	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25PCC12ME09	Materials Science and Engineering	2	1	--	3	2	1	--	3
		Examination Scheme							
			ISE	MSE		ESE			Total
		Theory	20	30		50			100
		Tutorial	50	--		--			50

Pre-requisite Course Codes	-	
Course Outcomes	CO1	Identify and fundamentally differentiate between various classes of materials.
	CO2	Demonstrate knowledge of various types of imperfection, deformation, and strengthening mechanisms in solids.
	CO3	Categorize various modes of failure.
	CO4	Predict the phases by analyzing various types of phase diagrams.
	CO5	Propose appropriate heat treatment for various metals and alloys studied for a particular application.
	CO6	Able to understand the properties and behavior of different new-age materials.

Part A (Theory)

Module No.	Unit No.	Topics	Ref	Hrs.
1	1.1	Introduction to Materials Science and Engineering, Why study MSE. Processing/Structure/Properties/Performance correlations.	1,2	03
	1.2	Materials classification. Types of atomic bonding.		
	1.3	Crystal structures. Crystallographic directions and planes.		
2	2.1	Imperfection in solids – point defects, line defects, Surface defects, and volume defects.	1,2	05
	2.2	Elastic and plastic deformation. Stress-Strain behavior. Mechanisms of deformation. Slip systems. Critical resolved shear stress. Deformation in Single and Polycrystalline materials.		
	2.3	Strengthening mechanism in metals. Recovery, Recrystallization, and Grain Growth.		
3	3.1	Fracture: Definition and types of fractures. Ductile fracture and Brittle fracture. Fracture mechanics. Fracture toughness. Ductile- to-Brittle transition.	1,2	04
	3.2	Fatigue Failure: Definition of fatigue. Cyclic stress. Mechanism of fatigue. Fatigue testing. S. N. Curve. Factors that affect fatigue life.		
	3.3	Creep: Definition and significance of creep. Effect of temperature and creep on the mechanical behavior of materials. Creep testing. Mechanism and types of creep.		
4	4.1	Solidification of metals. Crystalline and noncrystalline materials. Anisotropy. Theory of alloying.	1,2	05
	4.2	Phase diagrams – definition, basic concepts, and types. Development of microstructure.		
		The Iron-Iron Carbide Phase Diagram: Importance and allotropic forms		

	4.3	of Iron. Iron-Iron carbide diagram and its analysis. Classification of Plain carbon steels and Cast irons. Types of metal alloys – Ferrous and nonferrous (Basics)		
5	**5.1**	Principles of Heat treatment: Technology of heat treatment. Classification of the heat treatment process. Time-Temperature- Transformation diagram. Continuous Cooling Transformation Diagram. Superimposition of cooling curves on the TTT diagram.	1,2	05
	5.2	Heat treatment Process and applications: Annealing, normalizing, Spheroidzing, Hardening, Tempering, Austempering, Martempering, Maraging and Ausforming process.		
	5.3	Surface Hardening methods. Their significance and applications. Carburizing, Nitriding, Cyaniding, Carbon-nitriding. Induction hardening and Flame hardening processes.		
6	**6.1**	Ceramic Material: Structures, imperfections, and mechanical properties.	1,3	04
	6.2	Nanomaterials: Introduction, classification, fabrication methods. Biomaterials: Basic concept, classes, application.		
	6.3	Semiconductors: Introduction. Intrinsic and extrinsic semiconductors. Material preparation technique. Applications. Magnetic Material: Introduction, Classification of Magnetic Materials. Magnetic Dipoles and Magnetic Moments. Diamagnetic, Paramagnetic, Ferromagnetic, Ferrimagnetic, and Superparamagnetic Materials	1,2,3	
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

Theory:

ISE:

ISE activities carry 20 marks. These activities will be conducted throughout the semester.

MSE:

The written summative examination of 30 marks based on 50% syllabus for 90 minutes.

ESE:

The written summative examination will be conducted for 50 marks based on the complete syllabus (20% questions on syllabus covered before MSE and 80% questions on the remaining syllabus) for 120 minutes.

Tutorial:

Assessment shall be based on the tutorials evaluated through continuous assessment of understanding and application of materials science and engineering.

Recommended Books:

Text books:

[1] Materials Science and Engineering: An Introduction, 9 th edition by William D. Callister Jr. – Adapted by R. Balasubramaniam. Wiley India (P) Ltd (2020).

[2] Materials Engineering, – Dhirendra Kumar Dwivedi, All India Council for Technical Education, December 2022.

Reference Books:

[3] The Science and Engineering of Materials, 7 th edition by Donald R. Askeland, Wendelin JWright, Cengage Learning (2016).

[4] Materials Science and Engineering, 6 th edition by V. Raghavan, Prentice Hall India(2015).

AICTE Prescribed Textbook:

Materials Engineering, – Dhirendra Kumar Dwivedi, All India Council for Technical Education, December 2022.
(https://ekumbh.aicte-india.org/allbook.php#)

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	3	-	-	-	-	-	-	-	-	3	2
CO3	3	2	3	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	2
CO5	3	2	3	-	-	-	-	-	-	-	-	2	3
CO6	3	2	-	3	-	-	-	-	-	-	-	-	2

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC12ME10	Materials and Material Testing	L	T	P	L	T	P	Total
		--	--	2	--	--	1	1
		Examination Scheme						
			ISE	MSE	ESE		Total	
		Practical	**50**	**--**	**--**		**50**	

Pre-requisite Course Codes	-	
Course Outcomes	CO1	Able to determine the hardenability of steel samples.
	CO2	Compare different microstructures of steel samples
	CO3	Predict the heat treatment required to impart required properties in samples.
	CO4	Perform impact tests on the given components.

Sr. No.	Experiments Details	Hours
1	Impact Testing on steel specimen (Charpy test)	4
2	Impact Testing on steel specimen (Izod test)	4
3	Determination of hardenability of steel using the Jominy End Quench Test.	4
4	Sample preparation for metallographic observations.	2
5	Metallurgical Observations and Microstructure Analysis	2
6	Experiments based on any two heat treatment methods	4
	Total	**20**

Course Assessment:

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Text books:

[1] Materials Science and Engineering: An Introduction, 9 th edition by William D. Callister Jr. – Adapted by R. Balasubramaniam. Wiley India (P) Ltd (2020).
[2] Materials Engineering, – Dhirendra Kumar Dwivedi, All India Council for Technical Education, December 2022.

Reference Books:

[3] The Science and Engineering of Materials, 7 th edition by Donald R. Askeland, Wendelin JWright, Cengage Learning (2016).
[4] Materials Science and Engineering, 6 th edition by V. Raghavan, Prentice Hall India (2015).

AICTE Prescribed Textbook:

Materials Engineering, – Dhirendra Kumar Dwivedi, All India Council for Technical Education, December 2022.
(https://ekumbh.aicte-india.org/allbook.php#)

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	2	-	-	3	2
CO2	3	3	3	3	3	-	-	-	2	-	-	2	2
CO3	3	3	3	3	3	-	-	-	2	-	-	2	3
CO4	3	3	3	3	3	-	-	-	2	-	-	3	2

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	**Analyze**	Evaluate	Create

Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25PCC12ME11	Thermal Engineering Laboratory	--	-	2	--	--	1	1
		Examination Scheme						
			ISE	MSE	ESE		Total	
		Practical	50	--	--		50	

Pre-requisite Course Codes	Thermodynamics	
Course Outcomes	CO1	Explain the working principles of boilers, boiler mountings, and accessories.
	CO2	Elucidate the core concepts and applications of refrigeration and air conditioning systems.
	CO3	Understand different HVAC&R components and assess the performance of various refrigeration systems.
	CO4	Assess the performance and emissions characteristics of petrol and diesel engines under different operating conditions.
	CO5	Determine frictional power and mechanical efficiency of multi-cylinder petrol engines using the Morse test.
	CO6	Conduct heat balance analysis on internal combustion engines and interpret efficiency and energy distribution.

Sr. No	List of Experiment	Hrs.
1	Study of Boilers, Boiler Mountings and Accessories	2
2	Investigating the performance (COP, tonnage, Refrigeration efficiency) of an open air conditioning unit.	2
3	Assessment of the performance (COP, tonnage, Refrigeration efficiency) of an ice-plant test rig.	2
4	Evaluation of the performance of a cooling tower.	2
5	Study and assessment of an electrolux refrigeration unit.	2
6	Study of performance and emissions characteristics of a Single Cylinder/Multi Cylinder, Two/Four stroke petrol Engine at constant Speed/Load.	2
7	Determination of frictional power and mechanical efficiency of the Multi-cylinder Petrol Engine by Morse test.	2
8	Study of performance and emissions characteristics of a Single Cylinder/ Multi Cylinder, Two/Four stroke petrol Engine at constant Speed along with heat balance sheet.	2
9	Study of performance and emissions characteristics of a Single Cylinder, Four-stroke Diesel Engine at constant speed (With Electrical/ Rope Brake Dynamometer) (Load Test) along with Heat Balance Sheet.	2
10	Industrial Visit to a Power Plant	2
	Total	**22**

Course Assessment:

Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 25 marks for submission of experiments and 25 marks for oral/practical evaluation.

Reference Books:

1. Refrigeration and Air Conditioning – C. P. Arora, McGraw Hill
2. Heating, Ventilation, and Air Conditioning: Analysis and Design – Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler, Wiley
3. Refrigeration and Air Conditioning – R. S. Khurmi & J. K. Gupta, S. Chand Publications
4. Internal Combustion Engines – V. Ganesan, McGraw Hill
5. Internal Combustion Engine Fundamentals – John B. Heywood, McGraw Hill

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	2	2	-	-	-	-	-	-	2	3
CO2	3	3	-	2	2	-	-	-	-	-	-	2	3
CO3	3	3	-	2	2	-	-	-	-	-	-	3	3
CO4	3	3	-	2	2	-	-	-	-	-	-	3	3
CO5	3	3	-	2	2	-	-	-	-	-	-	3	2
CO6	3	3	-	2	2	-	-	-	-	-	-	3	2

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	**Analyze**	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25OE21	Emerging Technology and Law	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		MDM11
Course Outcomes	CO1	To recognize the importance of legal technology domain
	CO2	To demonstrate awareness of the laws related to emerging technologies and legal implications of their work
	CO3	To demonstrate understanding of the impact of emerging/contemporary technologies on the legal ecosystem
	CO4	To demonstrate awareness about company laws, FEMA and few other important acts related to engineering design and consumer protection

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Tech Legal Market**	1	4
	1.1	Legal Marketplace, Impact of Technology on Legal Profession		
	1.2	How technologists can help reshape legal system		
	1.3	Career Development in Legal Tech Domain		
2		**Emerging Technologies and Legal Implications-1**	1	8
	2.1	Cyber Crimes, Cyber Threats and Issues: Information Technology Act 2000		
	2.2	Blockchain and Legal Issues		
	2.3	Legal Implications of Artificial Intelligence		
	2.4	Electronic and Digital Signatures		
	2.5	Implications of Social Media Laws		
3		**Emerging Technologies and Legal Implications-2**	1	6
	3.1	Legal Ecosystem for Autonomous Vehicles and Unmanned Aerial Vehicles (UAV)		
	3.2	Privacy and Data Protection with a Trillion Connected & Cognitive Devices		
	3.3	Legal Ecosystem for 5G		
4		**Company Laws**	2,3	4
	4.1	Companies Act, 1956- Nature and Meaning, Classification of Companies, Incorporation of Companies		
	4.2	Sources of Capital, Board of Directors, Company Meetings	2,3	
5		**Regulation and Management of Foreign Exchange**		2
	5.1	Foreign Exchange Management Act FEMA 1999		
6		**Other Important Laws**	2,3	2
	6.1	Consumer Protection Act, Competition Act 2002, Semiconductor Integrated Circuits Layout-Design Act 2000, Designs Act 2000, Bureau of Indian Standards Act 2016,		
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. N. S. Nappinai, "*Technology Laws Decoded*," LexisNexis, 2017
2. Vibha Arora and Kunwar Arora, "*Law for Engineers*" Central Law Publications, 2017
3. Vandana Bhatt and Pinky Vyas, "*Laws for Engineers*", ProCare, 2015.
4. The Information Technology Act, 2000 (21 of 2000) | Bare Act 2026 Edition Paperback – 1 January 2026 by Whitesmann Publishing.
5. 5G and Beyond: Intellectual Property and Competition Policy in the Internet of Things Hardcover – Import, by Jonathan M. Barnett, Cambridge University Press.
6. The LegalTech Book, Editors Akber Datoo, Drago Indjic, Sophia Adams Bhatti, Susanne Chisht by Wiley Publisher.

Links:

1. https://www.sci.gov.in.
2. https://www.youtube.com/watch?v=nOquqbljcbU.
3. https://www.youtube.com/watch?v=RRmNJS35T_g.
4. https://www.youtube.com/watch?v=hLqbEG3LQYw.
5. https://www.youtube.com/watch?v=cMqhvJEDDZ8.
6. https://www.youtube.com/watch?v=gVcgD8TNM70.
7. https://www.youtube.com/watch?v=MrW8hiK72Yw.
8. https://www.youtube.com/watch?v=k5jEkTm5GIU.
9. https://www.youtube.com/watch?v=mahDTt_91qc.
10. https://www.indiacode.nic.in/bitstream/123456789/13116/1/it_act_2000_updated.pdf.
11. https://www.youtube.com/watch?v=Ri69oMUGoo4.

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	1	3	2	1	2	3	-	-	-
CO2	2	-	-	-	1	3	2	1	2	3	-	-	-
CO3	3	-	-	-	1	2	1	3	3	3	-	-	-
CO4	3	-	-	-	1	2	1	3	3	3	-	-	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25OE22	Principles of Management	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes	-	
Course Outcomes	After completing the given assignments and experiments, students will be able to:	
	CO1	Understand the evolution of management theories and their relevance today
	CO2	Apply planning tools and techniques to real-world business scenarios
	CO3	Understand effective organizational structures based on business requirements
	CO4	Study different leadership styles and apply appropriate leadership techniques in various situations.
	CO5	Recognize ethical dilemmas in management and apply responsible decision-making frameworks.
	CO6	Study critical thinking and problem-solving techniques to organizational issues.

Module No.	Topics	Hrs.
1	**Introduction to Management** Definition and Nature of Management: Understanding management as a process and its significance in organizations. Historical Evolution: Exploration of classical management theories, including contributions from Henri Fayol and Frederick Taylor. Managerial Roles and Skills: Analysis of the roles managers play and the skills required at different managerial levels.	4
2	**Planning** Strategic and Tactical Planning: Differentiating between long-term strategic planning and short-term tactical planning. Decision-Making Processes: Tools and techniques for effective managerial decision-making. Goal Setting and Management by Objectives (MBO): Establishing clear objectives and aligning them with organizational goals	4
3	**Organizing** Organizational Structure and Design: Examining various organizational structures and their impact on efficiency. Delegation and Authority: Understanding the distribution of authority and responsibility within an organization. Coordination and Communication: Strategies for effective internal communication and coordination among departments.	4
4	**Leading.** Leadership Theories and Styles: Study of different leadership models and their applicability. Motivation Techniques: Exploring theories of motivation and their implementation in the workplace. Team Dynamics and Group Behavior: Insights into managing teams and understanding group behavior.	4

5	**Control Systems and Processes** Establishing standards and monitoring performance. Financial Controls: Budgeting, financial reporting, and variance analysis. Quality Management: Introduction to quality control techniques and continuous improvement processes.	**5**
6	**Contemporary Issues in Management** Ethics and Social Responsibility: The role of ethics in managerial decisions and corporate social responsibility. Globalization and Management: Challenges and strategies in managing international operations. Innovation and Change Management: Managing organizational change and fostering innovation.	**5**
Total		**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

References :

1. Koontz, H., & Weihrich, H. (2010). *Essentials of Management: An International Perspective* (8th ed.). McGraw-Hill Education.
2. Robbins, S. P., & Coulter, M. (2017). *Management* (13th ed.). Pearson Education.
3. Daft, R. L. (2018). *Management* (13th ed.). Cengage Learning.
4. Stoner, J. A. F., Freeman, R. E., & Gilbert, D. R. (1995). *Management* (6th ed.). Prentice Hall.
5. Drucker, P. F. (2006). *The Practice of Management*. HarperBusiness.
6. Academy of Management Journal – Provides peer-reviewed research articles on management theory and practices.
7. Journal of Management Studies – Features cutting-edge research in all fields of management.

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	-	-	-	-	-	-	-	-	-	2	1	-	-
CO3	-	-	-	-	-	-	-	2	1	1	-	-	-
CO4	-	-	-	-	-	-	1	2	2	2	1	-	-
CO5	-	-	-	-	-	2	2	1	-	1	1	-	-
CO6	-	-	-	-	-		1	-	1	2	2	-	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25VSE12ME03	Computer Aided Machine Drawing	--	--	4	--	--	2	2
		Examination Scheme						
			ISE	MSE	ESE		Total	
		Practical	100	--	--		100	

Pre-requisite Course Codes	ESC11ME01	
Course Outcomes		Learner will be able to…
	CO1	Illustrate basic understanding of types of CAD model creation.
	CO2	Visualize and prepare 2D modeling of a given object using modeling software.
	CO3	Build solid model of a given object using 3D modeling software.
	CO4	Visualize and develop the surface model of a given object using modeling software.
	CO5	Generate assembly models of given objects using assembly tools of a modeling software
	CO6	Perform product data exchange among CAD systems.

Sr. No.	Topics	Ref	Hrs.
1	CAD Introduction, CAD models Creation, Types and uses of models from different perspectives. Parametric modeling.	1,2,3,4, 5,6,7,8	4
2	2D Modeling 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.)	1,2,3,4, 5,6,7,8	8
3	Solid Modeling 3D Geometric modeling of an Engineering component, demonstrating modeling skills using commands like Extrude, Revolve, Sweep, Blend, Loft etc.	1,2,3,4, 5,6,7,8	10
4	Surface Modeling Extrude, Sweep, Trim etc. and Mesh of curves, free form surfaces etc. Feature manipulation using Copy, Edit, Pattern etc.	1,2,3,4, 5,6,7,8	8
5	Assemble the components using assembly Constraints, Exploded views, interference check. Drafting (Layouts, Standard & Sectional Views, Detailing & Plotting).	1,2,3,4, 5,6,7,8	8
6	Data Exchange CAD data exchange formats Like IGES, PDES, PARASOLID, DXF and STL along with their comparison and applicability	1,2,3,4, 5,6,7,8	8
Total			49

Laboratory Contents:
Using the above knowledge and skills acquired through six modules students should complete Minimum three assemblies from the given sets of assignments using standard CAD modeler like PTC Creo/CATIA/ Solid work/UG /any other suitable software.

i. Set 1: 3D modeling of basic Engineering components likes Nuts, Bolts, Keys, cotter, Screws, Springs etc.

Set 2: 3D modeling of basic Machine components like Knuckle joint, Couplings: simple, muff, flanged Protected flange coupling, Oldham's coupling, Universal coupling.

ii. 3D modeling of basic Machine components like Clapper block, Single tool post, Shaper tool head slide, jigs and fixtures, element of engine system and Miscellaneous parts.
iii. Generation of any Assembly model (minimum five child parts) along with Production drawing for any of the system by creating 3D modeling with assembly constraints, Interference check, Exploded view, GD&T, Bill of material.
iv. Reverse Engineering of a physical model: disassembling of any physical model having not less than five parts, measure the required dimensions of each component, sketch the minimum views required for each component, convert these sketches into 3-D model and create an assembly drawing with actual dimensions

Course Assessment:
Laboratory Learning:

ISE: Laboratory ISE is divided into two components: 50 marks for submission of experiments and 50 marks for oral/practical evaluation.

Recommended Books:

Text books:

[1] Machine Drawing by N.D. Bhatt.
[2] A textbook of Machine Drawing by Laxminarayan and M. L. Mathur, Jain brothers Delhi
[3] Machine Drawing by Sidheshwar and Kanheya

Reference Books:

[4] Machine Drawing by Kamat and Rao
[5] Machine Drawing by M. B. Shah
[6] A textbook of Machine Drawing by R .B. Gupta, Satyaprakashan, Tech. Publication
[7] Machine Drawing by K.I. Narayana, P. Kannaiah, K. Venkata Reddy
[8] Autodesk Inventor 2011 for Engineers and Designers by Sham Tickoo and Surinder Raina, Dreamtech press.

AICTE Prescribed Textbook:

Computer Aided Machine Drawing Practice by Dr. Kanak Kalita
(https://ekumbh.aicte-india.org/allbook.php#)

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	3	-	-	-	-	-	-	2	-
CO2	3	2	2	2	3	-	-	-	-	-	-	2	-
CO3	3	2	2	2	3	-	-	-	-	-	-	2	-
CO4	3	2	2	2	3	-	-	-	-	-	-	2	-
CO5	3	2	2	2	3	-	-	-	-	-	-	2	-
CO6	3	2	2	2	3	-	-	-	-	-	-	2	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	**Analyze**	Evaluate	Create

Society of St. Francis Xavier, Pilar's
Fr. Conceicao Rodrigues College of Engineering
Fr. Agnel Ashram, Bandstand, Bandra (W), Mumbai – 400 050
(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
		L	T	P	SL	L	T	P	Total
25EEM12ME02	Technology Entrepreneurship	2	--	--	2	2	--	--	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	100	--		--		100	

Pre-requisite Course Codes		PCC11ME01
Course Outcomes	CO1	Identify problems worth solving
	CO2	Craft value proposition
	CO3	Prepare B-Plan
	CO4	Register virtual company

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Opportunity Discovery**	1	6
	1.1	Self-Discovery		
	1.2	Effectuation Principle		
	1.3	Identification of problems worth solving, how not to reinvent the wheel		
	1.5	Innovation vs Invention,		
	1.5	Market discovery, Pricing & Competitive Analysis		
2		**Value Proposition Canvas**	2,3	7
	2.1	Craft your value proposition		
	2.2	Presentation of Value Proposition Canvas		
	2.3	Presentation of Lean Canvas		
3		**Patent for Entrepreneur**	4	5
	3.1	Introduction to Intellectual Property & Patents		
	3.2	Patentability Criteria & Types of Patents		
	3.3	Patent Application Process		
4		**Business Model and Company Formation**	5	8
	4.1	Business Model and Lean Approach (Finance, Marketing, Operations)		
	4.2	Understanding Marketing & Sales & Advertising		
	4.3	Managing Cash flow & Sales strategies		
	4.4	Managing Employee & HRD		
	4.5	Case Studies & Engaging with Entrepreneurs		
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

ISE: Based on Self-Learning / Formative assessment activities will be conducted during the full semester - 100 Marks

Recommended Books:

1. Sarasvathym "Elements of Entrepreneurial Expertise (New Horizons in Entrepreneurship Series)" Edward Elgar Publishing.
2. Alexander Osterwalder "Business Model Generation :A Handbook for Visionaries, Game Changers, and Challengers"
3. Alex Osterwalder, Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadakos "Value Proposition Design: How to create Products and Services Customers Want"
4. The Entrepreneur's Guide to Patents, Trademarks, and Copyrights — Russell L. Parr
5. M.C. Bhandari "Company Law Procedures" LexiNexis, 2018
6. Management of Tech Key to Wealth Creations - by Tarek M. Khalil (and Ravi Shankar in later editions) 2016

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	-	-	-	-	2	-	-	2	-	-
CO2	3	3	3	-	-	-	-	2	-	-	2	-	-
CO3	3	3	3	-	-	-	-	2	-	-	2	-	-
CO4	3	3	3	-	-	-	-	2	-	-	2	-	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create

Course Code	Course Name	Teaching Scheme (Hrs/week)				Credits Assigned			
25VEC12ME02	Technology Innovation for Sustainable Development	L	T	P	SL	L	T	P	Total
		1	--	2	1	1	--	1	2
		Examination Scheme							
			ISE	MSE		ESE		Total	
		Theory	--	--		--		--	
		Practical	100	--		--		100	

Pre-requisite Course Codes		PCC11ME01
Course Outcomes	CO1	Demonstrate a broad and coherent knowledge of United Nations Sustainable Development Goals (SDGs)
	CO2	Build the vocabulary and develop a nuanced understanding of the SDG themes: people, planet, prosperity, peace and partnership
	CO3	Identify technological solutions to address challenges of SDGs
	CO4	Build the vision to explain how to create a technological solution for sustainability

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**What are SDGs**	1,2,3	3
	1.1	Concept of Sustainability. The Role of UN and the Need for SDGs. Why SDGs are important.		
	1.2	Introduction to 17 SDGs		
2		**People Theme**	4,5	4
	2.1	Sustainable development goals 1-5		
	2.2	Technological Solutions to advance people theme		
3		**Planet Theme**		6
	3.1	Sustainable development goals 6, 12-15	4,5	
	3.2	Technological Solutions to advance planet theme		
4		**Prosperity Theme**		7
	4.1	Sustainable development goals 7-11		
	4.2	Technological Solutions to advance prosperity theme		
5		**Peace Theme**	4,5	3
	5.1	Sustainable development goal 16		
	5.2	Technological Solutions to advance peace theme		
6		**Partnership Theme**	4,5	3
	6.1	Sustainable development goals 17		
	6.2	Technological Solutions to advance partnership theme		
Total				**26**

Self-Learning:

1. Self-learning hours include MOOCs, spoken tutorials, online resources, and extended study hours to enhance independent learning and better understanding of each module of the course content.
2. Evaluation of the self-learning components is carried out in all the evaluation components.

Course Assessment:

Quiz: 20 Marks
Activity: Case Study Presentation: 40 Marks
Activity: Short Film Creation/Poster Presentation and Final Project Presentation: 40 Marks

Recommended Books:

[1] https://sdgs.un.org/goals
[2] https://sdgs.un.org/tfm
[3] Himanshu Sharma, Tina Sobti "*An Introduction to Sustainable Development Goals*" 2018
[4] Henrik Skaug Sætra "*Technology and Sustainable Development*" Routledge, 2023
[5] Sinan Kufeoglu "*Emerging Technologies: Value Creation for Sustainable Development*", Springer International Publishing, 2022

Suggested CO - PO articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes* (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	3	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	3	2	-	-	-	-	-	-
CO4	-	-	-	-	-	3	2	-	-	-	-	-	-

Legends :- High: 03, Medium: 02,Low: 01, No Mapping: -

Blooms level

Remember	**Understand**	**Apply**	Analyze	Evaluate	Create