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-1-25

Effective from Academic Year 2025-26

Dr. DEEPAK BHOIR	Dr. BHUSHAN PATIL	DR. SURENDRA RATHOD
Dean Academics	HOD (Mechanical)	Principal

Preamble:

Greetings and congratulations to all the education partners Fr Conceicao Rodrigues College of Engineering for getting autonomous status to the college 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.

Government of Maharashtra has also directed Autonomous Colleges to revise their curriculum in line with National Education Policy (NEP) 2020 through Government Resolution dated 4th July 2023. We commit to ourselves to the effective implementation of UGC Regulations and NEP 2020 in its spirit.

Based on recent recommendations of the GR, we are pleased to offer our holistic curriculum for 2024-28, 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. Honors or Double Minor or Honors with Research.

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.

Curriculum Structure for UG Programs at Fr CRCE w.e.f. A.Y. 2025-26

Nomenclature of the courses in the curriculum	
Abbreviation	**Title**
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
RM	Research Methodologies
CEFP	Community Engagement or Field Project
ELC	Experiential Learning Courses
PRJ	Project
INT	Internship
CC	Cocurricular Courses
HMM	Honors and Multidisciplinary Minor
DM	Double Minor
RMM	Research and Multidisciplinary Minor

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.

Credit requirements for four different options of the Degrees:

Degree/SEM	I	II	III	IV	V	VI	VII	VIII	Total
B.Tech with Multidisciplinary Minor	20	20	22	22	22	22	20	20	168
B.Tech with Double Minor (Multidisciplinary & Specialisation Minor)	20	20 +2 *	22 +4 *	22 +4 *	22 +4*	22 +4 *	20 +2$	20 +2$	188
B.Tech with Research and Multidisciplinary Minor	20	20 +2 *	22 +4 *	22 +4 *	22 +4*	22 +4 *	20 +2$	20 +2$	188

Optional Credits $ credits (2) to be earned in VII/VIII

Salient Features of Curriculum:

- ✓ Framed as per Government Resolution dated 4th 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 learner
- ✓ Curriculum is designed to create excitement among learners for education through stories, activities, collaboration, hackathon, contest, case studies, creative art etc.

Curriculum is designed to make graduates responsible citizens of country with future ready skills to handle challenges of 21st Century

SEMESTERWISE CURRICULUM STRUCTURE

UG Mechanical Engineering Program:

SEM-III

Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit = 50 Marks)					Credits	
						ISE1	MSE	ISE2	ESE	Total	Points	Total
25BSC12ME05	BSESC	BSC	Statistical Techniques and Partial Differential Equations	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25PCC12ME05	PCPEC	PCC	Advanced Manufacturing Processes	TH	2	20	30	20	30	100	2	2
25PCC12ME06	PCPEC	PCC	Engineering Mechanics	TH	3	20	50	30	50	150	3	4
				PR	2	20	-	30	-	50	1	
25PCC12ME07	PCPEC	PCC	Machine Shop Practice	PR	2	20	-	30	-	50	1	1
25OE1X	MDC	OE	1. Law for Engineers 2. Financial Planning, Taxation and Investment	TH	2	50	-	50	-	100	2	2
25MDMXX1	MDC	MDM	MDM Course-1	TH	2	20	30	20	30	100	2	2
25MDMXX2	MDC	MDM	MDM Course-2	TH	2	20	30	20	30	100	2	2
25AEC12ME02X	HSSM	AEC	Modern Indian Language	TH	2	50	-	50	-	100	2	2
25VEC12ME01	HSSM	VEC	Human Values and Professional Ethics	TH	1	50	-	50	-	100	1	2
				PR	2						1	
25CEP12ME01	EL	CEFP	Community Engagement Project	PRJ	4	50	-	50	-	100	2	2
25DMX1	DM	DM	Double Minor Course	TH	2	20	30	20	30	100	2	4#
				TU	2	20	-	30	-	50	2	
25HR02	HR	HR	Honors with Research	-	-	-	-	-	-	-	4	4*
25DM01/25RM01	DM/RM	DM/RM	Introduction to Emerging Technologies	TH	2	50	--	50	--	100	2	2$
				Total	**TH:TU:PR 16:1:10=27**			**-**	**-**	**1100**	**-**	**22**

$ DM/HR 2 credits for Later Entry Students in second year

SEM-IV

Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE1	MSE	ISE2	ESE	Total	Points	Total
25BSC12ME06	BSESC	BSC	Thermodynamics	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25PCC12ME08	PCPEC	PCC	Mechanics of Solids	TH	3	20	50	30	50	150	3	4
				TU	1	20	-	30	-	50	1	
25PCC12ME09	PCPEC	PCC	Materials Science and Engineering	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
25PCC12ME10	PCPEC	PCC	Materials and Material Testing Lab	PR	2	20	-	30	-	50	1	1
25PCC12ME11	PCPEC	PCC	Thermal Engineering Lab	PR	2	20	-	30	-	50	1	1
25OE2X	MDC	OE	1. Emerging Technology and Law 2. Principles of Management	TH	2	50	-	50	-	100	2	2
25VSE12ME03	SC	VSEC	Computer Aided Machine Drawing	PR	4	50	-	50	-	100	2	2
25MDMXX3	MDC	MDM	MDM Course-3	TH	2	20	30	20	30	100	2	2
25EEM12ME02	HSSM	EEMC	Technology Entrepreneurship	TH	2	50	-	50	-	100	2	2
25VEC12ME02	HSSM	VEC	Technology Innovation for Sustainable Development	TH	1	40	-	60	-	100	1	2
				PR	2						1	
25DMX2	DM	DM	Double Minor Course	TH	2	20	30	20	30	100	2	4#
				TU	2	20	-	30	-	50	2	
25HR03	HR	HR	Honors with Research	-	-	-	-	-	-	-	4	4*
25BC	BC	BC	MOOC	-	-	-	-	-	-	-	-	2$
				Total	**TH:TU:PR 14:3:10=27**			**-**	**-**	**1100**	**-**	**22**

$ Discipline specific additional course to Lateral Entry (Diploma) students from Swayam Plus/Swayam platform

SEM-V

Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE 1	MSE	ISE2	ESE	Total	Points	Total
PCC13ME12	PCPEC	PCC	Fluid Mechanics & Hydraulic Machines	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
PCC13ME13	PCPEC	PCC	Theory of Machines	TH	2	20	30	20	30	100	2	3
				PR	2	20	-	30	-	50	1	
PCC13ME14	PCPEC	PCC	CAD/CAM and FEA	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
PCC13ME15	PCPEC	PCC	FEA and CFD Lab	PR	2	20	-	30	-	50	1	1
PCC13ME16	PCPEC	PCC	Industrial Automation	TH	2	20	30	20	30	100	2	2
PCC13ME17	PCPEC	PCC	Metrology and Quality Engineering	TH	2	20	30	20	30	100	2	2
PEC13MEXX	PCPEC	PEC	Program Elective Course	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
PEC13MEXX	PCPEC	PEC	Program Elective Lab	PR	2	20	-	30	-	50	1	1
OE03X	MDC	OE	1. Health, Wellness and Psychology 2. Emotional and Spiritual Intelligence	TH	2	50	-	50	-	100	2	2
MDMXX4	MDC	MDM	MDM Course-4	TH	1	20	30	20	30	100	2	2
DMX3	DM	DM	Double Minor Course	TH	2	20	30	20	30	100	2	4*
				TU	2	20	-	30	-	50	2	
HR04	HR	HR	Honors with Research								4	4*
				Total	**TH:TU:PR 15:2:8=25**			**-**	**-**	**1100**	**-**	**22**

SEM-VI

Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE 1	MSE	ISE 2	ESE	Total	Points	Total
PCC13ME18	PCPEC	PCC	Heat Transfer	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
PCC13ME19	PCPEC	PCC	Machine Design	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
PCC13ME20	PCPEC	PCC	Heat Transfer Lab	PR	2	20	-	30	-	50	1	1
PCC13ME21	PCPEC	PCC	Hydraulics and Pneumatics Lab	PR	2	20	-	30	-	50	1	1
PEC13MEXX	PCPEC	PEC	Program Elective Course	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
PEC13MEXX	PCPEC	PEC	Program Elective Course	TH	2	20	30	20	30	100	2	3
				TU	1	20	-	30	-	50	1	
PEC13MEXX	PCPEC	PEC	Program Elective Lab	PR	2	20	-	30	-	50	1	1
PEC13MEXX	PCPEC	PEC	Program Elective Lab	PR	2	20	-	30	-	50	1	1
OE04	MDC	OE	Public Relations and Corporate Communication	TH	2	50	-	50	-	100	2	2
MDMXX5	MDC	MDM	MDM Course-5	TH	2	50	-	50	-	100	2	2
VSE13ME04	SC	VSEC	Measurements and Systems Lab	PR	2	20	-	30	-	50	1	1
VSE13ME05	SC	VSEC	CNC Lab	PR	2	20	-	30	-	50	1	1
DMX4	DM	DM	Double Minor Course	TH	2	20	30	20	30	100	2	4*
				TU	2	20	-	30	-	50	2	
HR05	HR	HR	Honors with Research								4	4*
				Total	**TH:TU:PR 12:4:12=28**			**-**	**-**	**1100**	**-**	**22**

Structure of Credits to be completed in Final Year (SEM-VII and/or SEM-VIII):

SEM-VII and/or SEM-VIII														
Course Code	Course Vertical	Sub-Vertical	Course Name		Contact Hours	Examination Marks (1 Credit=50 Marks)					Credits	
						ISE 1	MSE	ISE 2	ESE	Total	Points	Total
	PCPEC	PEC	Program Elective		Online	As Per SWAYAM					12	12
MDM06	MDC	MDM	MDM Course-6 @		Online	As Per SWAYAM					4	4
RMC14ME01	EL	RM	Essentials of Research Methodology		Online	As Per SWAYAM					2	2
RMC14ME02	EL	RM	Intellectual Property Rights		Online	As Per SWAYAM					2	2
PRJ14ME01	EL	PR	Capstone Project	PR	12	100	-	100	-	200	6	6
	PCPEC	PEC	Course Seminar		Online	As per Rubrics for Seminar					2	2
DMX5/HR06	DM/HR	DM/RMM	Seminar/Project	PR	4	As per Rubrics for Seminar/Project					2*	2*
INT14ME01	EL	INT	Semester long Internship	PR	36-40 hrs	As Per Internship Manual					12	12
			Total								**40**	**40**

@MDM should be **Technical courses** related to **MDM**
Project or Internship is mutually exclusive in SEM-VII or SEM-VIII
Remaining credits can be acquired in SEM-V to SEM-VIII
Online course 1 Credit=4 Week course from SWAYAM can be taken in SEM V to SEM VIII
Online min 8 week course from SWAYAM can be taken in SEM V to SEM VIII to complete 2 credit course (Combination of two 4-week credit courses shall be allowed with prior approval)
* Online min 12 week course from SWAYAM can be taken in SEM V to SEM VIII to complete 3 credit course

List of Program Elective Courses:

Track-1: Manufacturing and Management

SEM-V: ***Any one Theory:***
PEC13ME11: Supply chain management
PEC13ME12: Costing and Cost Control
PEC13ME13: Mould and Metal Forming Technology
PEC13ME14: Additive Manufacturing
Lab:
PEC13ME15: Additive Manufacturing

SEM-VI: ***Any two Theory:***
PEC13ME16: Tool Engineering
PEC13ME17: Advanced Materials
PEC13ME18: Optimization Techniques
PEC13ME19: Project Management
PEC13ME110: Industrial Engineering and Operations Research
Lab:
PEC13ME111: Manufacturing Systems
PEC13ME112: Industrial Engineering and Operations Research

Track-2: Design and Automation

SEM-V: ***Any one Theory:***
PEC13ME21: Control Engineering
PEC13ME22: Finite Element Analysis
PEC13ME23: Dynamics of Machinery
Lab:
PEC13ME24: Condition Monitoring

SEM-VI: ***Any two Theory*****:**
PEC13ME25: Industrial Robotics
PEC13ME26: Modelling and Simulation
PEC13ME27: Design of Mechanical Systems

PEC13ME28: Product Design and Development
Lab:
PEC13ME29: Robotics and Control Engineering
PEC13ME210: Product Design

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

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			
BSC11ME05	Partial Differential Equations and Statistical Methods	L	T	P	L	T	P	Total
		2	1	0	2	1	0	3
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		Tutorial	20	--	30	--	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	Title	**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	Title	**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	Title	**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	**Title**	**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	**Title**	**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 I	**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**

Course Assessment:

Theory:

ISE-1: MCQ: 20 Marks
ISE-2: MCQ: 20 Marks
MSE: 90 minutes 30 Marks written examination based on Modules 1 and 2
ESE: 90 minutes 30 Marks written examination based on Modules 3, 4 and 5

Tutorial:

1. ISE-1 will be conducted for three tutorials evaluated for 20 marks.
2. ISE-2 will be conducted for five tutorials evaluated for 30 marks.

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.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC12ME05	Advanced Manufacturing Processes	L	T	P	L	T	P	Total
		2	--	--	2	--	-	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	30	20	30	100	
		TU/PR	--	--	--	--	--	

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).	2	05

	MEMS based - Overview about micro fabrication methods - Chemical vapor deposition (CVD); Physical vapor deposition (PVD), optical and electron beam lithography; Dry and wet etching.		
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) prepeg 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**

Course Assessment:

Theory:

ISE-1: Quiz (20 Marks) OR One assignment each on module 1, 2 and 3. Continuous pre-defined rubrics-based evaluation

ISE-2: Quiz (20 Marks) OR One assignment each on module 4, 5 and 6 or presentations by students in groups of 3 on recent topics related to metrology and quality engineering OR Interaction/viva other than presentation

MSE: 90 minutes of written examination based on 50% syllabus **(**30 Marks)

ESE: 90 minutes of written examination based on the rest of the syllabus covered after MSE (30 marks)

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).

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(Autonomous College affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		3	--	2	3	--	1	4
25PCC12ME06	Engineering Mechanics	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	50	30	50	150	
		PR	20	--	30	--	50	

Part A (Theory)

Pre-requisite Course Codes	-	
Course Outcomes	CO1	Learners will be able to 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	Learners will be locate the centroid of two dimensional Lamina
	CO3	Learners will be able to Correlate real life application to specific type of friction and estimate required force to overcome friction.
	CO4	Learners will able to establish relation between velocity and acceleration of a particle and analyze the motion by plotting the relation
	CO5	Learners will able to establish Kinematic relations for a rigid body
	CO6	Learners will be able to a nalyze 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		2
	1.2	**Resultant:** Resultant of coplanar and Non Coplanar (Space Force) 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.		5

	1.3	**Centroid:** First moment of Area, Centroid of composite plane Laminas		3
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 bodiesfree body diagrams.		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)		3
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 wedges and ladders		4
4	**4.1**	**Kinematics of Particle:** Motion of particle with variable acceleration. General curvilinear motion. Tangential& Normal component of acceleration, Motion curves (a-t, v-t, s-t curves). Application of concepts of projectile motion and related numerical.		6
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 mechanism. Velocity analysis of rigid body using ICR.		3
6	**6.1**	**Kinetics of a Particle:** Force and Acceleration: -Introduction to basic concepts, D'Alemberts Principle, concept of Inertia force, Equations of dynamic equilibrium, Newton's second law of motion. (Analysis limited to simple systems only.)		3
	6.2	**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.		3
	6.3	**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 and Oblique Central Impact. Loss of Kinetic Energy in collision of inelastic bodies		3
Total				**39**

Course Assessment:

Theory:

ISE-1:

Team Activity: (Two Hours Duration)-20 Marks

Activity may consists of following:
Debate (For Example Friction is Good or Bad)
Making Model of Some Concepts
Any other suitable activity
Assessment will be done by two teachers in the department who are teaching engineering mechanics

ISE-2: Two hours 30 Marks Quiz on Above Topics

MSE: 50 Marks written examination based on 50% syllabus of 120 Minutes Duration

ESE: 50 Marks written examination based on remaining 50% syllabus and of 120 Minutes Duration

Lab:

Part B (Lab)

Experiments to be completed in Lab			
E1	Verification of Polygon law of coplanar forces		**2**
E2	Verification of Principle of Moments (Bell crank lever.)		**2**
E3	Determination of support reactions of a Simply Supported Beam.		**2**
E4	Determination of coefficient of friction) using inclined plane		**2**
E5	Collision of elastic bodies (Law of conservation of momentum).		**2**
E6	Kinetics of particles. (collision of bodies)		**2**
Assignments to be completed in Lab			
A1	Resultant of Coplanar force system and Non Coplanar Force System		**2**
A2	Centroid of Composite plane Laminas		**2**
A3	Equilibrium of System of Coplanar Forces		**2**
A4	Kinematics of particles (Variable acceleration + Motion Curves +Projectile motion)		**2**
A5	Kinetics of particles (D'Alemberts Principle, Work Energy Principle, Impulse momentum Principle, Impact and Collisions.)		**2**
	Total		**22**

Course Assessment:-
(Lab)

ISE:

1. ISE-1 will be conducted for six activities (E1E2, E3, E4, E5, E6) Continuous pre-defined rubrics-based evaluation for 20 marks.

2. ISE-2 will be conducted for four activities (A1, A2, A3, A4, A5) Continuous pre-defined rubrics-based evaluation for 30 marks.

References:

1. Engineering Mechanics by R. C.Hibbeler.
2. Engineering Mechanics by Beer &Johnston, Tata McGrawHill
3. Engineering Mechanics by F. L. Singer, Harper& RawPublication
4. Engineering Mechanics by Macklin & Nelson, Tata McGrawHill
5. Engineering Mechanics by ShaumSeries
6. Engineering Mechanics by A K Tayal, UmeshPublication.
7. Engineering Mechanics by Kumar, Tata McGrawHill
8. Engineering Mechanics (Statics) by Meriam and Kraige, WileyBools
9. Engineering Mechanics (Dynamics) by Meriam and Kraige, WileyBools

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC12ME07	Machine Shop Practice	L	T	P	L	T	P	Total
		--	--	2	--	--	1	1
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Practical	20	--	30	--	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	16
2	Tool Grinding – To know basic tool Nomenclature	1	5
	Total		**21**

Course Assessment:

Laboratory work:

1. **ISE-1 (20 marks)**
   Submission of the one part made on Lathe machine and complete workshop book giving details of drawing of the job and timesheet.
2. **ISE-2 (30 marks)**
   i. Submission of the second part made on shaper, drilling machine and milling machine and complete workshop book giving details of drawing of the job and timesheet
   (20 marks)
   ii. Lab interaction: (10 marks)

Recommended Books:

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

AICTE Prescribed Textbook:

Workshop Manufacturing Practices by Prof. Veeranna D.K, Khanna Book Publishing (https://ekumbh.aicte-india.org/allbook.php#)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25OE11	Law for Engineers	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

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**

Course Assessment:

ISE-1: Quiz: 20Marks
Activity: Debating Session: 20 Marks
Activity: Poster Making: 10 Marks

ISE-2: Quiz: 20 Marks
Activity: Client Counseling: 10 Marks
Activity: Animation Making: 20 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

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25OE12	Financial Planning, Taxation and Investment	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Lab	50	--	50	--	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.

Course Assessment:

ISE-1: Quiz: **20 Marks**
Activity: Presentation on Financial Instruments: **10 Marks**
Activity: Preparing Investment Portfolio (20 Marks): Assign each student or group of students to create a hypothetical investment portfolio based on specific criteria such as risk tolerance, time horizon, and financial goals. They research different investment options, analyze their potential returns and risks, and justify their portfolio allocations in a written report or presentation.

ISE-2: Quiz: **20 Marks**
Activity: Tax Return Case Studies (*Perquisite: Pan Card (if not available, student should immediately apply and get pan card))* (10 Marks): Consider case study of fictional individuals or families and prepare tax returns based on their financial situations. This hands-on activity allows students to apply their knowledge of taxation laws and regulations in a practical context.

Activity: Financial Literacy Podcast (10 Marks): Have students create their own podcasts or audio recordings discussing key concepts related to financial planning, taxation, and investments. They can ***interview experts***, share personal finance tips, or discuss current events and trends in the financial industry.

Activity: Personal Finance Blog (10 Marks): Students create their own personal finance blogs or websites where they share articles, tutorials, and resources related to financial planning, taxation, and investments. This activity helps them develop their writing and research skills while sharing valuable information with their peers

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25AEC12ME021	Sanskrit for Beginners	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

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**

Course Assessment:

ISE-1: Activities and Assignments: 20 Marks
Oral Examination : 30 Marks
ISE-2: Activities and Assignments: 20 Marks
Oral Examination : 30 Marks

Recommended Books:

[1] Kumari, S. "*Sanskrita Chitrapadakoshah*," Mysuru: Bharatiya Bhasha Sansthanam, 1993

[2] *Samkrita-vyavahaara-sahasri* (Samskrit-English), New Delhi: Sanskrita Bharati

[3] Sampad, & Vijay, "*The Wonder that is Sanskrit*" Pondicherry: Sri Aurobindo Society, 2005.

[4] Satvlekar, S. D. "*Sanskrit Swayam Shikshak,"* Delhi: Rajpal & Sons, 2013

[5] Shastri, V K. "*Teach Yourself Samskrit: Prathama Diksha*" Delhi: Rashtryia Sanskrita Samsthana, 2012

[6] Vishwasa "*Abhyāsa-pustakam*", New Delhi: Samskrita Bharati, 2014

[7] https://onlinecourses.nptel.ac.in/

[8] https://www.learnsanskrit.org/

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25AEC12ME022	Tamil for Beginners	2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

Pre-requisite Course Codes		AEC11ME01
Course Outcomes	CO1	Demonstrate understanding of the Fundamentals of Tamil 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 to Tamil Alphabets and Pronunciation** History of Tamil language		1
	1.2	Learning Tamil Alphabets		1
	1.3	Basic Pronunciation and Oral drills with visual learning		2
	1.4	Greetings and common expressions		2
2	2.1	**Basic Grammar and Sentence Structure** Sentence Construction : Subject, Verb, Object (SVO)		2
	2.2	Present tense,Past tense and Future tense		2
	2.3	Common Nouns, Pronouns with negative imperatives		2
3	3.1	**Building Vocabulary for Everyday Conversation** Learning Numerals (Cardinal numbers) 1-20, 100. 200…1000		2
	3.2	Forming Simple sentences with interactive lessons		3
	3.3	Learning Days of week, Months of the year, Fruit, Food grains, Parts of the Body, Names of Common places like Hospitals, Market place, shops, Saloons..etc.		3
4	4.1	**Daily life and Survival Phrases** Day to day usage of language for daily routines in conversation with Student to Teacher, Vegetable shop vendor, Railway Station, conversation with Auto Drivers , Hospitals …etc.		3
	4.2	Role Play exercises in common situations		3
Total				**26**

Course Assessment:

ISE-1: Activities and Assignments: 20 Marks
Oral Examination : 30 Marks
ISE-2: Activities and Assignments: 20 Marks
Oral Examination : 30 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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
25AEC12ME023	Kannada for Beginners	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

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	Learning Kannada Alphabets		1
	1.3	Pronunciation and visual learning		2
	1.4	Greetings and Common expressions		2
2	2.1	**Basic Grammar and Sentence Structure with Subject, Verb, Objective (SVO)** Basics of Sentence Formation		2
	2.2	Present tense, Past tense, Future tense,and Introduction to Adjectives		2
	2.3	Common Nouns, Pronouns with negative imperatives		2
3	3.1	**Conversation Phrases and Language Vocabulary** Learning Numerals (Cardinal Numbers) 1-20 / 100 -1000		2
	3.2	Classified Sentences and Useful expressions		3
	3.3	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
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**

Course Assessment:

ISE-1: Activities and Assignments: 20 Marks
Oral Examination : 30 Marks
ISE-2: Activities and Assignments: 20 Marks
Oral Examination : 30 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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
25AEC12ME024	Telugu for Beginners	2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

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**

Course Assessment:

ISE-1: Activities and Assignments: 20 Marks
Oral Examination : 30 Marks
ISE-2: Activities and Assignments: 20 Marks
Oral Examination : 30 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

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned				
		L	T	P	L		T	P	Total
		1	--	2	1		--	1	2
			Examination Scheme						
25VEC12ME01	Human Values and Professional Ethics [HVPE]		ISE-I	MSE	ISE-II		ESE		Total
		Theory	50	---	50		---		100
		Practical	---	---	---		---		---

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 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**

Course Assessment:

ISE-1: AICTE & UNESCO's certificate course on Self-directed Emotional Learning for Empathy and Kindness (SEEK) **30 marks**
Link : https://www.framerspace.com/course/seek (Select SEEK self- directed cohort under the category of youth courses)

Activity: Quiz and assignments **20 Marks**

ISE-2: AICTE & UNESCO'S certificate course on Social Emotional Learning for Youth Waging Peace (SEL4YWP)- UNESCO **30 Marks**
Link: https://www.framerspace.com/course/ywp?cid=5eaff2c239109c2c12ef8bd3

**Participants need to register themselves in the link https://docs.google.com/spreadsheets/d/1dECtZbAmcPhKKelSEimVv-hzPV7dA_g-Brty2rxC2vE/edit?usp=sharing, before accessing the course content.

Activity: Article Discussion, Quiz and Assignments **20 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.

[6] http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25CEP12ME01	Community Engagement Project	L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Practical	50	--	50	--	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-1:
Activity: Report Submission: 20 Marks
Activity: Report Presentation: 30 Marks

ISE-2:
Activity: Report Submission: 20 Marks
Activity: Report Presentation: 30 Marks

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
25DM01/25RM01	Introduction to Emerging Technologies	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

Pre-requisite Course Codes	--	
After the successful completion students should be able to:		
Course Outcomes	CO1	Recognize the dynamic nature of emerging technologies and their evolving landscape.
	CO2	Demonstrate knowledge of the key characteristics and potential applications of emerging technologies.
	CO3	Identify the value, innovative solutions or applications for real-world challenges using emerging technologies
	CO4	Analyze the implications of emerging technologies on society, business, and various industries
	CO5	Identify various emerging technologies relevant to his/her discipline for personal and professional growth
	CO6	Recognize the need for continuous learning to keep pace with technological advancements.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction to Industrial Revolution, Important Inventions during various Industrial Revolutions (IR).	1,2	2
	1.2	Role of data, Enabling devices, Network and Human to Machine Interaction during IR	1,2	1
2	2.1	Data Science: Overview of data science, Data Science Life Cycle, Cloud Computing with examples of available Clouds, Big Data, Big data Life Cycle with Hadoop	1,2	3
	2.2	Artificial Intelligence and Machine Learning: Philosophy of AI, Components of AI, Important terminologies, AI Problem Solving, Real-World AI, Types of Machine Learning, Neural Networks, Applications: Computer Vision, Robotics, NLP. Societal Implications of AI.	1,2	3
	2.3	Fundamentals of Blockchain, Blockchain applications and architecture. Introduction to Cyber Security, Cyber attacks and defenses, Case studies.	1,2	3
	2.4	Robotic Process Automation, RPA Tools and Applications		1
3	3.1	Internet of Things (IoT): Introduction, IoT Sensors, IoT Data acquisition & platforms, IoT Data Communication, IoT data storage and Retrieval, IoT data analytics & visualization and IoT Security, IoT Product Development Life Cycle, Industrial IoT,	1,2	3

		Concept of Edge Computing. Case studies		
	3.2	Introduction to Immersive Technologies (AR, VR and MR), AR /VR systems with IOT, AI and Haptics, Tools needed to build AR Apps, usecases, Human Centric UX design	3	2
4	**4.1**	Semiconductor and Nanotechnology: Evolution of Semiconductor Industry, Trends and Innovations in Semiconductor Technologies with respect to material, devices, circuits, architecture and applications. Indian Semiconductor Industry: present status, market trends, challenges, policy initiatives by GoI	4	3
	4.2	Digital Manufacturing, Principles of 3D Printing, Classification and material used in 3D printing, software tools and applications to various fields. Introduction to Robotics, Drones and Autonomous Systems. Fundamentals of tools, software and hardware required to build robot and autonomous systems. Applications and Case studies.	1,6	3
	4.3	Other Trends in emerging technologies: 5G telecom networks and Electric Vehicles	6	2
Total				**26**

Course Assessment:

Theory:

ISE-1: 50 Marks

Rubric based assessment for activities conducted.

ISE-2: 50 Marks

Rubric based assessment for activities conducted.

Recommended Books:

[1] Vasudha Tiwari. Sunil Kumar Chaudhary and Iqbal Ahmed Khan, "*Emerging Technology For Engineers*", Vayu Education of India, 1st Edition.

[2] Chanagala Shankar, "*Emerging Technologies*", Bluerose Publishers Pvt. Ltd, 1st Edition

[3] Chandradev Yadav, "*The Evolution of Immersive Technologies: A Journey into the Extraordinary*", 1st Edition

[4] Website of India Semiconductor Mission (https://ism.gov.in/)

[5] SWAYAM course on 'An Introduction to Artificial Intelligence'

[6] Other relevant online resources to be used.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	1	--	2	1	--	3
25BSC12ME06	Thermodynamics	Examination Scheme						
			ISE1	MSE	ISE2	ESE		Total
		Theory	20	30	20	30		100
		Tutorial	20	--	30	--		50

Pre-requisite Course Codes	None	
Course Outcomes	CO1	Understand fundaments of thermodynamics and concept of temperature measurement
	CO2	Understand basic laws of thermodynamics and their significance.
	CO3	Understand applications of First and Second Laws and significance of disorder in a system.
	CO4	Understand use of above concepts in estimating availability and unavailability.
	CO5	Understand steam properties and use of steam tables and Mollier Chart
	CO6	Understand basic thermodynamic cycles used in different thermodynamic systems.

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**

Course Assessment:

Theory:

ISE-1: Activity: Assignments , Quiz (20 marks)
ISE-2: Activity: Assignments, Quiz (20 marks)
MSE: 90 minutes 30 Marks written examination based on 50% syllabus
ESE: 90 minutes 30 Marks written examination based on remaining syllabus after MSE

Tutorial:

ISE:

1. **ISE-1**
   Examples on Module 1, Module 2 and Module 3
   Continuous pre-defined rubrics-based evaluation for 20 marks.

2. **ISE-2**

Examples on Module 4, Module 5 and Module 6
Continuous pre-defined rubrics-based evaluation for 30 marks.

Recommended Books:

Text Books:

[1] Thermodynamics by P K Nag, 6th 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#)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25PCC12ME08	Mechanics of Solids	L	T	P	L	T	P	Total
		3	1	--	3	1	--	4
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	20	50	30	50	100	
		Tutorial	20	--	30	--	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	Analyse the stresses and deflection in beams and estimate the strain energy in mechanical elements.
	CO6	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	6
	1.2	Thermal stress and strain in single and compound bars	1-6	3
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	4
	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	3
	2.3	Bending moment diagrams for statically determinate beams subjected to point loads, uniformly distributed loads, uniformly varying loads, couple and their combinations,	1-6	3

		Calculation of maximum B.M. and the point of contra flexure under different loads		
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	2
	3.2	bending stress distribution for point and distributed loads in simply supported beams and cantilevers for common symmetrical sections.	1-6	3
	3.3	shear stress distribution for point and distributed loads in simply supported beams and cantilevers for common symmetrical sections.	1-6	3
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	2
	4.2	Macaulay's method for computation of deflection and slope	1-6	3
	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	3
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				**39**

Tutorial:

Sr. No.	Tutorial Details	Hours
1	Stress and Strain	**01**
2	Shear Force and Bending Moment in Beams	**01**
3	Torsion	**01**
4	Stresses in Beams	**01**
5	Deflection and slope of Beams	**01**
6	Strain Energy	**01**
7	Columns	**01**
8	Case examples Presentation	**01**
	Total Hours	**08**

Course Assessment:

Theory:

ISE-1:

Activity: Quizzes on first two modules (30 Marks)

ISE-2:

Activity: Quizzes on last three modules (20 Marks)

MSE: 120 minutes 50 Marks written examination based on 50% syllabus

ESE: 120 minutes 50 Marks written examination based on remaining syllabus after MSE

Tutorial:

1. **ISE-1**
   First three tutorials (20 marks)
   Continuous pre-defined rubrics-based evaluation for 20 marks.
2. **ISE-2**

i. Next four tutorials (20 marks)
Continuous pre-defined rubrics-based evaluation for 20 marks

ii. Presentations (10 Marks)
Students in a group of three to four should study and present the applications of mechanics of solid in real life case examples related to any of the following topics: deformation of solids, simple stress and strain, thermal stress and strain, principal stresses, shear force and bending moment diagrams, deflection and slope, torsion, columns, cylinders, Software analysis etc.

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#)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	1	--	2	1	--	3
25PCC12ME09	Materials Science and Engineering	Examination Scheme						
			ISE1	MSE	ISE2	ESE		Total
		Theory	20	30	20	30		100
		Tutorial	20	--	30	--		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.		
	4.3	The Iron-Iron Carbide Phase Diagram: Importance and allotropic forms 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**

Course Assessment:

Theory:

ISE-1: Quiz (20 Marks)
ISE-2: Quiz (20 Marks)
MSE: Two hours of written examination based on 50% syllabus **(**30 Marks)
ESE: 90 minutes 30 Marks written examination based on remaining syllabus after MSE

Tutorial

ISE-1
Lab activity:
Superimposition of the cooling curve on the TTT plot.

Drawing and labeling of Iron-Carbon Phase Diagram.
Assignments: One assignment each on any 3 out of 6 modules.
Continuous pre-defined rubrics-based evaluation for 20 marks.

ISE-2
Presentations by students in groups of 3 on recent topics related to Materials Science and Engineering (30 marks)

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#)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		--	--	2	--	--	1	1
25PCC12ME10	Materials and Material Testing	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Practical	**20**	**--**	**30**	**--**	**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, tensile, and fatigue tests on the given components.
	CO5	Conduct compression and bending test on wooden samples.

Sr. No.	Experiments Details	Hours
1	Impact Testing on steel specimen (Charpy and Izod test).	2
2	Determination of hardenability of steel using the Jominy End Quench Test.	2
3	Sample preparation for metallographic observations.	4
4	Experiments based on any two heat treatment methods.	2
5	Fatigue test on a steel rod.	2
6	Tensile test on a mild steel rod.	4
7	Compression test on a wooden block.	2
8	Bending test on a wooden specimen.	2
	Total	**20**

Course Assessment:

Laboratory work:

2. **ISE-1 (20 marks)**
   Submission of the observations made during the lab performance for the first 4 experiments covered during this assessment duration. Assessment will be based on pre-defined rubrics.

2. **ISE-2 (30 marks)**
   iii. Submission of the observations made during the lab performance for the last 4 experiments covered during this assessment duration. Assessment will be based on pre-defined rubrics (20 marks).
   iv. Lab interaction: (10 marks)

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#)

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
		--	-	2	--	--	1	1
25PCC12ME11	Thermal Engineering Laboratory	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Practical	20	--	30	--	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 Work

ISE-1:
Experiments 1-5
Continuous pre-defined rubrics-based evaluation for 20 marks.
ISE-2:
Remaining experiments.
Continuous pre-defined rubrics-based evaluation for 30 marks.

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

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25OE21	Emerging Technology and Law	L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

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

Course Assessment:

ISE-1: Quiz: 20 Marks
Activity: Negotiation: 30 Marks

ISE-2: Quiz: 20 Marks
Activity: Moot Court: 30 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

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
		2	--	--	2	--	--	2
25OE22	Principles of Management	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

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.	
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.
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
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	**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.
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.
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.

Assessment:

ISE-1: Quiz based on Module 1,2 and 3 (20 Marks)
Case study / Application with PPT Presentation (Group of 4 students) of Decision Making Process Approach, MBO (30 Marks)

ISE-2: Quiz based on Module 4,5 and 6 (20 Marks)
Case Study / Application / Research Literature Studies with PPT Presentation (Group of 4 students) on Leadership in Organization, Innovation and Change Management, continuous improvement processes (30 Marks)

Note: ISE will be based on Continuous predefined rubrics based evaluation

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.

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		--	--	4	--	--	2	2
25VSE12ME03	Computer Aided Machine Drawing	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Practical	50	--	50	--	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.	Practical Details	Ref	Duration
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		46

Course Assessment

1. **ISE-1 (50marks)**

   Term work
   Printouts/Plots: 40 marks
   Lab interaction: 10 marks

   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.

   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.

2. **ISE-2 (50 marks)**
   Printouts/Plots: 20 marks

   i. 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.

   ii. 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.

   iii. 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

   iv. End Semester Practical/Oral examination:
   To be conducted by pair of Internal Examiners
   1. Practical examination duration is two hours, based on Advance level of the Term work. Oral examination should also be conducted to check the knowledge of CAD Modeling Tools.
   2. The distribution of marks for practical examination shall be as follows:
   a. Practical Exam ….20 marks
   b. Oral Exam..... 10 marks
   3. Evaluation of practical examination to be done based on the printout of students work
   4. Students work along with evaluation report to be preserved till the next examination

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 text book 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 ShamTickoo and SurinderRaina, Dreamtech press

AICTE Prescribed Textbook:

Computer Aided Machine Drawing Practice by Dr. Kanak Kalita

(https://ekumbh.aicte-india.org/allbook.php#)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		2	--	--	2	--	--	2
25EEM12ME02	Technology Entrepreneurship	Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	50	--	50	--	100	
		Practical	--	--	--	--	--	

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 problem worth solving		
	1.4	Looking for solutions		
	1.5	Present the problem		
2		**Value Proposition Canvas and Business Model**	2,3	7
	2.1	Craft your value proposition		
	2.2	Presentation of Value Proposition Canvas		
	2.3	Business Model and Lean Approach (Finance, Marketing, Operations)		
	2.4	Presentation of Lean Canvas		
3		**Business Plan**	4	6
	3.1	Creation of Business Plan		
4		**Company Formation**	5	7
	4.1	Promoters, Capital, Shareholders		
	4.2	Directors, DIN		
	4.3	Company Name, Registrations		
	4.4	Branding		
Total				**26**

Course Assessment:

ISE-1:
Quiz: 10 Marks
Assignment: Effectuation case study: 10Marks
Activity: Presentation of Value Proposition Canvas: 30 Marks Rubric Based assessment

ISE-2:
Quiz: 10 Marks
Assignment: Presentation of Lean Canvas: 10Marks
Activity: Virtual Company registration: 30 Marks Rubric Based assessment

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] Garrett Sutton "*Writing Winning Business Plans*"

[5] M.C. Bhandari "*Company Law Procedures*" LexiNexis, 2018

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
25VEC12ME02	Technology Innovation for Sustainable Development	L	T	P	L	T	P	Total
		1	--	2	1	--	1	2
		Examination Scheme						
			ISE1	MSE	ISE2	ESE	Total	
		Theory	--	--	--	--	--	
		Practical	40	--	60	--	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
	4.1	Sustainable development goals 17		
	4.2	Technological Solutions to advance partnership theme		
Total				**26**

Course Assessment:

ISE-1: Initial Project Presentation (20 Marks)
Activity: Creation of Short Movie: (20 Marks)

ISE-2: Poster Making Competition (20 Marks)
Final Project Presentation (30 Marks) Report Writing (10 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