NUTAN MAHARASHTRA VIDYA PRASARAK MANDAL'S

NUTAN MAHARASHTRA INSTITUTE OF ENGINEERING AND TECHNOLOGY

AN AUTONOMOUS INSTITUTE | UNDER ADMINISTRATIVE SUPPORT OF PCET

ESTD : 1906

Curriculum Structure and Syllabus

of

Second Year B. Tech

Mechanical Engineering (2025 Pattern)

VISION OF THE INSTITUTE

To be a notable institution for providing quality technical education and ensuring ethical, moral and holistic development of students.

MISSION OF THE INSTITUTE

To nurture engineering graduates with state of the art competence, professionalism and problem solving skills to serve needs of industry as well as society.

VISION OF MECHANICAL ENGINEERING

To be a renowned mechanical engineering education provider for serving needs of industry and society.

MISSION OF MECHANICAL ENGINEERING

- To provide quality technical education with an effective teaching learning process.
- To bridge the gap between industry and academia by collaborative activities.
- To develop students with research, innovation and entrepreneurship activities.
- To advance graduates with professionalism and a sense of gratitude towards society.

INDEX

COURSE-WISE CREDIT DISTRIBUTION

Sr. No.	Type of Course	No. of Courses	Total Credits	
			No.	%
1.	Basic Science Course (BSC)	08	14	8.14
2.	Engineering Core Course (ECC)	10	15	8.72
3.	Programme Core Course (PCC)	30	53	30.82
4.	Programme Elective Course (PEC)	09	20	11.63
5.	Multidisciplinary Minor (MDM)	07	14	8.15
6.	Open Elective Course (OEC)	03	08	4.65
7.	Vocational and Skill Enhancement Course (VSEC)	04	08	4.65
8.	Ability Enhancement Course (AEC)	02	04	2.32
9.	Entrepreneurship / Management Course (EMC)	02	04	2.32
10.	Value Education Course (VEC)	02	04	2.32
11.	Experiential Learning Courses	08	22	12.79
12.	Indian Knowledge System	01	02	1.17
13.	Co-curricular Courses	02	04	2.32
TOTAL		86	172	100

SEMESTER-WISE COURSE DISTRIBUTION

COURSE DISTRIBUTION: SEMESTER WISE										
SR NO.	TYPE OF COURSE	NO. OF COURSES / SEMESTER								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	4	4	-	-	-	-	-	-	08
2.	Engineering Science Course (ESC)	6	4	-	-	-	-	-	-	10
3.	Programme Core Course (PCC)	-	2	6	6	5	5	4	2	30
4.	Programme Elective Course (PEC)	-	2	-	-	2	3	2	2	11
5.	Multidisciplinary Minor (MDM)	-	-	1	1	2	1	-	2	07
6.	Open Elective Course (OEC)	-	-	1	1	1	-	-	-	03
7.	Vocational and Skill Enhancement Course (VSEC)	1	1	1	-	-	1	-	-	04
8.	Ability Enhancement Course (AEC)	1	1	-	1	-	-	-	-	03
9.	Entrepreneurship / Management Course(EMC)	-	-	1	1	-	-	-	-	02
10.	Value Education Course (VEC)	-	-	1	1	-	-	-	-	02
11.	Experiential Learning Courses	-	-	-	1	1	1	1	1	05
12.	Indian Knowledge System	-	1	-	-	-	-	-	-	01
13.	Co-curricular Courses	1	1	-	-	-	-	-	-	02
Total		13	16	11	12	11	11	07	07	88

SEMESTER-WISE CREDIT DISTRIBUTION

CREDIT DISTRIBUTION: SEMESTER WISE										
1 Lecture hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit										
SR NO.	**TYPE OF COURSE**	**NO. OF CREDIT / SEMESTER**								**Total**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1.	Basic Science Course (BSC)	7	7	-	-	-	-	-	-	14
2.	Engineering Science Course (ESC)	9	6	-	-	-	-	-	-	15
3.	Programme Core Course (PCC)	-	3	10	10	10	8	8	4	53
4.	Programme Elective Course (PEC)	-	-	-	-	4	8	4	4	20
5.	Multidisciplinary Minor (MDM)	-	-	2	2	4	2	-	4	14
6.	Open Elective Course (OEC)	-	-	4	2	2	-	-	-	08
7.	Vocational and Skill Enhancement Course (VSEC)	2	2	2	-	-	2	-	-	08
8.	Ability Enhancement Course (AEC)	2	-	-	2	-	-	-	-	04
9.	Entrepreneurship / Management Course(EMC)	-	-	2	2	-	-	-	-	04
10.	Value Education Course (VEC)	-	-	2	2	-	-	-	-	04
11.	Experiential Learning Courses	-	-	-	2	2	2	8	8	22
12.	Indian Knowledge System	-	2	-	-	-	-	-	-	02
13.	Co-curricular Courses	2	2	-	-	-	-	-	-	04
Total		22	22	22	22	22	22	20	20	172

CURRICULUM STRUCTURE
Second Year B.Tech. Mechanical Engineering

Semester – III

Level - 5.0																	
Second Year B. Tech Mechanical Engineering																	
Semester III																	
Sr. No.	**Course Code**	**Course Type**	**Course Name**	**Credit Scheme**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**							
										CCE		**ESE**	**PR**	**OR**	**TW**	**TOTAL**	
				TH	**TUT**	**PR**	**L**	**T**	**P**	**UT**	**FA**	**SA**					
										25	**25**	**50**					
1	ME25PCC-201	Programme Core Course	Manufacturing Technology	2			2			25	25	50				100	
2	ME25PCC-202	Programme Core Course	Engineering Materials and Metallurgy	2			3			25	25	50				100	
3	ME25PCC-203	Programme Core Course	Engineering Materials and Metallurgy Lab			1			2					25		25	
4	ME25PCC-204	Programme Core Course	Engineering Thermodynamics	2			3			25	25	50				100	
5	ME25PCC-205	Programme Core Course	Engineering Thermodynamics Lab			1			2				25			25	
6	ME25PCC-206	Programme Core Course	Solid Mechanics	2			3			25	25	50				100	
7	ME25MDM-207	Multi-disciplinary Minor Course	Python Programming for Mechanical Engineers	2			2			25	25	50				100	
8	--	Open Elective Course	Open Elective Course-I	3	1		3	1		25	25	50				100	
9	--	Value Education Course	Value Education Course-I		1	1		1	2						25	25	
10	ME25VSEC-210	Vocational & Skill Enhancement Course	Vocational and Skill Enhancement Course- I			2			4					25	25	50	
11	IL25EMC-211	Entrepreneurship / Management Course	Principles of Management & Entrepreneurship		1	1		1	2						25	25	
TOTAL				**13**	**3**	**6**	**16**	**3**	**12**	**150**	**150**	**300**	**25**	**50**	**75**	**750**	
				22			**31**										

CCE- Comprehensive Continuous Evaluation**, ESE**- End Semester Evaluation, **TW**-Term Work, **OR**-Oral, **PR**-Practical, **TH**- Theory**, L**-Lecture, **TUT**-Tutorial, **UT**- Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

Basket: List of Courses – Open Elective Course -I

Course Code	Course Name	
CE25OEC-207	Computational Mathematics	Choose Any One
CAI25OEC-207	Probability Theory and Statistics Methods	
AIDS25OEC-207	Probability and Statistics	
IT25OEC-207	Numerical Statistical Analysis	
ETC25OEC-207	Vectors & Transforms	
ME25OEC-208	Applied Mathematics	

Basket: List of Courses – Value Education Course -I

Course Code	Course Name	
CSE25VEC-208	Universal Human Values	Choose Any One
ETC25VEC-208A	Professional Ethics for Engineers	
ETC25VEC-208B	Social Connect and Responsibility	

Basket: List of Courses – Vocational and Skill Enhancement Course -I

Course Code	Course Name	
ME25VSEC-210A	Workshop Technology	Choose Any One
ME25VSEC-210B	Object Oriented Programming with C++	

CURRICULUM STRUCTURE
Second Year B.Tech. Mechanical Engineering

Semester – IV

Label - 5.0																
Second Year B. Tech Mechanical Engineering																
Semester IV																
Sr. No.	**Course Code**	**Course Type**	**Course Name**	**Credits**			**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**						
										CCE		**ESE**	**PR**	**OR**	**TW**	**TOTAL**
				TH	**TUT**	**PR**	**L**	**T**	**P**	**UT**	**FA**	**SA**				
										25	**25**	**50**				
1	ME25PCC-251	Programme Core Course	Fluid Mechanics	3			3			25	25	50				100
2	ME25PCC-252	Programme Core Course	Fluid Mechanics Lab			1			2						25	25
3	ME25PCC-253	Programme Core Course	Solid Modelling & Drafting Lab			1			2				50		25	75
4	ME25PCC-254	Programme Core Course	Kinematics of Machines	2			3			25	25	50				100
5	ME25PCC-255	Programme Core Course	Kinematics of Machines Lab			1			2					25		25
6	ME25PCC-256	Programme Core Course	Applied Thermodynamics	2			2			25	25	50				100
7	ME25MDM-257	Multi-disciplinary Minor Course	Artificial Intelligence And Machine Learning	2			2			25	25	50				100
8	--	Open Elective Course	Open Elective Course-II	2			2			25	25	50				100
9	--	Value Education Course	Value Education Course-II	1	1		1	1							25	25
10	ME25ELC-260	Experiential Learning Course	Community Engagement Project			2			4					50		50
11	IL25EMC-260	Entrepreneurship / Management Course	Entrepreneurship Skill Development		1	1		1	2						25	25
12	IL25AEC-261	Ability Enhancement Course	Modern Indian Languages (Marathi)	1		1	1		2						25	25
TOTAL				**13**	**2**	**7**	**14**	**2**	**14**	**125**	**125**	**250**	**50**	**75**	**125**	**750**
				22			**30**									

CCE- Comprehensive Continuous Evaluation**, ESE**- End Semester Evaluation, **TW**-Term Work, **OR**-Oral, **PR**-Practical, **TH**- Theory**, L**-Lecture, **TUT**-Tutorial, **UT**- Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

Basket: List of Courses – Open Elective Course –II

Course Code	Course Name	
CE25OEC-257	Digital Marketing	Choose Any One
ETC25OEC-257	Engineering Economics	
ME25OEC-258	Digital Finance	

Basket: List of Courses – Value Education Course -II

Course Code	Course Name	
CE25VEC-258	Indian Constitution	Choose Any One
AIDS25VEC-258	Environmental Science	

Course Syllabus
Semester-III

Program	S.Y. B.Tech (Mechanical Engineering)				Semester: III		
Course	Manufacturing Technology				Code:	ME25PCC-201	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Manufacturing Practice Workshop.

Course Objectives: This course aims at enabling students:

1. To know about fundamentals of metal cutting process, tool wear and tool life.
2. To describe various casting methods and aspects related to mould design.
3. To understand basics of metal forming processes and tooling.
4. To classify, describe and configure the principles of various welding techniques.

Course Outcomes: After completion of the course, students will be able to:

CO1: Apply metal cutting mechanics and tool wear analysis to optimize machining processes.

CO2: Design gating systems, risers, and analyze casting defects for efficient metal casting processes.

CO3: Evaluate forces, power, and deformation in rolling, forging, and sheet metal operations.

CO4: Compare welding techniques, interpret weld symbols, and identify defects for quality joining.

Course Contents

Unit	Description	Duration [Hrs]
I	**Theory of metal cutting** Basics of subtractive manufacturing, operations on Lathe, Milling. Basics of metal cutting mechanics, Chip formation and types of chips, Orthogonal and oblique cutting, Shear angle and Merchant's theory, Cutting Forces and Power Estimation, Properties of cutting tool materials, Tool signature, Tool wear and tool life, Taylor's tool life equation	07
II	**Metal Casting Technology** **Introduction to casting processes, Patterns**: Pattern materials, types of pattern, allowances pattern design, molding sand, Properties of molding sands, Core making, melting practices and furnaces, Pouring and Gating system, Cleaning and Finishing of casting, Defects and remedies. Principle and equipment of Die casting, Centrifugal casting, Investment casting, Continuous casting. Numerical estimation to find mold filling time, Riser design and placement, Principles of cooling and solidification of casting.	08
III	**Metal Forming Technology** **Introduction to Metal Forming-** Stress-Strain Analysis in Metal Forming, Bulk Deformation Processes, Defects in Metal Forming, **Rolling:** Types, defects, and applications, Rolling force estimation, Torque and power requirements for rolling mills **Forging:** Open-die, Closed-die, and Impression-die forging, Estimation of Forging Load using uniform deformation energy equation,	08

	Sheet Metal Working: Types of sheet metal operations, Press working equipment and terminology**,** design of simple progressive die**:** strip lay-out and percentage utilization, clearance analysis, centre of pressure, estimation of cutting forces and press capacity	
IV	**Joining Technology** Joining process classification, soldering, brazing, welding symbols, types of joint, Electrodes- types and purpose of electrodes, electrode coatings (flux), welding defects, testing and inspection of welds, Working principles, applications of welding processes: Arc welding: MIG, TIG, Resistance welding: Spot, Seam, Heat generation in resistance welding, Gas Welding: Types of flames, oxy-acetylene gas welding. Solid State Welding: Friction Welding, Modern Welding Processes: Laser welding plasma arc welding, submerged arc welding, projection welding, electron beam welding, ultrasonic welding	**07**
	Total	**30**

Text Books:

1. A Text book of Manufacturing Technology, Metal Cutting and Machine Tools, P. N. Rao, Vol. 2nd edition, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2002
2. P. N. Rao, "Manufacturing Technology Vol. I & II" , Tata McGraw Hill Publishers
3. P. C. Sharma, "Production Engineering", Khanna Publishers

Reference Books:

1. Theory of Metal Cutting, M. C. Shaw, 1st Edition, Oxford and I.B.H. publishing, 1994
2. Production Technology Manufacturing Systems Vol. - I & II, R. K. Jain, Khanna Publishers
3. Production Technology - HMT, Tata McGraw Hill publication

e-sources:

1. https://nptel.ac.in/courses/112103248
2. https://nptel.ac.in/courses/112104028
3. https://nptel.ac.in/courses/112107215
4. https://nptel.ac.in/courses/112104301
5. https://nptel.ac.in/courses/112104195

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Engineering Materials & Metallurgy			Code:		ME25PCC-202	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites: Fundamentals of Engineering Physics and Chemistry, Basic knowledge of atomic structure and mechanical properties of solids.

Course Objectives: This course aims at enabling students:

1. To understand the crystal structure, imperfections, and mechanical behavior of engineering materials.
2. To apply phase diagrams and solidification concepts for alloy design and heat treatment.
3. To analyze the effects of heat treatment and alloying elements on mechanical properties.
4. To evaluate corrosion, failure mechanisms, and their control in engineering applications.

Course Outcomes: After completion of the course, students will be able to:

CO1: Explain the crystal structures, imperfections, and properties of engineering materials.

CO2: Apply phase diagram concepts and transformation principles to predict alloy behavior.

CO3: Analyze the effects of heat treatment and alloy composition on mechanical properties.

CO4: Examine corrosion mechanisms, fracture, fatigue, and creep in materials.

Course Contents

Unit	Description	Duration [Hrs]
I	**Structure and Properties of Materials** Crystal structures (BCC, FCC, HCP), Miller indices, crystal imperfections (point, line, surface), diffusion, solidification of metals, and mechanical properties (stress–strain, hardness, ductility, toughness).	8
II	**Phase Diagrams and Alloy Systems** Binary phase diagrams, isomorphous and eutectic systems, Gibbs phase rule, iron–carbon diagram, invariant reactions, lever rule, classification of steels and cast irons.	8
III	**Heat Treatment of Steels and Non-Ferrous Alloys** Annealing, normalizing, hardening, tempering, surface hardening (carburizing, nitriding, induction hardening), TTT and CCT diagrams, aluminium and copper alloys.	7
IV	**Corrosion, Failure, and Material Selection** Types and mechanisms of corrosion, corrosion protection, fracture (brittle/ductile), fatigue, creep, and principles of material selection for mechanical design.	7
	Total	30

Text Books:

1. Dr. V. D. Kodgire & S. V. Kodgire, “Material Science & Metallurgy For Engineers”, Everest Publication.

2. S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw-Hill.
3. V. Raghavan, Materials Science and Engineering, PHI Learning.
4. S. Donald Askeland & Wendelin Wright, The Science and Engineering of Materials, Cengage.

Reference Books:

1. W.D. Callister & D.G. Rethwisch, Materials Science and Engineering – An Introduction, Wiley.
2. O.P. Khanna, Material Science and Metallurgy, Dhanpat Rai Publications.
3. Rajan, Sharma & Sharma, Heat Treatment – Principles and Techniques, PHI.
4. Donald R. Askeland, The Science and Engineering of Materials, Cengage Learning.

e-sources:

1. https://nptel.ac.in : IIT Lectures on Physical Metallurgy and Heat Treatment of Steels.
2. https://asminternational.org : ASM Handbooks and Databases.
3. https://www.sciencedirect.com: Materials Engineering Journals.

e-Books:

1. Materials Science and Engineering: An Introduction by W.D. Callister (Wiley eBook).
2. Introduction to Physical Metallurgy by S.H. Avner (McGraw-Hill eBook).

MOOC / NPTEL/YouTube Links:

1. NPTEL Course: Introduction to Materials Science and Engineering : Prof. K. Bhanu Sankara Rao (IIT Madras).
2. NPTEL Course: Heat Treatment of Steels : Prof. Pradeep Kumar (IIT Kanpur).
3. YouTube Channel: IIT Bombay Metallurgy Lectures: Phase Diagrams and Heat Treatment.

Program	S. Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Engineering Materials and Metallurgy Lab			Code:	ME25PCC-203		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
1	-	2	-	-	25	-	25

Pre-requisites: Fundamentals of Engineering Physics and Chemistry, Basic knowledge of atomic structure and mechanical properties of solids.

Course Objectives: This course aims at enabling students:

1. To understand the crystal structure, imperfections, and mechanical behavior of engineering materials.
2. To apply phase diagrams and solidification concepts for alloy design and heat treatment.
3. To analyze the effects of heat treatment and alloying elements on mechanical properties.
4. To evaluate corrosion, failure mechanisms, and their control in engineering applications.

Course Outcomes: After completion of the course, students will be able to:

CO1: Explain the crystal structures, imperfections, and properties of engineering materials.
CO2: Apply phase diagram concepts and transformation principles to predict alloy behavior.
CO3: Analyze the effects of heat treatment and alloy composition on mechanical properties.
CO4: Examine corrosion mechanisms, fracture, fatigue, and creep in materials.

Course Contents

S. No.	Suggested List of Experiments/Assignments (Minimum Eight Experiments/Assignments to be performed)
1	Study of metallurgical microscope and specimen preparation.
2	Identification of microstructures of plain carbon steels.
3	Study of microstructure of cast iron and non-ferrous alloys.
4	Validation of experimental results of Tension and Compression tests using ductile and brittle materials
5	Hardness testing – Brinell/Vickers/Rockwell methods.
6	Impact testing – Izod and Charpy tests.
7	Jominy end-quench test for hardenability of steel.
8	Corrosion rate measurement in different environments.
9	Study of heat treatment effects using microstructural analysis.
10	Case study on material selection considering functional and environmental requirements

Reference Books:

1. W.D. Callister & D.G. Rethwisch, Materials Science and Engineering – An Introduction, Wiley.
2. O.P. Khanna, Material Science and Metallurgy, Dhanpat Rai Publications.
3. Rajan, Sharma & Sharma, Heat Treatment – Principles and Techniques, PHI.
4. Donald R. Askeland, The Science and Engineering of Materials, Cengage Learning.

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Engineering Thermodynamics			Code:		ME25PCC-204	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites: Engineering Mathematics, Engineering Physics

Course Objectives: This course aims at enabling students:

1. To develop an understanding of the fundamental principles of thermodynamics.
2. To study the behavior of pure substances and analyze vapor power cycles.
3. To understand the fuel combustion process and the composition of combustion products.
4. To evaluate performance analysis of a steam generator.

Course Outcomes: After completion of the course, students will be able to:

CO1: Describe the basics of thermodynamics with heat and work interactions.
CO2: Determine the properties of steam and their effect on performance of vapour power cycle.
CO3: Analyze the fuel combustion process and products of combustion.
CO4: Analyze steam generators and boiler draught systems for efficient and safe operation.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Thermodynamics** Introduction, Review of basic definitions, Zeroth law of Thermodynamics, Macro and Microscopic Approach, State Postulate, State, Path, Process and Cycles, Point function and Path function, quasi static process, Equilibrium, Temperature (concepts, scales, international fixed points and measurement of temperature), Constant volume gas thermometer and constant pressure gas thermometer, mercury in glass thermometer. **First Law of Thermodynamics:** Concept of heat and work, Sign convention and its conversion. First law of thermodynamics, Joules experiments, Equivalence of heat and work. Application of first law to flow and non-flow Processes and Cycles. Steady flow energy equation (SFEE), Applications of SFEE to various devices such as Nozzle, Turbine, Compressors, Boilers etc. PMM-I kind.	9
II	**Properties of Pure substances & Thermodynamics of Vapour Cycle** **Properties of Pure substances:** Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-v, T-s and h-s plots (Mollier Chart) for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined) Non-flow and Steady flow Vapour Processes, Change of Properties, Work and Heat transfer.	9

	Thermodynamics of Vapour Cycle: Rankine Cycle, Comparison of Carnot cycle and Rankine cycle, Introduction to Steam power Plant, Efficiency of Rankine Cycle, Relative Efficiency, Effect of Varying operating parameters like Superheat, Boiler and Condenser Pressure on performance of Rankine cycle, Modified Rankine Cycle.	
III	**Fuels and Combustion** Types of fuels, Proximate and ultimate analysis of fuel, Combustion theory, Combustion Equations, Theoretical and Excess air requirements, Equivalence ratio, Analysis of products of combustion, Calorific value - HCV & LCV. Bomb Calorimeters. Flue Gas Analysis using Orsat Apparatus, Exhaust Gas analyser, Enthalpy of formation, Adiabatic flame temperature.	**9**
IV	**Steam Generators & Boiler Draught** **Steam Generators:** Classification, Constructional details of low pressure boilers, Primary Features of high pressure (Power) boilers, Location, Construction and working principle of boiler, Boiler mountings and accessories, Instrumentations required for safe and efficient operation, Introduction to IBR Act, Boiler performance Calculations-Equivalent Evaporation, Boiler efficiency, Heat balance Sheet. **Boiler Draught:** Classification, Necessity of Draught, Natural draught, Determination of Height of chimney, Diameter of chimney, condition for maximum discharge, Forced draught, Induced draught, Balanced draught, Draught losses.	**9**
	Total	**36**

Text Books:

1. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill Publications
2. R. K. Rajput, "Engineering Thermodynamics", EVSS Thermo, Laxmi Publications
3. P. L Ballaney, "Thermal Engineering", Khanna Publishers
4. C.P. Arora, "Thermodynamics", Tata McGraw Hill.
5. Domkundwar, Kothandaraman and Domkundwar,"Thermal Engineering", Dhanpat Rai Publishers.
6. M M Rathore, "Thermal Engineering", Tata McGraw-Hill

Reference Books:

1. Rayner Joel, "Basic Engineering Thermodynamics", AWL-Addison Wesley
2. Cengel and Boles, "Thermodynamics an Engineering Approach", McGraw Hill
3. G.VanWylen, R.Sonntag and C.Borgnakke, "Fundamentals of Classical Thermodynamics", John Wiley & Sons
4. Holman J.P, "Thermodynamics", McGraw Hill

MOOC / NPTEL/YouTube Links:

1. https://www.youtube.com/watch?v=GMBpZZtjXM&list=PLDEBABBC
2. https://www.youtube.com/watch?v=pMmHdWvN_FI&list=PLyqSpQzTEM_QOKxVxZnQgOkzgzWP
3. https://www.youtube.com/watch?v=LPQXF-GoA&list=PLwdnzlVogoWV-nYItOMxgPXfEiM
4. https://www.youtube.com/watch?v=WgAaVHWEjw&list=PLpekhDcoNDSxcDCCoObBEgVKIwWVZ

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Engineering Thermodynamics Lab			Code:	ME25PCC-205		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
1	-	2	-	25	-	-	25

Pre-requisites : Basics of laws of Thermodynamics, Basics of Mathematics

Course Objectives: This course aims at enabling students:

1. To validate first law of thermodynamics
2. To understand different sensors used in thermal system ,
3. To understand dryness fraction of steam

Course Outcomes: After completion of the course, students will be able to:

CO1: Validate the first law of thermodynamics through experimental methods.
CO2: Measure and analyze thermal properties of steam and fuels using calorimeters.
CO3: Identify and study thermal instruments, boilers, and combustion analysis equipment.
CO4: Apply concepts of entropy and energy through demonstrations and industrial exposure.

Course Contents

S. No.	Suggested List of Experiments/Assignments
1	Joule's experiment to validate, first law of thermodynamics.
2	Survey of temperature sensors used in various thermal systems.
3	Determination of dryness fraction of steam using combined separating and throttling calorimeter.
4	Determination of HCV of solid or gaseous fuel using Bomb or Junker's calorimeter respectively.
5	Demonstration on Orsat Apparatus.
6	Demonstration of boilers using models.
7	Study of Entropy, Available energy, Unavailable energy.
8	Visit to any Process Industry/Plant having Boiler equipped with Accessories.

Reference Books:

1) Rayner Joel, "Basic Engineering Thermodynamics", AWL-Addison Wesley.
2) Cengel and Boles, "Thermodynamics an Engineering Approach", McGraw Hill.

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Solid Mechanics			Code:	ME25PCC-206		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
3	3	-	-	25	25	50	100

Pre-requisites : Engineering Mathematics, Engineering Mechanics

Course Objectives: This course aims at enabling students:

1. To develop understanding of the fundamental concepts of stress, strain, and material behaviour under loading.
2. To enable students to analyze beams and draw shear force and bending moment diagrams under various loading conditions.
3. To impart knowledge of bending and shear stresses, and methods for calculating slope and deflection in beams.
4. To explain torsional behavior in shafts, buckling of columns, and concepts of principal stresses and theories of failure.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Explain stress–strain behavior and deformation in simple and composite members.
CO2: Analyze beams using shear force and bending moment diagrams.
CO3: Determine stresses, slope, deflection, and torsion in beams and shafts.
CO4: Evaluate column stability and failure theories under combined loading.

Course Contents

Unit	Description	Duration [Hrs]
I	**Simple Stress and Strain** Concept of stress and strain, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants, Stresses and strains in determinate and indeterminate, homogeneous and Composite bars under concentrated loads and self-weight (only theory part), Temperature stresses in simple members.	08
II	**Shear Force and Bending Moment Diagrams** Introduction to Shear force diagram and bending moment diagrams with application, SFD & BMD for statically Determinate beam due to concentrated load, uniformly distributed load, uniformly varying load, couple and Combined loading, Relationship between rate of loading, shear force and bending moment, Concept of zero shear force, Maximum bending moment, point of contra-flexure.	08
III	**Beam Stresses, Slope and deflection of beams** Bending Stress on a Beam: Theory of simple bending: Flexural formula, bending stress distribution diagrams for, Common cross sections (rectangular, I,T,C), Bending stress distribution along the same cross-section,	10

	Shear stresses: Introduction to transverse shear stress on a beam with application, shear stress distribution Diagram along the Circular, Hollow circular, Rectangular, I & T cross-section. Slope and deflection of beams: Introduction to slope & deflection on a beam with application, slope, deflection and Radius of Curvature, Macaulay's Method, Slope and Deflection for all standard beams.	
IV	**Torsion in Shafts ,Buckling of Columns and Principal Stresses, Theories of Failure** **Torsion in shafts:** Introduction to torsion on a shaft with application, Basic torsion formulae and assumption in Torsion theory, Torque transmission on strength and rigidity basis, Torsional Resilience. **Buckling of columns:** Introduction to buckling of column with its application, Different column conditions and Critical, safe load determination by Euler's theory. Limitations of Euler's Theory. **Principal Stresses:** Introduction to principal stresses with application, Transformation of Plane Stress, Principal Stresses and planes (Analytical method and Mohr's Circle), Stresses due to combined Normal and Shear stresses. **Theories of failure: Introduction** to theories of failure with application, Maximum principal stress theory, Maximum shear stress theory, Maximum distortion energy theory, Maximum principal strain theory, Maximum strain energy theory.	**10**
	Total	**36**

Text Books:

1. R. K. Bansal, "Strength of Materials", Laxmi Publication
2. S. Ramamurtham, "Strength of material", Dhanpat Rai Publication
3. S.S. Rattan, "Strength of Material", Tata McGraw Hill Publication Co. Ltd
4. B.K. Sarkar, "Strength of Material", McGraw Hill New Delhi
5. Singer and Pytel, "Strength of materials", Harper and row Publication
6. R. C. Hibbeler, "Mechanics of Materials", Prentice Hall Publication

Reference Books:

1. G. H. Ryder, "Strength of Materials", Macmillan Publication
2. Beer and Johnston, "Strength of materials", CBS Publication
3. James M. Gere, "Mechanics of Materials", CL Engineering
4. Timoshenko and Young, "Strength of Materials", CBS Publication, Singapore
5. Egor P Popov, "Introduction to mechanics of solids", Prentice Hall Publication

e-sources:

1. Prof. S.K. Bhattacharyya, IIT Kharagpur , "NPTEL Web course material" https://drive.google.com/file/d/1N2Eyv9ofPimIT2OSMZeMrSxe68Ulclei/view
2. https://nptel.ac.in/courses/112107146
3. https://onlinecourses.nptel.ac.in/noc23_me140/preview

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Python Programming for Mechanical Engineers			Code:		ME25MDM-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
02	02	-	-	25	25	50	100

Pre-requisites: Basic Programming Skills, Mathematics.

Course Objectives: This course aims at enabling students:

1. To introduce the fundamentals of Python programming including data types, control structures, functions, and file handling for engineering applications
2. To enable students to use Python libraries like NumPy, Pandas, Matplotlib, and Scikit-learn for data handling, visualization, and basic machine learning tasks.
3. To apply Python programming for solving engineering mechanics and machine design problems including force systems, failure theories, and fatigue analysis.
4. To model and analyze air-standard and steam power cycles using Python for thermodynamic performance evaluation.

Course Outcomes: After completion of the course, student will be able to:

CO1: Write Python programs for solving engineering problems Comprehend methods for capturing, specifying, and analyzing software requirements.
CO2: Interpret various scenario-based problems to provide feasible solutions.
CO3: Read and write data from/to files in Python Programs
CO4: Design Python programs/ applications for a given requirement.

Course Contents

Unit	Description	Duration [Hrs]
I	**Basics of Python programming** Assignments, Variables, Datatypes-Numbers, List, Tuple, String, Set, Dictionary. Loops- For loop, If loop and While loop. Functions in python. File handling. **Introduction to Data Structures** What are Data structures, Types of Data structures, Introduction to Stacks and Queues	07
II	**Python requirements for Machine Learning** Python libraries: NumPy, Pandas, Data-frames, Matplotlib-Plotting 2D-data, Sub plots, Contour plots, Surface plots, Polar plots. Scikit-learn packages	07
III	**Python programs on Mechanics, Machine Design** Coplanar forces, Friction, Projectile motion, Von-Mises failure theory plots. Python scripts in design and simulation, Fatigue criteria	07

IV	**Python programming for Thermal system** Plot and visualize the streamlines of fluid flow, Flow over the stream lined body (Streamline plot and pressure distribution)- Aerofoil, Cylinder and Sphere. **Analyse Thermodynamics cycles through Python programming** Air standard cycles: Otto, Diesel, Dual, and Steam cycle: Rankine and Modified Rankine cycle.	**09**
	Total	**30**

Text Books:

1. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, 2nd Edition.
2. Learn Python the Hardway by Zeo A Shaw, 3rd Edition

Reference Books:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd Edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
3. Data Structures and Algorithmic Thinking with Python by Narasimha Karumanchi Introducing Python by Bill Lubanovic, O'Reilly Media, 2014.
4. Python Essential Reference, 4th Edition by David M. Beazley, Pearson Education, 2009

E books:

1. https://www.onlineprogrammingbooks.com/learning-program-using-python/
2. https://www.greenteapress.com/thinkpython/thinkpython.pdf
3. https://www.coursera.org/learn/python-basics

Program	S.Y. B.Tech (Open Elective Course-I)			Semester: III			
Course	Computational Mathematics			Code:	CE25OEC-207		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Basic knowledge of algebra, trigonometry, and calculus from First-Year Engineering Mathematics.

Course Objectives: This course aims at enabling students:

1. To develop foundational knowledge of logic, sets, functions, relations, and combinatorics.
2. To model and analyze computational problems using discrete mathematical structures.
3. To understand conceptual clarity and knowledge of Statistical methods and probability.
4. To understand Numerical techniques to approximate solutions for interpolation, integration, and ordinary differential equations.
5. To understand different transform methods like Fourier/Z transforms.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Apply propositional/predicate logic and proof techniques for problem solving.
CO2: Solve counting problems using combinatorics and recurrence relations.
CO3: Apply Statistical methods, such as correlation and regression, to analyze and interpret experimental data relevant to reliability engineering and probability theory in testing and quality control.
CO4: Obtain Interpolating polynomials, numerically differentiate and integrate functions, and numerically solve differential equations using single-step and multi-step iterative methods in modern scientific computing.
CO5: Apply transforms to engineering systems related to signals, circuits, and control applications.

Course Contents

Unit	Description	Duration [Hrs]
I	**Logic, Proof Techniques & Sets** Propositional logic, truth tables, Predicate logic, quantifiers Logical implications, inference rules Proof techniques: direct, contradiction, contrapositive, Mathematical induction Sets: set operations, algebra of sets Functions: injective, surjective, bijective	9
II	**Relations, Recurrence & Combinatory** Recurrence relations (basic introduction) Relations: definition, properties, equivalence relations, partial orders Combinatory: Permutations & combinations, Pigeonhole principle Inclusion–exclusion principle	9

III	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation, Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of hypothesis: Chi-square test	**9**
IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**9**
V	**Fourier and Z-Transforms** **Fourier Transform:** Introduction to time-domain and frequency-domain representation of signals. Complex exponential form of Fourier series. Fourier integral representation. Fourier Transform and inverse Fourier Transform. Properties of Fourier Transform such as linearity, time shifting, frequency shifting, and scaling. Fourier sine and cosine transforms with inverses. **Z-Transform:** Discrete-time signals and systems. Definition of Z-transform and region of convergence (ROC). Z-transform of basic sequences. Properties of Z-transform. Inverse Z-transform using standard pairs and partial fraction method. **Applications of Z-Transform**: Application of Z-transform in solving linear difference equations, analysis of discrete-time systems, stability analysis, and modeling of simple digital filters. Fourier sine and cosine transforms and their inverses.	**9**
	Total	**45**

Text Books:

1. Rosen, K. H., Discrete Mathematics and Its Applications, 8th Edition, McGraw-Hill Education, 2019. ISBN: 978-1-259-67651-2.
2. Kolman, B., Busby, R. C., & Ross, S., Discrete Mathematical Structures, 6th Edition, Pearson/Prentice Hall, 2009/2010. ISBN: 978-0-13-229751-6.
3. Lipschutz, S., & Lipson, M., Schaum's Outline of Discrete Mathematics, Revised 3rd Edition, McGraw-Hill Education, 2009. ISBN: 978-0-07-161586-0.
4. Grimaldi, R. P., Discrete and Combinatorial Mathematics: An Applied Introduction, 5th Edition, Pearson/Addison-Wesley, 2004 (reprints 2013). ISBN: 978-0-321-21103-3.
5. Ramana, B. V., Higher Engineering Mathematics, Tata McGraw-Hill, 2006. ISBN: 978-0-07-063419-0.

Reference Books:

1. Kenney, J. F. and Rosen, K. H., Discrete Mathematics, 1st Edition, McGraw-Hill Education, 2012. ISBN: 978-0-07-338309-5
2. Biggs, N. L., Discrete Mathematics, 2nd Edition, Oxford University Press, 2003.ISBN: 978-0-19-850717-8
3. Graham, R. L., Knuth, D. E. and Patashnik, O., Concrete Mathematics: A Foundation for Computer Science, 2nd Edition, Addison-Wesley, 1994. ISBN: 978-0-201-55802-9
4. Deo, N., Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1974. ISBN: 978-0-13-363473-0
5. Epp, S. S., Discrete Mathematics with Applications, 4th Edition, Cengage Learning, 2011. ISBN: 978-0-495-39132-6
6. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern Ltd., New Delhi (Indian Edition), 1999 (Reprinted). ISBN: 978-81-224-0883-6
7. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., Numerical Methods for Scientific and Engineering Computation, 7th Edition, Khanna Publishers, 2013. ISBN: 978-81-7409-205-9

e-sources:

MOOC / NPTEL/YouTube Links:

1. NPTEL / SWAYAM Course: Discrete Mathematics by IIT Ropar- https://onlinecourses.nptel.ac.in/noc20_cs82/preview
2. NPTEL / SWAYAM Course: Discrete Mathematics for CS by IIT Kanpur — https://onlinecourses.nptel.ac.in/noc25_cs27/preview

Program	S.Y. B.Tech (Open Elective Course-I)			Semester: III			
Course	Probability Theory and Statistical Methods			Code:		CAI25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of basic understanding of algebra and arithmetic operations is essential.

Course Objectives: This course aims at enabling students:

1. To introduce the fundamental concepts of probability, random variables, and distributions required to model real-world uncertainty.
2. To develop the ability to analyze discrete and continuous probability models and interpret their applications.
3. To provide understanding of statistical measures, sampling techniques, and the behaviour of sample data.
4. To explain estimation methods, hypothesis testing, and inference techniques used for data-driven decision making.
5. To enable students to apply probability and statistical tools for solving practical engineering and computational problems.

Course Outcomes: After completing this course, students will be able to:

CO1: Explain random variables, probability distributions, and their properties.

CO2: Apply standard discrete and continuous distributions to solve problems.

CO3: Analyze statistical measures and perform hypothesis testing for decision-making.

CO4: Apply point estimates, interval estimates, and MLE for parameter estimation.

CO5: Evaluate stochastic processes and Markov chain behaviors in AI-related scenarios.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Probability & Random Variables** Sets, events, sample space, mutually exclusive events, independent events, conditional probability, Bayes' theorem, random variables (discrete and continuous), PMF, PDF, CDF, expectation, variance, moments, joint distributions, marginal distributions, conditional distributions, independence of random variables, Markov's inequality, Chebyshev's inequality, Chernoff bounds, Weak Law of Large Numbers, Strong Law of Large Numbers, Central Limit Theorem. **Case Studies (Select any one):** Spam classification using Bayes' theorem, weather prediction using conditional probability, joint probability in manufacturing defect analysis, network traffic modelling using Central Limit Theorem.	10
II	**Probability Distributions** Bernoulli distribution, Binomial distribution, Geometric distribution, Poisson distribution, Poisson process, Uniform distribution, Exponential distribution, Normal distribution, mean and variance of distributions, Introduction of moment generation,	08

	applications in AI/ML and queuing systems. **Case Studies (Select any one):** Call center arrival modelling using Poisson distribution, defect detection in manufacturing using binomial distribution, waiting time analysis using exponential distribution, sensor reading variations modeled using normal distribution.	
III	**Hypothesis Testing** Parameter and statistic, null hypothesis, alternative hypothesis, Type I error, Type II error, significance level, p-value, power of a test, large sample tests (mean, difference of means, proportion, difference of proportions), small sample tests (t-test for mean, t-test for difference of means), chi-square test, F-test for variances, hypothesis testing for real-world decision making. **Case Studies (Select any one):** A/B testing for e-commerce click-through rate improvement, medical data testing for treatment effectiveness, comparison of accuracy between two ML models, evaluating impact of teaching method using student score data.	**10**
IV	**Estimation – Point, Interval & MLE** Point estimation, interval estimation, confidence intervals for mean, confidence intervals for proportion, confidence intervals for binomial, Poisson and normal parameters, properties of estimators (unbiasedness, consistency, efficiency), Maximum Likelihood Estimation, MLE for binomial parameters, MLE for Poisson parameters, MLE for exponential distribution, MLE for normal distribution parameters. **Case Studies (Select any one):** MLE-based click-through rate estimation, estimation of failure rate of electronic components using exponential distribution, estimation of customer arrival rate in retail using Poisson distribution, confidence interval estimation for OTT movie rating averages.	**09**
V	**Stochastic Processes & Markov Chains** Introduction to stochastic processes, branching processes, Markov chains, transition probability matrix, state classification, recurrent states, transient states, absorbing states, stationary distributions, applications of Markov chains in AI, introduction to martingales and stopping times. **Case Studies (Select any one):** Google PageRank using Markov chains, customer loyalty state transition modelling, weather forecasting using Markov model, reinforcement learning grid-world transition modelling.	**08**
	Total	**45**

Text Books:

1. R. A. Johnson, Miller and Freund's "Probability and Statistics for Engineers", Pearson Publishers, 9 th Edition, 2017.
2. John E. Freund, Benjamin M. Perles, "Modern Elementary Statistics", 12th Edition, Pearson, 2013. 3. Hamdy A. Taha, "Operations Research: An Introduction", Pearson, 2017, Tenth Edition.
3. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, S.Chand & Co, 2020.
4. Kantiswarup, P.K.Gupta and Manmohan Singh, "Operations Research", Sultan Chand & Sons, 2014.

Reference Books*:*

1. Sheldon M. Ross : Introduction to Probability and Statistics for Engineers and Scientists Academic

Press.
2. A. Papoulis & S. U. Pillai : Probability, Random Variables, and Stochastic Processes McGraw-Hill
3. J. S. Milton & J. C. Arnold : Probability and Statistics in the En**gineering and Computer Sciences** McGraw-Hill

e-sources:

1. NPTEL – Stochastic Processes (IIT Bombay) https://nptel.ac.in/courses/111102014
2. University of Cambridge – Stochastic Processes Notes https://www.statslab.cam.ac.uk/~rrw1/markov/M.pdf

Program:	**S.Y. B.Tech (Open Elective Course-I)**			**Semester: III**			
Course	**Probability & Statistics**			**Code:**	**AIDS25OEC-207**		
Credits	**Teaching Scheme (Hrs./Week)**			**Examination Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**UT**	**FA**	**SA**	**Total**
4	**3**	**-**	**1**	**25**	**25**	**50**	**100**

Pre-requisites: Prior knowledge of basic understanding of algebra and arithmetic operations, Fundamental concepts of probability (events, sample space, basic rules).

Course Objectives: This course aims at enabling students:

1. To introduce the basic concepts of random variables and probability distributions.
2. To develop the ability to apply standard discrete and continuous distributions to real-world problems.
3. To understand fundamental statistical measures and distribution properties.
4. To provide knowledge of hypothesis testing methods for decision-making.
5. To enable students to analyze real-life situations using statistical reasoning and case studies.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Understand Set Theory in details.
CO2: Understand random variables, distribution functions, and basic probability concepts.
CO3: Apply standard discrete and continuous distributions (Binomial, Poisson, Uniform,

Exponential, Normal) to solve simple problems. CO4: Analyze statistical measures such as mean, quantiles, inequalities (Markov, Chebyshev), and distribution properties. CO5: Perform hypothesis testing for population parameters and interpret results in real-life case studies.		
Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Introduction to Set Theory** Basics of set Theory: Introduction to sets and algebra of sets, Random Experiment, Sample Space, Events, Complementary Events, Union and Intersection of Two Events, Difference Events, Exhaustive Events, Mutually Exclusive Events, Equally Likely Events, Independent Events.	**8**
II	**Introduction to Probability** Probability Theory: Mathematical & Statistical definition of Probability, Need of probability theory in Data science, Axiomatic definition of probability, Addition Theorem, Multiplication Theorem, Theorems of Probability, Conditional Probability, Inverse Probability, Joint Probability, Total Probability and Bayes Theorem. Case Study: Use of probability in real-life situations, like weather forecasting, sports betting, sales forecasting etc	**7**
III	**Introduction to Statistics** Introduction, Origin and Development and scope of Statistics, Population and Sample, Sampling –Introduction, Types of Sampling, Purposive Sampling, Random Sampling, Simple Sampling, Stratified Sampling, Parameter and Statistic, Sampling Distribution 54 Sampling With and Without Replacement, Population Parameters, Sample Statistics. Introduction, Arithmetic Mean, Simple and weighted mean for raw data, Discrete frequency distribution, Continuous frequency distribution, Properties of A.M.,Merits & Demerits of A.M. Median, Mode for raw data, Merits and demerits of Median and Mode. Case Study: Create measures of central tendency for a real-life example dataset, such as the payroll dataset or titanic dataset. Case study of sampling for any real-world problem like exit poll statistics	**10**
IV	**Descriptive Statistics** Measures of Dispersion, Skewness and Kurtosis: Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard	**10**

	Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Coefficient of Variation, Skewness, Kurtosis. Correlation and Regression : Bivariate Distribution, Scatter diagrams, Correlation, Karl Pearson's coefficient of correlation, Rank correlation, Regression, Regression Coefficients, Lines of Regression. Case study: Create measures of dispersion for a real-life example dataset like students dataset, iris detection etc.	
V	**Probability Distributions & Hypothesis Testing** Random Variables: Distribution function, PMF, PDF, basic properties; mean, median, quantiles, Markov and Chebyshev inequalities.Standard Distributions: Bernoulli, Binomial, Poisson, Uniform, Exponential, Normal – definitions and simple applications.Moment concepts (introduction) and basic characteristics of the above distributions.Hypothesis Testing: Statistical hypothesis, null and alternative hypotheses, level of significance, Type I & II errors, tests for mean and proportion. Case studies based on binomial distribution and hypothesis testing for real-life decision problems.	**10**
	Total	**45**

Text Books:

1. M. Mood, F. A. Graybill, D. C. Boes**,** *Introduction to the Theory of Statistics*, McGraw-Hill.
2. Robert V. Hogg, Joseph McKean, Allen T. Craig, *Introduction to Mathematical Statistics*, Pearson.
3. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics,* Sultan Chand & Sons.

Reference Books:

1. Sheldon Ross, A First Course in Probability, Pearson.
2. William Mendenhall, Statistics for Engineering and the Sciences, CRC Press.
3. J.E. Freund, Mathematical Statistics, Pearson.
4. Gareth James et al**.**, An Introduction to Statistical Learning, Springer.

e-sources:

1. NPTEL Courses (IIT Bombay / IIT Kanpur)
2. Probability and Statistics for Engineers
3. Statistical Inference
4. Khan Academy – Statistics & Probability
5. MIT OpenCourseWare – Probability & Statistics

Program	S.Y. B.Tech (Open Elective Course-I)			Semester : III			
Course	Numerical Statistical Analysis			Code:	IT25OEC-205		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Basic knowledge of Engineering Mathematics, Algebra, Calculus, and Programming Concepts.

Course Objectives: This course aims at enabling students:

1. To solve algebraic and transcendental equations using numerical methods.
2. To apply interpolation, curve fitting, numerical differentiation, and numerical integration techniques.
3. To analyze probability theory, random variables, and standard probability distributions.
4. To utilize statistical tools for sampling, correlation, regression, and hypothesis testing.
5. To develop analytical skills for engineering problems using numerical and statistical techniques.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Apply numerical techniques to solve algebraic and transcendental equations with convergence analysis.
CO2: Use interpolation, curve fitting, numerical differentiation, and numerical integration effectively.
CO3: Explain probability concepts and apply standard probability distributions to engineering problems.
CO4: Perform sampling, regression analysis, correlation and statistical data interpretation.
CO5: Conduct hypothesis testing such as t-test, z-test, chi-square, anova & construct confidence intervals.

Course Contents

Unit	Description	Duration [Hrs]
I	**Numerical Solution of Equations** Types of Errors: Absolute, Relative, Percentage error Roots of algebraic & transcendental equations, Bisection Method, Regula Falsi Method, Newton–Raphson Method, Secant Method, and Convergence of iterative methods.	9
II	**Interpolation & Curve Fitting** Finite differences**,** Interpolation: Newton Forward & Backward Interpolation, Lagrange's Interpolation**,** Newton's Divided Difference Formula, Curve fitting: Least Squares Method, Fitting Straight Line, Parabola, and Exponential Curves.	9
III	**Numerical Differentiation & Integration** Numerical differentiation using Newton's formulas, Maxima & minima using numerical differentiation, Numerical Integration:	9

	Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Error analysis for numerical differentiation & integration.	
IV	**Probability & Statistical Distributions** Basic Probability Theory, Bayes' Theorem, Random Variables, Discrete & Continuous Probability Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution, Moments, Skewness & Kurtosis.	**9**
V	**Sampling, Regression & Hypothesis Testing** Sampling Techniques & Sampling Distribution, Correlation: Karl Pearson coefficient, Regression Analysis: Linear regression & multiple regression, Hypothesis Testing: t-test, z-test, Chi-square test, ANOVA (One-way), Confidence intervals.	**9**
	Total	**45**

Text Books:

1. S.S. Sastry – Introductory Methods of Numerical Analysis, *PHI*
2. Erwin Kreyszig – Advanced Engineering Mathematics, *Wiley*
3. Gupta & Kapoor – Fundamentals of Mathematical Statistics, *Sultan Chand*

Reference Books:

1. Jain, Iyengar, Jain – *Numerical Methods for Scientific and Engineering Computation*, New Age
2. William Navidi – *Engineering Statistics*, McGraw Hill
3. Richard Johnson – *Statistics & Data Analysis*, Pearson

E Sources:

1. NPTEL: Numerical Methods (IIT Bombay / IIT Kharagpur)
2. MIT Open Course Ware: Numerical Analysis
3. Khan Academy: Statistics & Probability

E Books:

1. https://www.aerostudents.com/courses/applied-numerical-analysis/IntroductoryMethodsOfNumericalAnalysis.pdf
2. https://lib.zu.edu.pk/ebookdata/Engineering/Energy%20System/Advanced%20engineering%20mathematics%20by%20Kreyszig%20E.pdf

MOOC / NPTEL/YouTube Links:

1. NPTEL: Probabilistic Models & Numerical Methods
2. Coursera: Numerical Methods for Engineers
3. YouTube: Numerical Methods – Dr. T.K. Roy

Program	S.Y. B.Tech (Open Elective Course-I)				Semester : III		
Course	Vectors and Transforms				Code:	ETC25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Univariate Calculus, Multivariate Calculus

Course Objectives: This course aims at enabling students:

1. To develop a strong foundational understanding of transform techniques to analyze and solve engineering and communication-related problems.
2. To Provide conceptual clarity in formulating and solving differential equations arising in various engineering applications.
3. To Equip students with numerical methods for interpolation, numerical integration, and solving ordinary differential equations with practical computational approaches.
4. To Enable students to understand, differentiate, and integrate vector fields, and apply these concepts to engineering and physical systems.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Apply transforms such as Laplace transform, to solve problems related to signal processing and control systems.

CO2: Apply integral transforms such as, Fourier transform to solve problems related to signal processing and control systems.

CO3: Apply transforms such as Z-Transform to solve problems related to signal processing and control systems.

CO4: Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.

CO5: Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.

Course Contents

Unit	Description	Duration [Hrs]
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n , scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	09

II	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations.	**09**
III	**Fourier and Z-Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their inverses. Z-Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations	**09**
IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**09**
V	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields	**09**
	Total	**45**

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 10 Edition.
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication),44th Edition.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill , New York, First Edition.
4. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 4/e, Tata McGraw Hill Editions, 2002, ISBN 0-07-047437-0.
5. Dr. B. S. Garewal, Numerical Methods in Engineering and Science, 7/e, Khanna Publishers, ISBN 81-74009-205-6

E sources:

1. https://onlinecourses.nptel.ac.in/noc23_ma54/
2. https://nptel.ac.in/courses/111106111

Program	S.Y. B.Tech (Open Elective Course-I)					Semester: III	
Course	Applied Mathematics				Code:	ME25OEC-208	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Univariate Calculus**,** Multivariate Calculus**,** Fourier series, Collection, classification, and representation of data

Course Objectives: This course aims at enabling students:

1. To build students' conceptual understanding and ability to apply Laplace Transform techniques.
2. To build students' conceptual understanding and ability to apply Inverse Laplace Transform techniques.
3. To build students' conceptual understanding and ability to apply Fourier Transform techniques.
4. To build students' conceptual understanding and ability to apply Statistical methods and probability.
5. To understand the Vector field, its Differentiation and Integration.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Apply transforms such as the laplace transform to solve problems related to mechanical systems.
CO2: Apply transforms such as the inverse laplace transform to solve problems related to mechanical systems, such as differential equations, mass, and spring systems.
CO3: Apply integral transforms, such as the fourier transform to solve problems related to mechanical systems
CO4: Apply statistical methods like correlation and regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.
CO5: Perform vector differentiation and integration, analyze the vector fields and apply to magnetic fields

Course Contents

Unit	Description	Duration [Hrs.]
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	9
	Inverse Laplace Transform Introductory remarks; Inverse transforms of some elementary	

II	functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations.	**9**
III	**Fourier Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, and their inverse Fourier transform, inverse Fourier sine transform, inverse Fourier cosine transform	**9**
IV	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation, Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of hypothesis: Chi-square test and t- test	**9**
V	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stokes' theorem. Applications to problems in Electro-magnetic fields	**9**
	Total	**45**

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication)
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.
4. Thomas' Calculus by George B. Thomas (Addison-Wesley, Pearson).
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press)
6. Jason Brownlee, 'Statistical Methods for Machine Learning', Machine learning Mastery.

e-sources:

1 https://nptel.ac.in/courses/111107098
2 https://nptel.ac.in/courses/111105041

Program	S.Y. B.Tech (Value Education Course-I)			Semester : III			
Course	Universal Human Values			Code:		CSE25VEC-208	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	-	2	1	-	-	25	25

Pre-requisites: Social Values, Communication

Course Objectives: This course aims at enabling students:

1. To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity
2. To elaborate on 'Self-exploration' as the process for Value Education.
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence.

Course Outcomes: After completion of the course, students will be able to:

CO1: Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.

CO2: Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.

CO3: Explain relationship between one self and the other self as the essential part of relationship and harmony in the family.

CO4: Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence and draw ethical conclusions in the light of right understanding

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Value Education** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations	4
II	**Harmony in the Human Being** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health	4
III	**Harmony in the Family and Society** Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Values in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	4
IV	**Harmony in the Nature (Existence)**	3

	Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence, Professional Ethics in the light of Right Understanding, Strategies for Transition towards Value-based Life and Profession	
	Total	**15**

The subject instructor supposed conduct the activities based on the topic covered during the tutorial sessions. The few activities should be individual or in group. The students supposed to submit the properly written documents.

Suggested list of Experiments/Assignments

Sl. No.	Experiments/Assignments
1	Introduce yourself in detail. What are your life goals? How do you make goals for your life? How do you distinguish between right and wrong? What are your major accomplishments and faults in life? Observe and study them
2	Man-made issues such as energy and material resource depletion, pollution, global warming, ozone depletion, deforestation, and soil degradation pose a threat to the survival of life on Earth. What is the source of these ailments and what is the solution, in your opinion?
3	There is rapidly growing danger due to nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression, and suicidal attempts. What do you think is the root cause of these threats to human happiness and peace? What is the solution in your opinion?
4	Our "Natural Acceptance" ability allows us to choose what is right or wrong for ourselves. We are not educated to listen to our "Natural Acceptance," which can be confused by perceptual biases and sensory stimuli. Explore the following: (i) What is your natural level of respect for yourself and others? (ii) What is "naturally acceptable" to you: nurturing or exploiting others? Is your lifestyle consistent with your natural acceptance or divergent from it?
5	Share a personal experience when you demonstrated deliberate devotion to values in a challenging scenario
6	Identify any two major problems confronting society now and investigate the underlying causes. Can these be handled based on natural acceptance of human values? If so, how should one move in this approach given the current situation?
7	Having awareness about nature, its four orders and their mutual fulfillment. Activities to be performed-written assignment, chart making.
8	List down all your desires, Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.
9	Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are: 1a. Do I want to make myself happy? 2a. Do I want to make the other happy? 3a. Is the other want to make him happy? 4a. Is the other want to make me happy? Intention (Natural Acceptance) 1b. Am I able to make myself always happy? 2b. Am I able to make the other always happy?

	3b. Is the other able to make him always happy? 4b. Is the other able to make me always happy? What is the answer? Competence Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention & competence as well as the others' intention & competence.
10	1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under- evaluation, over-evaluation or otherwise evaluation. 2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.
11	Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group. Develop three chapters to introduce social science-its need, scope and content in the primary education of children
12	List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders. List what do you take from nature; and what do you give back to nature? Are you a source of harmony in Nature?

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81-957703-6-6 (e-book)
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)

Reference Books:

1. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak
2. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
3. N. Tripathy, 2003, Human Values, New Age International Publishers.
4. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

e-Sources:

1. Jeevan Vidya: Ek Parichaya — A. Nagaraj (1999)
   https://uhvparivar.org/publications/otherbooks/Jeevan-Vidya-ek-Parichay.pdf

eBooks:

1. A Foundation Course in Human Values and Professional Ethics
   https://uhvparivar.org/publications/uhvbooks/UHV-FCV-3E-Textbook.pdf

MOOC / NPTEL/YouTube Links:

1. Swayam Course on "Understanding Human Being Nature and Existence Comprehensively" by Dr. Kumar Sambhav
   https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
2. NPTEL Course on "Exploring Human Values: Visions of Happiness and Perfect Society" by Prof.

A. K. Sharma IIT Kanpur
https://nptel.ac.in/courses/109104068

3. UHV Lecture Series – Prof. R. R. Gaur
https://www.youtube.com/playlist?list=PLz0n_SjOttT0LlwM1zVfPVTz3wGM5seXm

Program	S.Y. B.Tech (Value Education Course-I)			Semester: III			
Course	Professional Ethics for Engineers			Code:	ETC25VEC-208A		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Pre-requisites: Basic understanding of business management.

Course Objectives: This course aims at enabling students:

1. To provide the students an understanding of the meaning of ethics in engineering profession.
2. To introduce an awareness of ethical duties and responsibilities of engineers in the practice of their Careers.
3. To provide a sociological understanding of the social impact of technology and engineering.
4. To examine some of the classical cases as well as contemporary ethical issues in engineering Profession.

Course Outcomes: After completion of the course, students will be able to:

CO1: Practice the moral values that ought to guide the engineering profession.
CO2: Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations.
CO3: Know the definitions of risk and safety also discover different factors that affect the perception of risk.
CO4: Appreciate the ethical issues and know the code of ethics adopted in various professional bodies and industries.

Course Contents

Unit	Description	Duration [Hrs]
I	**Ethics in Engineering** Understanding basic concepts Ethics- Engineering Ethics- Engineering as Profession – Difference between occupation and professions- Professional Ethics - Codes of Ethics in Engineering profession- Moral dilemmas and moral autonomy in Engineering profession.	**4**
II	**Engineering as Social Experimentation** Engineering as experimentation-Engineers as responsible Experimenters-A balanced outlook on Law.	**4**
III	**Social Impact of Technology and Engineering** Ethos of science and engineering- Ethical leadership in engineering and society, social responsibility of scientist/ researchers, Intellectual property and society, Cross cultural issues in engineering research.	**3**
IV	**Major Issues in Engineering Ethics and Environment** Ethics and sustainable engineering- Computer ethics- Analysing ethical problems in research- Ethics in collaborative research- Engineers as expert consultants and advisors- Corporate Social Responsibility (CSR).	**4**

	Total	15
Course Contents		
Sl. No.	**Suggested List of Experiments/Assignments**	
1	Study of basic ethical concepts including values, morals, rights, duties, and ethical reasoning frameworks relevant to engineering practice.	
2	Study of engineering as a profession with emphasis on professional roles, responsibilities, accountability, and distinction between occupation and profession.	
3	Study of professional ethics and codes of ethics as prescribed by recognized professional engineering bodies, highlighting ethical conduct and compliance.	
4	Study of moral dilemmas in engineering practice through case studies to develop ethical reasoning and decision-making skills.	
5	Study of engineering as social experimentation focusing on risk, safety, uncertainty, and the responsibility of engineers as responsible experimenters.	
6	Study of law and ethics in engineering practice to understand regulatory compliance and the need for a balanced ethical and legal outlook.	
7	Study of social, environmental, and sustainability impacts of technology and engineering in the context of societal well-being..	
8	Study of research ethics and intellectual property rights including issues related to plagiarism, authorship, innovation, and societal benefit.	
9	Study of computer ethics and ethics in collaborative engineering work covering data privacy, cybersecurity, and professional integrity.	
10	Study of corporate social responsibility (CSR), ethical leadership, and sustainable practices in engineering organizations.	

Text Books:

1. Naagarazan, R.S. , "Professional Ethics and Human Values " New age International
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall

Reference Books:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice all of India, New Delhi, 2004.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Wadsworth Thompson Learning, United States, 2000.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

MOOC / NPTEL/YouTube Links:

1. https://youtu.be/ag1fHF7aL0A?si=vlNPA0Ea7ZjKAT3S
2. https://youtu.be/ag1fHF7aL0A?si=_T2VV3q_iYG4rj8L

Program	S.Y. B. Tech. (Value Educational Course-I)				Semester : III		
Course	Social Connect and Responsibility				Code:	ETC25VEC-208B	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Course Objectives: This course aims at enabling students:

1. To enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
2. To provide a formal platform for students to communicate and connect with their surroundings.
3. To enable to create of a responsible connection with society.

Course Outcomes: After completion of the course, students will be able to:

CO1**:** Perform tree plantation and adoption activities and document plant characteristics, relevance, and cultural significance.

CO2: Demonstrate understanding of local heritage and crafts through field visits and digital documentation.

CO3: Explain principles of organic farming and wet waste management and relate them to sustainable campus practices.

CO4: Analyze water conservation practices in community settings and prepare evidence-based documentation.

CO5: Explore and document local culinary heritage, indigenous materials, and food lore through field-based interactions.

Course Contents

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage student's interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed :

Unit	Description	Duration [Hrs]
I	**Plantation and adoption of a tree** Plantation of a tree that will be adopted for four years by a group of B. Tech. students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature carried out by the project groups.	3
II	**Heritage walk and crafts corner** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.	3

III	**Organic farming and waste management** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.	**3**
IV	**Water Conservation** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.	**3**
V	**Food Walk** City's culinary practices, food lore, and indigenous materials of the region used in cooking.	**3**
	Total	**15**

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	**Tree Plantation & Adoption Activity** Students will plant a sapling on campus or a designated location and adopt it for four years. They must record initial environmental conditions, plant type, and growth indicators.
2	**Documentary/Photo Blog on Adopted Plant** Each group will prepare a short documentary or a photo blog about the adopted tree covering: • Plant origin • Botanical features • Usage in daily life • Cultural, folklore, and literary significance
3	**Heritage Walk Documentation** Students will participate in a heritage walk within the city to study historical sites, traditional architecture, and community spaces. They will document observations with photographs and short descriptions.
4	**Crafts Corner Study & Documentation** Visit a local crafts workshop (e.g., pottery, weaving, metalwork) to interact with craftsmen and understand techniques, tools, and cultural relevance. Prepare a photo blog or documentary on evolution and practice of the craft.
5	**Organic Farming Exposure Visit** Students will visit an organic farm or agricultural field to learn about: • Organic farming techniques • Soil preparation • Bio fertilizers • Crop rotation • Pest control methods A reflective report will be prepared based on observations.

6	**Wet Waste & Compost Management Practical** Study wet waste collection, segregation, and composting processes in nearby villages or campus. Students will carry out small-scale composting using daily biodegradable waste.
7	**Water Conservation Practices Survey** Survey nearby villages/campus to document traditional and modern water conservation practices such as: • Rainwater harvesting • Check dams • Greywater reuse • Percolation pits Prepare a photo blog or documentary presenting current practices and recommendations.
8	**Food Walk & Culinary Culture Mapping** Conduct a food walk to explore local dishes, ingredients, indigenous cooking materials, and culinary traditions. Students will document: • History behind specific dishes • Food lore • Traditional preparation methods

Textbooks:

1. Agricultural Sustainability: Strategies for Organic, Climate-Smart, and Resource-Conserving Farming, *Shravanthi et al., First edition, 2025.*
2. Hydrological Measurements for Watershed Research – Wasi Ullah et al., First Edition.
3. Perspectives in Environmental Studies – Kaushik & Kaushik, First Edition,2018.

e-sources:

1. https://www.youtube.com/watch?v=iaQjEDYyWKw
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Workshop Technology			Code:		ME25VSEC-210 A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
02	-	04	-	-	25	25	50

Pre-requisites: Manufacturing Processes, Manufacturing Practice Workshop, Engineering Physics, Chemistry ,Engineering Graphics , Engineering Materials and Metallurgy

Course Objectives: This course aims at enabling students:

1. To understand the drawing standards, geometric dimensioning & stack up analysis and application of GD&T symbols in the industries.
2. To understand the design principles for different approaches in the industry.
3. To understand safety norms required while using various machine tools and shop floor.
4. To understand the principles & acquire skills to produce components using application of various manufacturing processes.
5. To understand the principles & acquire skills to produce components using application of press operations and manufacturing / process plans

Course Outcomes: After completion of the course, students will be able to:

CO1: Read and interpret industrial drawings using standard practices.
CO2: Apply GD&T principles and interpret surface finish and welding symbols.
CO3: Apply design principles to develop safe and efficient products.
CO4: Identify and communicate safety standards in mechanical workshops.
CO5: Plan and execute assembly jobs using appropriate materials and processes.

S. No.	Suggested List of Experiments/Assignments	Duration (Hrs)
01	Study and reading of Industrial Drawings to understand standard industrial practices viz. Dimensioning, GD&T, and Surface finish, welding symbols, etc. a. Machine Drawing, b. Production Drawing, c. Part Drawing, d. Assembly Drawing – (i) Assembly Drawing for Design, (ii) Assembly Drawing for Instruction Manuals, (iii) Exploded Assembly Drawing, (iv) Schematic Assembly	**4**
02	Study of basic concepts of Geometric Dimensioning & Tolerances (GD&T) – a. Terminology, Maximum and Minimum Material conditions, Features, Rules for GD&T, Datum Control b. Adding GD&T to a Design, Form Tolerances c. Orientation Tolerances, Profile Tolerances d. Location Tolerances, Run out Tolerances, e. Surface finish, f. Welding symbols	**4**
03	Study of basics of Design for Manufacturing (DFM), Design for Assembly and Disassembly and Design for Safety with suitable examples	**4**
04	Study and analyze the safety standards and safety measures implemented in various sections of a mechanical workshop, prepare informative posters or	**4**

	comprehensive reports.	
05	Production/machining of assembly job containing 2-3 components and suitable for assembly with standard components viz. nut, screw, bearing etc. consisting at least 4-5 operations from the following list: 1. Raw material selection (Suitable for job in assignment) 2. Raw material preparation like hacksaw cutting, etc. 3. Rough turning on lathe/CNC 4. Rough milling on Milling machine or VMC viz. machining flats, gear cutting, keyways, etc. 5. Drilling/tapping/threading 6. Surface finishing using Grinding/Polishing/Buffing, etc.	**6**
06	Fabrication of a component by joining two similar or dissimilar metals using TIG, MIG, or gas welding techniques.	**4**
07	Manufacturing one engineering component using casting/forging in available workshop facilities of any engineering material like wax, tin, etc. **OR** Observe and demonstrate the manufacturing processes of castings and forgings during an industrial visit.	**4**
	Total	**30**

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : III			
Course	Object Oriented Programming with C++			Code:			ME25VSEC-210B
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
02	-	04	-	-	25	25	50

Pre-requisites: Fundamental of Computing and Programming, C

Course Objectives: This course aims at enabling students:

1. To understand the fundamentals of Object-Oriented Programming concepts using C++.
2. To understand and implement object-oriented programming concepts.
3. To apply OOPS principles in engineering-oriented problems.
4. To develop logical thinking and coding discipline.

Course Outcomes: After completion of the course, students will be able to:

CO1: Apply fundamental C++ programming constructs and object-oriented concepts to solve basic computational problems.

CO2: Design and implement classes, constructors, and member functions for modeling real-world entities.

CO3: Demonstrate inheritance, polymorphism, and function overloading for code reusability and extensibility.

CO4: Develop structured and modular C++ programs using recursion and advanced OOPS features.

Suggested List of Experiments/Assignments

S.No	Description
01	Write a program to check whether a given number is Palindrome or not.
02	Write a program to implement Matrix Multiplication.
03	Program to implement user-defined functions demonstrating function declaration, definition, and calling.
04	Program to implement a Bank Account class with data members and member functions for deposit and withdrawal.
05	Program to implement a Student Information class to store and display student details.
06	Program to demonstrate the use of constructors (default and parameterized).
07	Program to find the factorial of a given number using recursion.
08	Program to implement function overloading demonstrating compile-time polymorphism.
09	Program to implement multiple inheritances to demonstrate code reusability.

Program	S.Y. B.Tech (Entrepreneurship Management Course)			Semester : III			
Course	Principles of Management and Entrepreneurship			Code:		IL25EMC-211	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	2	1	25	-	-	25

Pre-requisites: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives: This course aims at enabling students:

1. To introduce the fundamental concepts, functions, and principles of management
2. To develop the ability to plan, organize, lead, and control organizational activities
3. To familiarize with the concept of entrepreneurship
4. To develop skills for identifying business opportunities
5. To create awareness about MSME policies, institutional support systems, startup ecosystem.

Course Outcomes: After completion of the course, students will be able to:

CO1: Explain fundamental principles, functions of management with the role and responsibilities of manager.
CO2: Design and develop the plan, strategies, organizational structure and HR processes.
CO3: Apply motivational theories for leadership in organizational situations
CO4: Identify entrepreneurial traits and competencies
CO5: Create the opportunities to utilize government and financial support systems through business plans.

Unit	Course Contents	Duration (Hrs)
I	**Theory of Management** Meaning, Nature, Scope and Importance of Management, Functions of Management – Planning, Organizing, Staffing, Directing, Controlling, Levels of Management – Top, Middle and Lower, Roles of a Manager (Mintzberg's Managerial Roles), Evolution of Management Thought: Classical Theory (Fayol, Taylor), Behavioral Approach, Modern Approaches (System, Contingency), Social and Ethical Responsibilities of Managers	03
II	**Planning and Techniques in Management** Planning – Nature, Process, Types of Plans, MBO (Management by Objectives), Decision Making – Types, Steps, Techniques, Organizing – Concept, Types of Organization Structures (Functional, Divisional, Matrix), Span of Control, Delegation of Authority, Centralization vs Decentralization, Staffing – Manpower Planning, Recruitment, Selection and Training	03
III	**Leadership and Control** Leadership – Meaning, Importance, Qualities of a Leader, Leadership Styles – Autocratic, Democratic, Laissez-faire, Transformational, Motivation – Meaning, Importance, Motivation Theories – Maslow, Herzberg, McGregor Theory X & Y, Communication – Process, Types, Barriers, Effective	03

	Communication Techniques, Controlling – Concept, Steps, Techniques of Control, Budgetary and Non-Budgetary Controls.	
IV	**Introduction to Entrepreneurship and Business Plan** Concept and Meaning of Entrepreneurship**,** Characteristics and Competencies of Successful Entrepreneurs**,** Types of Entrepreneurs – Innovative, Imitative, Serial, Social, Women Entrepreneurs**,** Entrepreneurial Process – Idea Generation to Enterprise Launch**,** Creativity and Innovation – Techniques and Tools**,** Barriers to Entrepreneurship – Personal, Social, Situational. Micro, Small & Medium Enterprises (MSMEs) – Definition, Importance, Opportunities, Business Environment – Internal & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. Institutional Support for Entrepreneurship: MSME-DI, DIC, NSIC, SIDBI, NABARD, KVIC, NIESBUD, EDII, Start-up India, Make in India, Atal Innovation Mission. Financial Support: Seed Funding, Angel Investors, Venture Capital, Bank Loans	**06**
	Total	**15**

Sr.No.	**List of Experiment**
1	Case Study on Functions of Management in a Real-World Organization
2	Preparation of Vision, Mission, and Objectives for a Startup Idea
3	Case Study on Evolution of Management Thought – Classical to Modern Approaches
4	Case Study on Motivation Strategy Development for Employee Productivity Improvement
5	Business Communication Activity – Drafting Official Letters, Memos, and Emails
6	Decision-Making Exercise Using Decision Tree or SWOT Analysis
7	Preparation of a Basic Business Plan for a Startup
8	Market Survey and Opportunity Identification for New Ventures
9	Preparation of Project Report for an Entrepreneurial Idea
10	Group Activity: Role Play on Leadership and Team Management

Text Books

1. Stephen Robins, Mary Coulter, David Decenzo. Fundamental of Management, 11th Edition, Pearson, 2020, ISBN 13: 978-0-13-517515-6
2. Richard L. Hughes, Robert C. Ginnett, Gordon J. Curphy. Leadership, 09th Edition, Mc Graw Hill, 2022, ISBN-13. 978-9355320704
3. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.

Reference Books

1. Jennifer M. George. Contemporary Management, 1st Edition, Mc Graw Hill, 2024, ISBN13: 9781264948390
2. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

MOOC / NPTEL/YouTube Links:

1. https://www.coursera.org/learn/entrepreneur-guide-beginners
2. Entrepreneurship By Prof. C Bhaktavatsala Rao IIT Madras https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. Entrepreneurship Essentials By Prof. Manoj Kumar Mondal IIT Kharagpur
4. https://onlinecourses.nptel.ac.in/noc20_ge08/preview

Course Syllabus
Semester-IV

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : IV			
Course	Fluid Mechanics			Code:		ME25PCC-251	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
3	3	-	-	25	25	50	100

Pre-requisites: Engineering Mathematics**,** Engineering Mechanics

Course Objectives: This course aims at enabling students:

1. To understand basic fluid properties, fluid statics, and pressure measurement.
2. To study fluid kinematics, dynamics, and common flow-measurement devices.
3. To analyze laminar and turbulent flows, pipe losses, pipe networks, and power transmission.
4. To understand boundary layer behaviour, flow separation, drag, and lift.
5. To apply dimensional analysis and model laws for predicting prototype performance.

Course Outcomes: After completion of the course, students will be able to:

CO1: Analyze fluid properties and classify fluid types.
CO2: Apply hydrostatic laws to determine fluid pressure variation.
CO3: Use manometers and pressure devices for pressure measurement.
CO4: Determine pressure forces, center of pressure, and floating body stability.
CO5: Apply dimensional analysis and model laws to fluid flow systems.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fluid Properties and Fluid Statics** Fluid State and Intrinsic Properties: Definition of fluid, concept of continuum. Density, specific weight, specific gravity. Viscosity, viscosity laws, types of fluid and rheology, vapor pressure, compressibility. Surface tension, capillarity. Hydrostatics and Pressure Measurement: Forces acting on fluid element, Pascal's law, hydrostatics law. Pressure scale, piezometer, barometer, manometer - simple, inclined, differential, micro manometer, inverted. Forces on Submerged Bodies: Total pressure and center of pressure on submerged plane surfaces, curved surface submerged in liquid. Buoyancy, flotation, stability of bodies.	08
II	**Fluid Kinematics and Dynamics** **Fluid Kinematics and Flow Analysis:** Lagrangian and Eulerian approaches. Steady/unsteady, uniform/non-uniform, laminar/turbulent, rotational/irrotational. Velocity and acceleration fields (local and convective components). Continuity equation in one-dimensional (1D) and three-dimensional (3D) flow. Path line, stream line, and streak line, concept of a stream tube. Stream function and velocity potential function, concept of a flow net. **Fluid Dynamics and Energy Principles**	07

	Various forces acting on fluid elements (gravity, pressure, viscous forces), Euler's equation of motion along a streamline, derivation and application, Bernoulli's theorem (application and limitations) and modified Bernoulli's theorem for real fluids. Stagnation pressure, Hydraulic Grade Line (HGL), and Total Energy Line (TEL). **Flow Measurement and Devices:** Venturimeter, orifice meter, pitot tubes. Introduction to orifices, notches, and weirs.	
III	**Viscous Flow and Flow Through Pipes** Laminar Flow Analysis: Entrance region theory for pipe flow, Velocity and shear stress distribution for laminar flow through a pipe (Hagen-Poiseuille flow), Laminar flow between fixed parallel plates, Couette flow (Laminar flow between one fixed and one moving parallel plate) Turbulent Flow and Losses: Velocity profile of turbulent flow (qualitative description), Concept of hydrodynamic ally smooth and rough boundaries. Major Losses: Head loss due to friction (without expressions). Minor Losses: Losses due to fittings, bends, sudden expansion/contraction (without expressions). Use of Moody's chart for determining the friction factor, Compounding of pipes	**07**
IV	**Boundary Layer Theory and Drag/Lift** Boundary Layer Fundamentals: Boundary layer formation over a flat plate. Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness. Flow Separation and Control: Understanding the cause and effect of boundary layer separation. Methods to control separation (e.g., suction, blowing, vortex generators). **Aerodynamic Forces and Flow Types:** Drag and lift concepts. Types of drag (e.g., friction drag, pressure drag). Definition and significance of drag coefficient and lift coefficient. Definition and characteristics of aerofoil, bluff body, and streamline body.	**07**
V	**Dimensional Analysis** **Dimensional Analysis:** Introduction, system of dimensions, Dimensional homogeneity, Buckingham-Pi Theorem, repeating variables, dimensionless numbers and their physical significance **Similitude & Model Testing:** Model & prototype, similarity, scaling parameters, model laws, objectives, importance and application of model studies.	**07**
	Total	**36**

Text Books:

1. Sukumar Pati, "Fluid Mechanics and Hydraulics Machines", TATA McGraw Hill.
2. Munson, Young and Okiishi, "Fundamentals of Fluid Mechanics", Wiley India
3. Potter Wiggert, "Fluid Mechanics", Cengage Learning
4. Fox, Pichard, "Introduction to Fluid Mechanics", McDonald- Wiley
5. Modi P. N. and Seth S. M, "Hydraulics and Fluid Mechanics",Standard Book House.
6. Cengel & Cimbla, "Fluid Mechanics",TATA McGraw-Hill
7. F. M. White, "Fluid Mechanics", TATA McGraw-Hill
8. R. K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publication

Reference Books:

1. Kundu, Cohen, Dowling, “Fluid Mechanics”, Elsevier India
2. Chaim Gutfinger David Pnueli, “Fluid Mechanics” Cambridge University press.
3. Edward Shaughnessy, Ira Katz James Schaffer, “Introduction to Fluid Mechanics”, Oxford University Press

e-sources:

https://www.classcentral.com/subject/fluid-mechanics
https://ocw.mit.edu/courses/2-06-fluid-dynamics-spring-2013/
https://www.edx.org/learn/fluid-mechanics

e-Books:

1. Fluid Mechanics by Frank M. White: https://warwick.ac.uk/fac/sci/eng/staff/ymc/members/former/azimi/project/references/white_frank_m._-_fluid_mechanics_4th_ed_mcgraw_hill.pdf
2. Fundamentals of Fluid Mechanics by Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi: https://lib.zu.edu.pk/ebookdata/Engineering/Biomedical%20Engineering/fundamentalsoffluidmechanics6theditionbymunson-130724163620-phpapp01.pdf
3. Fluid Mechanics by Yunus A. Çengel and John M. Cimbala: https://lunyax.wordpress.com/wp-content/uploads/2018/04/fluid-mechanics-fundaments-and-applications.pdf
4. An Introduction to Fluid Dynamics by G.K. Batchelor: https://elmoukrie.com/wp-content/uploads/2022/04/g.-k.-batchelor-an-introduction-to-fluid-dynamics-cambridge-university-press-2000.pdf

MOOC / NPTEL/YouTube Links:

https://nptel.ac.in/courses/112104118
https://onlinecourses.nptel.ac.in/noc25_ce107/preview
https://onlinecourses.swayam2.ac.in/nou25_me12/preview
https://www.youtube.com/watch?v=fa0zHI6nLUo

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : IV			
Course	Fluid Mechanics Lab			Code:	ME25PCC-252		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
1	-	2	-	-	-	25	25

Pre-requisites: Engineering Mechanics (Statics & Dynamics), Calculus & Differential Equations, Basic Measurement Techniques.

Course Objectives: This course aims at enabling students:

1. To verify hydrostatic law and Bernoulli's theorem experimentally.
2. To operate and interpret pressure and flow measuring devices.
3. To identify flow regimes using Reynolds number.
4. To determine friction factor and head losses in pipes.
5. To evaluate floating body stability and measure fluid viscosity.

Course Outcomes: After completion of the course, students will be able to:

CO1: Verify hydrostatic laws and measure fluid viscosity.
CO2: Assess floating body stability via metacentric height.
CO3: Calibrate and use pressure and flow instruments.
CO4: Verify Bernoulli's theorem and identify flow regimes.
CO5: Determine energy losses and friction factors in pipes.

Course Contents

S. No.	Suggested List of Experiments/Assignments
1	Pressure Measurement and Calibration (or Verification of Hydrostatic Law)
2	Verification of Bernoulli's Theorem
3	Determination of Hydraulic Coefficients for an Orifice Meter
4	Determination of Reynolds Number and Demonstration of Flow Regimes
5	Determination of Friction Factor and Head Loss in Pipes (Major Losses)
6	Determination of Head Loss Coefficients for Various Pipe Fittings (Minor Losses)
7	Stability Analysis of a Floating Body (Ship Model) and Determination of Metacentric Height
8	Determination of Kinematic and Dynamic Viscosity using a Redwood Viscometer

Reference Books:

1. Fluid Mechanics by Frank M. White
2. Fundamentals of Fluid Mechanics by Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi

3. Fluid Mechanics by Yunus A. Çengel and John M. Cimbala
4. Fluid Mechanics with Engineering Applications by Robert L. Daugherty, Joseph B. Franzini, and E. John Finnemore

Program	S.Y. B.Tech (Mechanical Engineering)					Semester : IV
Course	Solid Modelling & Drafting Lab			Code		ME25PCC-253
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks		
	Lecture	Practical	Tutorial	PR	OR	TW	Total
1	-	2	-	50	-	25	75

Pre-requisites: Engineering Graphics, Solid Mechanics, Engineering Materials and Metallurgy

Course Objectives: This course aims at enabling students:

1. To introduce solid modeling and CAD principles for industry applications.
2. To create 2D drawings and 3D models of components and assemblies.
3. To read, interpret, and create standard engineering drawings.
4. To apply geometric and dimensional constraints in part modeling.
5. To visualize and simulate mechanical systems using assembly modeling.

Course Outcomes: After completion of the course, students will be able to:

CO1: Apply the tools from cad software's to complete 2d sketches of the mechanical components
CO2: Build a complete 3d model of components by applying different commands and constraints
CO3: Develop a 3d model based on surface parameters
CO4: Conclude on appropriate constraints between different parts of the assemblies for generating the complete model
CO5: Create a complete working drawing of mechanical components/assembly.

Course Contents

S. No.	Suggested List of Experiments/Assignments
1	**2D Sketching with Geometrical & Dimensional Constraints** — Fully constrained profiles; relations and dimensions. **Output:** 6 Fully constrained profiles drawing
2	**Solid Modelling -**including Core features (extrude / revolve / cut / fillet / chamfer / shell /draft/pattern). **Output:** at least 3 parts Production drawing + calculation of mass properties by applying suitable material.
3	**Surface Modelling** Introduction to surface modeling (patch, loft, and sweep), free form surfacing, creation of closed volume. **Output:** Generation of 3D model by using surface parameters Such as product casing design, automotive body panel design etc.
4	Assembly modelling of the Mechanical Product Assembly or assembly parts modelled in Practical assignment-2 using proper assembly constraint conditions and generation of exploded view for assemblies like Couplings, Clutches, Gear Assemblies, Engine/Pump/Turbine Components, Valves, Machine Tools, Automobile Components,

	Gearbox, Pressure Vessels, etc. **Output:** Assembly drawing **Or** Assembly Modelling by importing parts/components from free online resources like CAD and Product development software websites, forums, blogs, etc.
5	Generating views from 3D parts and assemblies, Exploded views, Bill of Materials (BOM), GD&T symbols, Dimensioning **Output:** Generation of 2D working drawings (minimum 2 views) of parts and assembly created in experiment 3 above

Reference Books:

1. Introduction to Solid Modelling Using SolidWorks 2008, Joseph C. Musto and William E. Howard
2. SOLIDWORKS 2016 Basic Tools, Paul Tran.
3. Mechanical Engineering Drawing and Design, S. Pal and M. Bhattacharyya

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : IV			
Course	Kinematics of Machines			Code:	ME25PCC-254		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites : Engineering Mechanics**,** Engineering Graphics**,** Engineering Mathematics

Course Objectives: This course aims at enabling students:

1. To understand motion transmission and geometric relationships among machine components.
2. To analyze displacement, velocity, and acceleration in mechanisms using analytical and graphical methods.
3. To synthesize mechanisms for prescribed motion, path, or function generation.
4. To understand the principles of motion transmission through gears and cams, and to analyze and design gear trains and cam mechanisms used in automotive and robotic systems.

Course Outcomes: After completion of the course, students will be able to:

CO1: Identify and classify mechanisms based on motion, constraints, and degrees of freedom.
CO2: Analyze planar mechanisms using analytical, vector, and graphical approaches.
CO3: Synthesize mechanisms and cams for desired motion characteristics.
CO4: Apply kinematic theory to practical systems such as gears, cam-follower systems, and robot manipulators.

Course Contents

Unit	Description	Duration [Hrs]
I	**Fundamentals of Mechanisms and Motion Analysis** Kinematic link, pair, chain, mechanism, machine, and structure**,** Degree of Freedom (Mobility): Gruebler's and Kutzbach criteria**,** Grashof's law and its implications**,** Inversions of four-bar, slider-crank, and double-slider mechanisms**,** Introduction to compliant and spatial mechanisms**,** Real-life applications (automotive, industrial machinery)	**9**
II	**Velocity and Acceleration Analysis** Analytical approach for planar mechanisms, Graphical approach for planar mechanisms, Coriolis component of acceleration, Klein's construction for slider-crank mechanism, Computer-aided mechanism analysis (MATLAB / Python / CAD-based simulation)	**9**
III	**Synthesis and Design of Mechanisms** Types of synthesis: Type, Number, and Dimensional synthesis, Tasks of kinematic synthesis: Path, Function, and Motion generation, Precision positions and Chebyshev spacing, Graphical and analytical synthesis of four-bar and slider-crank mechanisms, Freudenstein's equation, relative pole method, Introduction to modern synthesis using optimization and software integration, Case study: linkage synthesis in robotic arms and walking mechanisms	**9**

IV	**Kinematics of Gears, Cams, and Robotic Mechanisms** Spur Gear**,** Introduction to Helical Gear, Spiral Gear, Bevel Gear**,** Gear trains: simple, compound, and epicyclic**,** Introduction to Cams and followers**,** Cam profile synthesis for uniform velocity, SHM, and cycloidal motions**,** Case study: gear trains in industrial robots and automotive transmissions	**9**
	Total	**36**

Text Books:

1. Ghosh & A. K. Mallik — Theory of Mechanisms and Machines
2. S. S. Rattan — Theory of Machines
3. J. J. Uicker, G. R. Pennock & J. E. Shigley — Theory of Machines and Mechanisms

Reference Books:

1. K. J. Waldron, G. L. Kinzel & S. K. Agrawal — Kinematics, Dynamics and Design of Machinery
2. R. L. Norton — Kinematics and Dynamics of Machinery
3. Anirvan DasGupta (IIT Kharagpur, NPTEL) — Kinematics of Mechanisms and Machines

MOOC / NPTEL/YouTube Links:

https://onlinecourses.nptel.ac.in/noc25_me46/preview
https://onlinecourses.nptel.ac.in/noc25_me164/preview

Program	S.Y. B.Tech (Mechanical Engineeering)			Semester : IV			
Course	Kinematics of Machines Lab			Code:	ME25PCC-255		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
1		2	-	-	25	-	25

Pre-requisites : Engineering Mechanics**,** Engineering Graphics, Engineering Mathematics

Course Objectives: This course aims at enabling students:

1. To understand and visualize the motion of various planar mechanisms through physical and virtual models.
2. To perform graphical and analytical analysis of velocity and acceleration in mechanisms.
3. To use computational and simulation software for mechanism analysis and synthesis.
4. To study and design motion transmission systems such as cams, gears, and gearboxes using experimental and virtual tools.

Course Outcomes: After completion of the course, students will be able to:

CO1: Identify and model planar mechanisms using physical prototypes.

CO2: Analyze velocity and acceleration of links in mechanisms using graphical and computational methods.

CO3: Apply virtual lab and simulation tools to study the motion characteristics of couplings, cams, and quick return mechanisms.

CO4: Design and synthesize mechanisms and cam profiles using suitable computational or programming tools.

Course Contents

S. No.	Suggested List of Experiments/Assignments (Minimum Eight Experiments/Assignments to be performed)
1	To make a model of any mechanism using waste material by the group of 3-4 students.
2	Design any planar mechanism using software (GEOGEBRA, SAM etc.)
3	Assignment using virtual lab for Oldhams Coupling, Quick return mechanism
4	Determine the velocity and acceleration of links in a four-bar mechanism using graphical approach.
5	Locate instantaneous centres and find velocity of various links in a planar mechanism.
6	Perform velocity and acceleration analysis of a mechanism using computational software.
7	To do a computer programming for synthesis of mechanism
8	To study various types of gearbox.
9	To study and verify cam jump phenomenon

10	To generate a cam profile using computational software (MecAnalyzer, any 3D modelling software)

Reference Books:

1. Ghosh & A. K. Mallik — Theory of Mechanisms and Machines
2. S. S. Rattan — Theory of Machines
3. J. J. Uicker, G. R. Pennock & J. E. Shigley — Theory of Machines and Mechanisms

Program	S.Y. B.Tech (Mechanical Engineering)			Semester : IV			
Course	Applied Thermodynamics			Code:	ME25PCC-256		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites: Fundamental of Thermodynamics**.**

Course Objectives: This course aims at enabling students:

1. To determine COP of refrigeration cycle and study psychometric properties and processes.
2. To study working of engine, fuel-air ratio, air standard cycle and its performance.
3. To understand combustion in SI and CI engines and factors affecting performance parameter.
4. To understand different systems in IC engines and alternative fuels.

Course Outcomes: After completion of the course, students will be able to:

CO1: Determine cop of refrigeration system and analyze psychometric processes.
CO2: Discuss basics of engine terminology, air standard, fuel air and actual cycles.
CO3: Identify factors affecting the combustion performance of S.I. and C.I. engines.
CO4: Explain working of various I.C. engine systems and use of alternative fuels.

Course Contents

Unit	Description	Duration [Hrs]
I	**Basics of Refrigeration and Psychrometry.** **Refrigeration**: Reversed Carnot Cycle, unit of refrigeration, Simple Vapour Compression Cycle (VCC), Refrigerating Effect, Compressor Power & COP. Simple Vapor Absorption Cycle (VAC), Comparison between VCC & VAC. **Psychrometry:** Introduction, Psychrometry and Psychrometric Properties, Basic Terminologies & Psychrometric Relations, Psychrometric Processes, Psychrometric Chart.	8
II	**Introduction to Internal Combustion (IC) Engine.** **IC Engine**: Components and Construction details, Terminology, Classification, Applications, Intake and exhaust system, Valves actuating mechanisms, Valve timing diagram. **Fuel, Air and Actual Cycle**: Air-standard cycles, fuel air cycles, and actual cycles, Effects of variables on performance, various losses, and Comparison of Air standard with Fuel and Actual cycle.	8
III	**SI and CI Engines** **SI Engines:** Theory of Carburetion and Types of Carburetor, Working of Simple Carburetor, Electronic Fuel Injection System, Combustion stages in SI engines, Abnormal Combustion, Theory of Detonation and Parameters affecting detonations, Rating of fuels in SI engines, Combustion Chambers used in SI Engine. **CI Engines:** Fuel Injection system, Construction and Working of Fuel Pump,	7

	Fuel Injector and Various types of Nozzle, Combustion stages in CI engines, Theory of knocking and Parameters affecting knocking, Rating of fuels in CI engines, Combustion Chambers used in CI Engines.	
IV	**Engine Systems and Alternative Fuels.** **Cooling system**: Air Cooling, Liquid cooling, and Lubrication system: Objectives of lubrication system, properties of lubricant, Methods of lubrication system, Ignition system: battery coil ignition system, magneto ignition system, Electronics Ignition (CDI, TCI), Maximum Brake Torque (MBT) & spark advance. Supercharging and Turbo-charging. **Alternative Fuels**: Bio-diesel, Ethanol, LPG, CNG and Hydrogen.	**7**
	Total	**30**

Text Books:

1. Arora C. P., "Refrigeration and Air Conditioning", Tata McGraw-Hill
2. V. Ganesan, "Internal Combustion Engines", Tata McGraw-Hill
3. M. L. Mathur and R.P. Sharma, "A course in Internal combustion engines", Dhanpat Rai & Co.
4. H.N. Gupta, "Fundamentals of Internal Combustion Engines", PHI Learning Pvt. Ltd.

Reference Books:

1. Dossat Ray J, "Principles of refrigeration, S.I. version", Willey Eastern Ltd, 2000
2. Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill
3. Domkundwar & Domkundwar, "Internal Combustion Engine", Dhanpat Rai & Co.
4. R. Yadav, "Internal Combustion Engine", Central Book Depot, Ahmedabad.
5. S.Domkundwar,C.P. Kothandaraman,A.Domkundwar,"Thermal Engineering",DhanpatRai & Co.

e-sources:

MOOC / NPTEL/YouTube Links:

Program	S.Y. B.Tech (Mechanical Engineering)					Semester : IV	
Course	Artificial Intelligence and Machine Learning			Code:		ME25MDM-257	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites : Basic mathematics (algebra, calculus, statistics)**,** Basic programming, Fundamental mechanical engineering knowledge

Course Objectives: This course aims at enabling students:

1. To understand basics of AI/ML, data types, and feature engineering required for mechanical applications.
2. To learn and apply key ML algorithms for regression, classification, and clustering.
3. To develop complete ML models with pre-processing, tuning, and evaluation techniques.
4. To gain fundamental knowledge of deep learning and reinforcement learning for mechanical engineering use-cases.

Course Outcomes: After completion of the course, students will be able to:

CO1: Identify data types and apply suitable feature extraction/selection techniques.
CO2: Implement ML algorithms to solve mechanical engineering problems.
CO3: Build and evaluate ML pipelines using appropriate tuning and validation methods.
CO4: Apply DL and RL techniques to real-world mechanical engineering applications.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to AI/ML & Data/Feature Engineering** Introduction to Artificial Intelligence and Machine Learning; Need of AIML in Mechanical Engineering; Approaches to AI – Cybernetics & brain simulation, Symbolic, Sub-symbolic, Statistical; Categories of ML – Supervised, Unsupervised, Reinforcement; Data types – numerical, categorical, time-series, image, sensor; Dataset elements – features, labels, samples; Issues in data – missing values, noise, outliers; Feature extraction – statistical features, Principal Component Analysis (PCA); Feature selection – ranking methods, decision tree–based feature selection (Entropy, Information Gain with simple numerical examples), exhaustive search **Real World Application:** Feature engineering for tool wear prediction**,** Vibration feature extraction for bearing fault diagnosis.	7
II	**ML Algorithms: Regression, Classification & Clustering** Supervised learning models – Linear Regression (line/plane/hyperplane), Multivariable regression, Polynomial Regression, Regularization (Ridge & Lasso); Classification models – Logistic Regression, Naive Bayes, k-NN, SVM (Linear & RBF), Decision Tree (ID3 with Entropy & IG); Ensemble methods – Random Forest, Bagging, Boosting, Gradient Boosting, XGBoost; Unsupervised learning – K-means clustering, Hierarchical clustering, PCA for	7

	dimensionality reduction; Bias–Variance trade-off; Distance metrics – Euclidean, Manhattan, Minkowski. **Real World Application:** Classification of defective vs. non-defective components**,** Clustering vibration signals for rotating machine health monitoring	
III	**ML Model Development, Tuning & Evaluation** ML pipeline – problem identification (classification, regression, clustering, ranking), data collection and pre-processing (cleaning, encoding, scaling), train–test split, K-fold cross-validation; Model selection and hyper parameter tuning using Grid Search CV and Randomized Search CV; Regularization to avoid overfitting; Bootstrap sampling; Model performance evaluation – Confusion Matrix (TP, FP, TN, FN), Accuracy, Precision, Recall, F1-score, ROC–AUC, Error metrics (MSE, RMSE, MAE); Type-I and Type-II errors and their engineering interpretation; End-to-end ML workflow – dataset → pre-processing → model building → tuning → evaluation → deployment. **Real World Application:** Optimization of machining parameter prediction models, Accuracy evaluation for casting/welding defect classifiers	**8**
IV	**Deep Learning, Reinforcement Learning & Mechanical Applications** Neural Networks – Perceptron, Multi-Layer Neural Networks, activation functions (ReLU, Sigmoid, Tanh, Softmax), loss functions (MSE, Cross-Entropy), Gradient Descent & Gradient Ascent, Batch Normalization, Hyper parameter tuning; Convolutional Neural Networks – convolution, pooling, padding, CNN forward & backward pass, Reinforcement Learning – RL framework, exploration vs. exploitation, Bellman optimality principle, Q-Learning, SARSA, Value-based, Policy-based and Model-based RL; Applications in robotics, digital twins, intelligent manufacturing, CNC optimization and Industry 5.0 environments.	**8**
	Total	**30**

Text Books:

1. Deisenroth, Faisal, Ong, Mathematics for Machine Learning, Cambridge University Press, 2020.
2. B Joshi, Machine Learning and Artificial Intelligence, Springer, 2020.
3. Parag Kulkarni and Prachi Joshi, "Artificial Intelligence – Building Intelligent Systems", PHI learning Pvt. Ltd., ISBN – 978-81-203-5046-5, 2015

Reference Books:

1. Solanki, Kumar, Nayyar, Emerging Trends and Applications of Machine Learning, IGI Global, 2018.
2. Mohri, Rostamizdeh, Talwalkar, Foundations of Machine Learning, MIT Press, 2018.
3. Kumar, Zindani, Davim, Artificial Intelligence in Mechanical and Industrial Engineering, CRC Press, 2021.
4. Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH

MOOC / NPTEL/YouTube Links:

1. http://nptel.ac.in/courses/111101003/
2. https://nptel.ac.in/courses/106/106/106106202/
3. https://nptel.ac.in/courses/112/103/112103280/

Program	S.Y. B.Tech (Open Elective Course-II)			Semester : IV			
Course	Digital Marketing			Code:	CE25OEC-257		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites: General awareness of marketing terms such as target audience, branding, product, pricing, etc.

Course Objectives: This course aims at enabling students:

1. To understand the fundamentals and evolution of digital marketing and its significance compared to traditional marketing.
2. To develop skills in creating digital marketing strategies including PPC, social media, email, mobile, and display advertising.
3. To gain hands-on knowledge of social media marketing, app store optimization (ASO), and search engine optimization (SEO).
4. To apply digital marketing concepts in practical scenarios through case studies and mini-projects.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Explain the fundamentals of digital marketing and differentiate it from traditional marketing.
CO2: Design and implement digital marketing strategies across social media, search engines, and mobile platforms.
CO3: Execute SEO, ASO, and paid advertising campaigns using real-world tools and techniques.
CO4: Develop practical digital marketing outputs such as marketing plans, keyword research sheets, ad campaigns, and social media creatives.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Digital Marketing:** Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, The Digital users in India, Digital marketing Strategy-Consumer Decision journey Digital advertising Market in India, Skills in Digital Marketing, Digital marketing Plan. **Case study**: Launching a Tech Startup's Mobile App —"Smart Budget"	7
II	**Digital Marketing strategy:** **strategy** used in Digital Marketing, PPC and online marketing through social media, Social Media Marketing, Google web-master and analytics overview, Email Marketing, Mobile Marketing Display adverting, Buying Models, different type of ad tools, Display advertising terminology, types of display ads, different ad formats **Case study: Social Media Marketing**	8

	Platforms: Instagram, YouTube Shorts, LinkedIn	
III	**Social Media Marketing** Fundamentals of Social Media Marketing& its significance, Necessity of Social Media Marketing, Facebook Marketing: Facebook for Business, Facebook Insight, Different types of Ad formats, setting up Facebook Advertising Account, Facebook audience & types, Designing Facebook Advertising campaigns, Facebook Avatar, Apps, Live, Hashtags **Case study**: App Store Optimization (ASO)	**8**
IV	**Search Engine Optimization (SEO)** Introduction to SEO, How Search engine works, SEO Phases, History of SEO, How SEO Works, Googlebot (Google Crawler), Types of SEO technique, Keyword Planner tools Social media Reach- Video Creation & Submission, Maintenance- SEO tactics, Google search Engine **Case study: Provide REAL outputs like a mini-project** Marketing plan, Keyword research sheet Google Ads mock screenshot FB Ads audience design Social media creative poster 1 reel script	**7**
	Total	**30**

Text Books:

1. Dave Chaffey & Fiona Ellis-Chadwick, "Digital Marketing", 8th Edition, Pearson, 2022, ISBN: 9781292738086.
2. Rajan Gupta & Supriya Madan, "Digital Marketing", Dreamtech Press, 2023, ISBN: 9789355511522.

Reference Books:

1. Klaus Solberg Søilen, "Digital Marketing", Springer, 2024, ISBN: 9783031695186.
2. Dionne Solomons et al., "eMarketing: The Essential Guide to Marketing in a Digital World", 6th Edition, 2020, ISBN: 9780639707808.

Program	S.Y. B.Tech (Open Elective Course-II)			Semester : IV			
Course	Engineering Economics			Code:		ETC25OEC-257A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites: Basic Knowledge of economics & mathematics.

Course Objectives: This course aims at enabling students:

1. To enable the students to understand the economic theories which may be applied to maximise return and the economic environment in which they have to operate.
2. To introduce fundamental economic principles relevant to engineering analysis and decision-making.
3. To develop the ability to apply time-value-of-money concepts for evaluating engineering alternatives.
4. To Learn cost estimation, depreciation, and break-even analysis for effective financial planning in engineering projects.

Course Outcomes: After completion of the course, students will be able to:

CO1: Identify the core concepts of economics and recognize its potential in addressing modern day socio- economic challenges.

CO2: Compare and analyze alternatives based on present, annual, rate of return, benefit over cost analyses, time value of money in evaluation of investments and projects in real life and the impact of economic factors on feasibility of real life projects.

CO3: Analyze and predict the economic impact of engineering solutions to make financially prudent decisions in everyday life.

CO4: Evaluate the role of economics to give knowledge to the students about various costs for determining the manufacturing of a product.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction** Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand- Price elasticity of Demand, Cross elasticity of Demand, Production - Production Function, Production Process and Factors of Production, Market - Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts, E-commerce.	8
II	**Money- its evaluation and function, Bank** Commercial Bank and Central Bank and brief idea about function of banking system. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, IPR & WTO, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, and Balance of Payment	8

III	**Role of Science, Engineering and Technology in economic Development:** Some of the burning problems of rural and slum areas in India and how engineering and technology may be used to alleviate them, example of Green Revolution and White revolution. Reasons for their success and can we replicate them. Sustainable Development	**7**
IV	**Elementary Economic Analysis; Interest formulas and their Applications:** Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future worth method, Annual equivalent, Internal Rate of return; Evaluating Production Operations, Business Risk Management.	**7**
	Total	**30**

Text Books:

1. A Textbook of Engineering Economics: The Principles and Applications, D. R. Kiran, BS Publications, First Edition, 2021.
2. Engineering Economics Test & Cases, D N Dwivedi, Dr H L Bhatia & Dr. S N Maheshwari, Vikas Publishing House Pvt. Ltd, First Edition -2025.

Reference Books:

1. Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi 2nd edition, Cambridge University.
2. Practical Applications of Engineering Economics, Kal R. Sharma, Momentum Press. Engineering Economics, R. Panneerselvam, PHI Learning Private Ltd.

e-sources:

https://youtu.be/-5q7RB1GWEA

Program	S.Y. B.Tech (Open Elective Course-II)			Semester: IV			
Course	Digital Finance			Code:		ME25OEC-258	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	3	-	-	25	25	50	100

Pre-requisites: Basic Finance and Economics**,** Cyber Security & Digital Payments

Course Objectives: This course aims at enabling students:

1. To understand the evolution of digital finance and the influence of big data on financial systems.
2. To apply digital payment ecosystems and ongoing transformations in digital banking.
3. To understand the core concepts of blockchain, cryptocurrencies, and decentralized finance.
4. To understand the applications of AI, machine learning, and analytics in financial services.

Course Outcomes: After completion of the course, students will be able to:

CO1: Explain the basics of digital finance, big data, and regulatory frameworks.
CO2: Analyze digital payments, FinTech trends, and neo-banking models.
CO3: Illustrate blockchain, cryptocurrencies, and DeFi systems.
CO4: Discuss the role of AI/ML for financial analytics.

Course Contents

Unit	Description	Duration [Hrs]
I	**Digital Finance Fundamentals & Big Data** **Evolution & Fundamentals of Digital Finance:** Evolution of digital finance and the shift from traditional to digital systems. Introduction to FinTech and technological transformations in financial services. Overview of regulatory frameworks and compliance in the digital era. **The Rise of Big Data in Finance:** Role of big data in shaping financial decision-making and risk management. Leveraging data science for personalization and modern financial services **Case Study:** DBS Bank's Digital Transformation	7
II	**Digital Payment Systems & Digital Banking Transformation** **Digital Payment Ecosystems:** Historical evolution and digitalization of payment systems (ECS, RTGS, NEFT, IMPS, UPI, mobile wallets, contactless payments), Attributes of a well-functioning payment system and the role of banks. **Fintech Innovations & Disruption:** FinTech startups, challenger banks, and peer-to-peer lending models, FinTech applications across banking, NBFCs, insurance, lending, audit, and compliance, Regulatory guidelines (e.g., RBI guidelines) and risks associated with new payment models. The Future of Digital Banking: How	7

	traditional banks are adapting and the rise of neo-banks, Digital banking trends and evolving customer expectations **Case Study:** Unified Payments Interface (UPI) in India	
III	**Blockchain, Cryptocurrencies & Decentralized Finance** **Blockchain Technology:** Fundamentals of blockchain and underlying cryptographic techniques, Smart contracts and decentralized finance (DeFi) applications. Cryptocurrencies & Digital Assets: Overview and evolution of cryptocurrencies (Bitcoin, Ethereum, etc.), Central Bank Digital Currencies (CBDCs) and other emerging digital assets. **Advanced Applications & Case Studies:** Impact of blockchain on payments, lending, and financial settlements, Real-world case studies and disruptive potential in global finance **Case study:** The Sand Dollar (Bahamas' CBDC)	**8**
IV	**Artificial Intelligence, Machine Learning in Financial Analytics** **AI & Machine Learning in Finance:** Predictive analytics in stock markets, trading, and algorithmic/high frequency trading, Credit risk analysis and automated decision-making using AI. Data Analytics & Financial Applications: Data sourcing, cleaning, processing, and visualization for financial data, Sentiment analysis and AI-driven portfolio management. **Practical Projects & Case Studies:** Hands-on projects: building stock price prediction models, fraud detection systems, and credit score prediction models, Real-world applications in digital lending and wealth management **Case study:** Thread programming Using Pthreads, POSIX	**8**
	Total	**30**

Text Books:

1. C. Skinner, Digital Finance: Big Data, Startups, and the Future of Financial Services, 1st edition. Hoboken, NJ, USA: Wiley, 2016.
2. J. H. M. T. Jeffry, Introduction to FinTech, 1st edition. Noida, India: Pearson Publications, 2018
3. D. Tapscott and A. Tapscott, The Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World, 1st edition. New York, NY, USA: Penguin Random House, 2016.
4. M. López de Prado, Machine Learning for Asset Managers, 1st edition . Cambridge, UK: Cambridge University Press, 2020.
5. "FinTech: The Impact and Role of Financial Technology" by Parag K. Patel, Wiley publications, 1st edition

Reference Books:

1. R. Ghose, Future Money: Fintech, AI and Web3. London, UK: Kogan Page, 2024.
2. Y. Hilpisch, Artificial Intelligence in Finance: A Python-Based Guide, 1st edition. Sebastopol, CA, USA: O'Reilly Media, 2020.
3. M. López de Prado, Advances in Financial Machine Learning, 1st edition. Hoboken, NJ, USA:

Wiley, 2018.
4. S. Chishti and J. Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs, and Visionaries, 1st edition. Hoboken, NJ, USA: Wiley, 2016.
5. D. Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st edition. Berkeley, CA, USA: Apress, 2017.
6. B. Hines, Digital Finance: Security Tokens and Unlocking the Real Potential of Blockchain, 1st edition. Hoboken, NJ, USA: Wiley, 2020

E- Books:

1. P. H. Beaumont, Digital Finance: Big Data, Start-ups, and the Future of Financial Services, 1st edition. London, U.K.: Routledge, 2019. Link: https://download.e-bookshelf.de/download/0015/1963/23/L G-0015196323-0047264745.pdf
2. N. Urbach and M. Roglinger, Big Data and Artificial Intelligence in Digital Finance, 1st edition. Cham, Switzerland: Springer, 2022 Link: https://library.oapen.org/bitstream/id/fefe46c7-449549ba-bcab-9cf1851e81e6/978-3-030-94590-9.pdf
3. L. Perlman, An Introduction to Digital Financial Services, 1st edition., 2018. Link: https://www.academia.edu

MOOC/NPTEL/YouTube Links:

1. https://www.my-mooc.com/en/mooc/introduction-to-fintech/
2. https://mooc.besideproject.eu/courses/blockchain-use-cases-in-digital-finance/
3. https://www.coursera.org/specializations/digital-transformation-financial-services

Program	S.Y. B.Tech (Value Education Course-II)					Semester : IV	
Course	Indian Constitution			Code:		CE25VEC-258	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	1	-	1	-	-	25	25

Pre-requisites: Knowledge of and Indian history, civics, and societal structure to comprehend constitutional principles and governance frameworks is essential.

Course Objectives: This course aims at enabling students:

1. To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
2. To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. To channelize students' thinking towards basic understanding of the constitutional principles and statutory institutions.
4. To enable students to critically evaluate constitutional provisions and apply them to contemporary social, political, and administrative contexts.

Course Outcomes: After completion of the course, the students will be able to:

CO1: Identify and explore the basic features and modalities about Indian constitution.
CO2: Differentiate and relate the functioning of Indian Parliamentary System at the center and state level.
CO3: Understand the administrative structure of various branches of government.
CO4: Examine different aspects of Indian Legal System and its related bodies.

Course Contents

Unit	Description	Duration [Hrs]
I	**Introduction to Constitution** Meaning & Constitutionalism, Introduction to Constitution: Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and itslegal status, Citizenship. **Case Study :** The Kesavananda Bharati Case (1973) – Basic Structure & Constitutionalism	4
II	**System of Government- Center & State level and local level** Structure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure, and distribution of legislative and financial powers between the Union and the States, local self-government. **Case Study :** S.R. Bommai v. Union of India (1994) – Misuse of President's Rule	4

III	**Government: Union & State** Executive & Legislature, composition, powers and functions, Local Self Governments – Panchayat Raj Institutions & Urban Local Bodies (Municipalities). Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women **Case Study:** Indira Gandhi v. Raj Narain (1975) – Executive Accountability(Powers of Election Commission, Executive accountability, Free & fair elections)	**4**
IV	**Constitution Functions** Indian Federal System and its characteristics, Federal structure & distribution of legislative and financial powers between the Union and the States. Centre & State Relations, President's Rule, Constitutional Amendments and powers, Constitutional Functionaries, Emergency Provisions, Assessment of working of the Parliamentary System in India. **Case Study :** GST & Federal Structure (2017–2023)	**3**
	Total	**15**

Text Books:

1. E 1. Durga Das Basu, ―Introduction to the Constitution of India ―, Prentice Hall of India, New Delhi,24th edition,2020, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, ― Our Constitution: An Introduction to India's Constitution andconstitutional Law‖, NBT, 5th edition, 2014, ISBN-9781107034624

Reference Books:

1. Maciver and Page, ―Society: An Introduction Analysis ―, Laxmi Publications, 4th edition, 2007, ISBN-100333916166
2. PM Bhakshi, ―The constitution of India‖, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition,2017, ISBN-108131262375
3. Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi.
4. Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press.

e-Books:

1. The full text of the Constitution of India (latest version) — available for download in English (and other Indian languages). Legislative Dashboard+2legislative.gov.in+2
2. Updated 2024 edition (English + Hindi Diglot) — PDF version. S3WaaS
3. Official publication with all amendments (as on May 2022) — PDF version. S3WaaS
4. A simple introductory book: The Constitution of India — An Introduction (by NCERT) — which gives a good basic overview. NCERT

MOOC / NPTEL/YouTube Links:

1. Constitution Law and Public Administration in India (NPTEL-NOC, IIT Madras) — comprehensive course covering constitutional law + public admonition. https://onlinecourses.nptel.ac.in/noc20_lw03/preview
2. Playlist on YouTube: "Constitutional Studies" (NPTEL) — lectures by law professors covering fundamentals, history, structure, rights etc. https://www.youtube.com/playlist?app=desktop&list=PLyqSpQzTE6MZj2GBVpJ3c7cfvMTcKrPL&utm_

source=chatgpt.com

Program	S.Y. B.Tech (Value Education Course-II)			Semester: IV			
Course	Environmental Science			Code	AIDS25VEC-258		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	1	-	1	-	-	25	25

Pre-requisites: Prior Knowledge of Multidisciplinary nature of environmental studies; components of environment — atmosphere, hydrosphere, lithosphere and biosphere is essential.

Course Objectives: This course aims at enabling students:

1. To gain an understanding of the Environment where we live
2. To comprehend the importance of water
3. To educate about Air and Noise pollution
4. To explain the concepts of E- waste and Green Computing

Course Outcomes: After completion of the course, students will be able to:

CO1: Analyze the impacts of different types of environmental pollution on ecosystems and physical resources.

CO2: Describe the sources and effects of water, air, and noise pollution on human health and the environment.

CO3: Identify sources and types of e-waste and analyze basic e-waste management practices.

CO4: Apply green computing principles to promote environmental sustainability and reduce ecological impact.

	Course Contents	
Unit	Description	Duration [Hrs]
I	**Environmental pollution** Environmental pollution: Environment and its importance, Definition, Types. Effect of environmental pollution on Plants, Non-living things.	3

II	**Water Pollution** Water Pollution: Definition, Sources of water Pollution, Types of waste water-Domestic and industrial waste water	4
III	**Air pollution** Air pollution: Definition, Sources/causes of air pollution. Atmospheric layers, Effects on human. Noise Pollution: Definition of Noise Pollution, Types of Noise Pollution.	4
IV	**E-waste management** E-waste management: Definition of E-waste, Sources of E-waste, Types of E-waste Green computing: Definition, Objectives of Green Computing, Necessity, Environmental benefits	4
	Total	15

Tutorial Conduction and Term work Guidelines (Set of Suggested Activities)

1	Report/Presentation on the effect of Environmental Pollution on any world famous Structure/ monument.
2	Report/Presentation on importance of different sources of water available nearby them.
3	Report/Presentation based on the data collected from the local authorities on air pollution and noise pollution.
4	Report/Presentation on the E-Waste generated in the campus.
5	Time-series analysis of natural resource consumption of a given country using publicly available data

Text Books:

1. 'Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. 5th edition (1 July 1998) WCB, McGraw Hill.
2. "The text book of Environmental studies", Dr. P. D. Raut, Shivaji University, 2013.
3. "A Text Book of Environmental Studies", Dr. D. K. Asthana, S. Chand.
4. "Environmental Pollution, monitoring and control", S. M. Khopkar, New Age Publication.

Reference Books

1. Bharucha, E., ―Textbook of Environmental Studies‖, Universities Press (2005), ISBN-10:8173715408
2. Mahua Basu, ―Environmental Studies‖, Cambridge University Press, ISBN-978-1-107-5317-3

Online Sources:

1. https://onlineethics.org/cases/life-and-environmental-science-ethics-case-studies

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Program	S.Y. B.Tech (Mechanical Engineering)			Semester: IV			
Course	Community Engagement Project			Code:	ME25ELC-260		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	4	-	-	50	-	50

Pre-requisites: Basic understanding of social and ethical responsibilities, Teamwork and communication skills acquired in prior coursework or group activities, Familiarity with problem-solving methodologies and project planning, Conversation in local language

Course Objectives: This course aims at enabling students:

1. To Establish a mutually beneficial relationship between the college and the community
2. To engage with their local community, fostering empathy, teamwork, and problem solving skills while contributing positively to their surroundings.
3. To understand the challenges faced by the local community and the role of engineering in addressing those challenges.
4. To apply technical knowledge and skills to design solutions or interventions that creates a positive impact on the community.
5. To evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

Course Outcomes: After completion of the course, students will be able to:

CO1: Identify and analyze local community needs and challenges by engaging with stakeholders and evaluating real-world problems.

CO2: Design and implement practical, creative, and context-specific solutions using engineering principles to address community issues.

CO3: Reflect and evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.

Course Contents

• A group of 3 to 4 students or a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.

• Each group is allotted to a faculty member of the department as a mentor.

• The group of students will be associated with a government official / village authority /NGOs etc. concerned, allotted by the district administration, during the duration of the project.

• The Community Engagement Project should be different from the regular programmes of NSS/NCC/Green Club/Hobby Clubs, Special Interests Groups etc

• An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor/HoD.

• Project report shall be submitted by each student/group of students.

• An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be

done based on the active participation of the student and marks could be awarded by the mentor/HoD.
• Students groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e-waste management or any other activity in an area of their studies and as per his/her aptitude

Suggestive list of topics under Community Engagement Project

The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. It is expected that the focus should be on specific local issues in their nearby areas. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall

1. Use/ miss-use of cell phones
2. Career orientation of youth
3. Water facilities and drinking water availability
4. Health and hygiene of the school going students, home makers and old personals
5. Health intervention and awareness programmes
6. Horticulture
7. Herbal and Nutrition
8. Traditional and Modern health care methods
9. Food habits
10. Air/Sound/Water pollution
11. Plantation and Soil protection
12. Renewable energy and Solar Systems
13. Yoga awareness and practice
14. Health care awareness programmes and their impact
15. Organic farming
16. Food adulteration
17. Incidence of Diabetes and other chronic diseases
18. Blood groups and blood levels
19. Chemicals in daily life
20. Music and dance
21. Women education and empowerment etc.

Project Scope

• Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
• Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
• Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
• Promote health through awareness programs on hygiene, nutrition, and exercise.
• Teach basic computer or technical skills to students, staff, or the community

Proposal Submission

CEP Group should Submit a two-page project proposal, preferably prior to the term commencement outlining the following: -

• Title of the project
• Aim, Objective and expected outcome
• Plan of execution (timeline and activities).
• Place of the CEP and involvement of any local authority, NGP

• Required resources (if any).
• Get approval from the designated faculty mentor.

Text Books:

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.
3. Design Thinking for Social Innovation. IDEO Press, 2015.
4. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

Reference Books:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice all of India, New Delhi, 2004.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Wadsworth Thompson Learning, United States, 2000.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

e-sources:

MOOC / NPTEL/YouTube Links:

1. NPTEL course: Ecology and Society, https://onlinecourses.nptel.ac.in/noc20_hs77/preview
2. UNESCO: Education for Sustainable Development https://www.unesco.org
3. EPICS (Engineering Projects in Community Service) https://engineering.purdue.edu/EPICS
4. Ashoka: Innovators for the Public https://www.ashoka.org
5. Design for Change https://www.dfcworld.com

Program	S.Y. B.Tech (Entrepreneurship Management Course)				Semester : IV		
Course	Entrepreneurship Skill Development				Code:	IL25EMC-260	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Pre-requisites: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives: This course aims at enabling students:

1. To introduce the fundamental principles of entrepreneurship, forms of business organizations, and the start-up ecosystem.
2. To enable students to identify, evaluate, and select viable business opportunities using structured techniques.
3. To familiarize students with business models, financial planning, and market validation strategies.
4. To expose students to key marketing strategies, customer acquisition techniques, and branding essentials for start-ups
5. To develop students' entrepreneurial mind-set and their ability to communicate and pitch business ideas effectively using structured storytelling techniques

Course Outcomes: After completion of course, the students will be able to:

CO1: Describe the role of entrepreneurship in economic growth and the startup ecosystem.
CO2: Apply creative techniques to viable business ideas based on customer needs.
CO3: Develop a basic business model using tools like the Business Model Canvas through market research.
CO4: Implement basic marketing strategies for start-ups.
CO5: Deliver a concise business pitch using storytelling and effective communication techniques.

	Detailed Syllabus	
Unit	Description	Duration [Hrs]
I	**Introduction to Entrepreneurship** Entrepreneurship: Definition and evolution, Role of entrepreneurship in economic development, Role in job creation, GDP, and innovation. Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience. Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Intrapreneurship (corporate entrepreneurship), Lifestyle and small business	3

	entrepreneurship, Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited. Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking. Overview of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems	
II	**Idea Generation & Opportunity Recognition** Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneur- ship. Brainstorming: Rules of effective brainstorming. Individual vs. group brainstorming. Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping. Understanding Customer Needs and Pain Points: Customer pain points and their identification, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user inter- views, and empathy mapping. Evaluating Opportunities: Difference between an "idea" and an "opportunity." Basic filters: Desir- ability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends, market gaps.	**3**
III	**Business Model Development** Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups. Key Components of BMC: Value Proposition: Defining what unique value the product/service of- fers. Addressing customer pain points. Customer Segments: Identifying target customers. Creating customer personas Revenue Models: Direct sales, subscriptions, freemium, licensing, etc. Basic Market Research for Validation: Importance of market research in early-stage business de- velopment. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops.	**3**
IV	**Customer Acquisition , Pitching & Funding Sources** Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and content optimization, On-page vs. off-page SEO Importance of Digital Presence – Website essentials, blogs, and analytics tools. Customer Acquisition Strategies: Understanding the Customer Journey – Awareness, interest, de- cision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer mar- keting (micro-influencers), Email marketing basics, building a landing page and collecting lead. Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value propo- sition, target audience, Delivery tips: Clarity, brevity, confidence Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks, Angel investors: Role, expectations, approach, Brief on incubators, government schemes, crowdfunding.	**6**
	Total	**15**

Practical's/ Assignments			
Sl. No.	**Title**	**Objective**	**Description**
1	Entrepreneurial Mindset Reflection	To encourage students to explore their personal views on entrepreneurship and recognize the key characteristics of an entrepreneurial mindset by studying the journey of a real-world entrepreneur.	**Write a reflective essay** (500–600 words) based on the following: • Explain what entrepreneurship means to you personally. • Identify an entrepreneur (Indian or global) whom you admire and explain the reasons for your admiration. • Highlight specific mindset traits (e.g., risk-taking, resilience, innovation, adaptability) that contributed to this entrepreneur's success. • Reflect on how these traits align with your own strengths or indicate areas you wish to develop.
2	Idea Generation Challenge	To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.	**Generate 10 Business Ideas** Use any structured brainstorming technique Ideas can be tech-based, social impact, service-based, or product-based 2. Select One Idea- Choose the most promising idea from your list 3. Write a 1-page Concept Summary, include the following: • Problem Identified: Describe the specific problem or pain point your idea addresses. • Solution Overview: Briefly describe your business idea. • Target Audience: Identify the group of people or organizations that would benefit. • Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students develop a clear, structured business model and test its assumptions through customer	**Part A: Business Model Canvas** 1. Choose a business idea (from Assignment 2 or a new one). 2. Create a Business Model Canvas

		conversations. The goal is to learn how to validate ideas through real-world feedback and refine the business concept accordingly.	with all 9 key blocks: o Customer Segments o Value Propositions o Channels o Customer Relationships o Revenue Streams o Key Resources o Key Activities o Key Partnerships o Cost Structure 3. Present the BMC in visual or tabular format. **Part B: Customer Interviews & Insights** 1. Identify 2–3 potential customers from your target segment. 2. Conduct brief interviews (5–10 minutes each) to gather insights on: o Their pain points o Their reaction to your proposed solution o Willingness to pay or use your product/service 3. Summarize findings in a 1–1.5 page report that includes: o Key customer quotes or paraphrased insights o A revised Value Proposition or Customer Segment block (if needed) 4. A short reflection: key learnings and potential changes to your idea.

4	Business Launch Plan – Marketing & Financial Snapshot	To develop a practical understanding of how marketing stratey and financial planning go hand-in-hand in launching a startup. Students will define a basic marketing campaign and align it with estimated costs, pricing, and projected revenue	You are preparing to launch your business idea. Prepare a combined Marketing and Financial Snapshot including the following **Part A: Marketing Campaign Plan** • Define your target market by identifying primary customers. • Design a mini-campaign using one or more of the following channels: Social media (e.g., Instagram, LinkedIn) Print/digital flyers Email marketing • Describe the campaign content, including the message or offer to be promoted. Optionally, create 1–2 sample marketing materials. Write a 300-word explanation outlining your marketing strategy and expected impact. **Part B: Financial Snapshot** 1. Startup Costs – Estimate your initial costs (fixed + variable) 2. Pricing Strategy – State your pricing model and justification Break-even Analysis – Basic cost vs. sales estimate 4. 6-Month Revenue Projection – Expected sales and income Format: Use a simple table or spreadsheet (optional)
5	Elevator Pitch Video	To help students develop confidence and clarity in presenting their business idea in a short, compelling format. The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly.	**Prepare a 90-second elevator pitch for your** **business idea** (the same or refined idea used in earlier assignments). Your pitch should cover the following elements: The Problem – Problem Identification The Solution – Description of your product/service. Value Proposition – The unique value

			proposition. Target Audience – Audience for your idea. o Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** o Record a video and submit it with written version of your pitch. o Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** o Share what you learned about communicating your idea Describe challenges or rewards you experienced in the process

Text Books:

1. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.
2. Drucker, Peter F. Innovation and Entrepreneurship: Practice and Principles, Reprint Edition, Harper Business, 2006. ISBN: 9780060851132.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

Reference Books

1. Ries, Eric. The Lean Startup: How today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything, Portfolio (Penguin Random House), 2015. ISBN: 9781591847847.

MOOC/NPTEL/YouTube Links:

e-sources:

1. https://onlinecourses.nptel.ac.in/noc20_ge08/preview
2. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc20_mg35
4. https://www.coursera.org/learn/entrepreneur-guide-beginners
5. https://wadhwanifoundation.org/
6. https://www.youtube.com/@wadhwani-foundation/videos

Program	S.Y. B.Tech (Ability Enhancement Course)			Semester : IV			
Course	Modern Indian Language (Marathi)			Code:	IE25AEC-261		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	1	2	-	-	-	25	25

अभ्यासक्रमाची उद्दिष्टे :

१. प्रात भौषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमांतिल संज्ञापनातिल स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्व विकास आणि भाषा यांतील सहसंबंध स्पष्ट करणे.
४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.

अभ्यासक्रम परिणाम (COs)

अभ्यासक्रम यशस्वीपणे पूर्ण केल्यानंतर विद्यार्थी खालील परिणाम साध्य करू शकतील:

CO1: शैक्षणिक व व्यावसायिक वातावरणात प्रातभाषिक संवाद कौशल्ये प्रभावीपणे प्रदर्शित करणे.
CO2: प्रसारमाध्यमांच्या संज्ञापनातील रचना, भूमिका आणि महत्त्व स्पष्टपणे समजावून सांगणे.
CO3: व्यक्तिमत्व विकास आणि भाषाज्ञान यांतील परस्पर संबंधांचे विश्लेषण करणे.
CO4: लोकशाहीतील जीवनशैली व प्रसारमाध्यमे यांच्यातील परस्पर संबंधांचे मूल्यांकन करणे.
CO5: विविध प्रसारमाध्यमांसाठी अचूक, संरचित आणि प्रभावी लेखन तयार करणे.

Course Contents

Unit	Description	Duration [Hrs]
१.	भाषा आणि व्यक्तिमत्व विकास : सहसंबंध लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे	७
२.	**प्रसारमाध्यमांसाठी लेखन** वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितसंपादन नभोवाणीासाठी भाषणाची संहितालेखन दूरचित्रवाणीासाठी माहितीपटासाठी संहितालेखन	७
३.	भाषा, जीवन व्यवहार आणि नवमाध्यमे, सामाजिक माध्यमे नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम	७
४.	वेबसाइट आणि ब्लॉग, ट्विटरासाठी लेखन व्यावसायिक पत्रव्यवहार	७
	Total	२८

संदर्भ ग्रंथ :

१. सायबर संस्कृती, डॉ. रमेश वसखेडे
२. उपयोगित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेंगई, सुजाता शेंगई
३. ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ'लिरी
४. संगणक, अच्युत गोडबोले, मोज प्रकाशन, मुंबई

५. इंटरनेट, डॉ. प्रभोध चौबे, मनोरमा प्रकाशन, मुंबई
६. व्यावहारिक मराठी, डॉ. ल. रा. नसराबादकर, फडके प्रकाशन, कोल्हापूर
७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्षापूंकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे

Course Contents

Sl. No.	Suggested List of Experiments/Assignments
1	Read a specific column (Sports, political, finance, editorial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal. "दैनिक मराठी वर्तमानपत्रांमध्ये विशिष्ट कॉलम (क्रीडा, राजकीय, वित्त, संपादकीय, शिक्षण, आंतरराष्ट्रीय बातम्या इ.) वाचा, सारांश द्या आणि व सादरीकरण करा. त्या संदर्भातील सगळा सारांश जर्नल मध्ये जमा करावा."
2	Write blogs and posts on social media up to 200 words on recent development in their field of study. "सोशल मीडियावर त्यांच्या अभ्यासाच्या क्षेत्रातील अलीकडील विकासावर 200 शब्दांपर्यंत ब्लॉग लिहा, आणि पोस्ट करावा"
3	Professional letter / report writing. a. Write letter to the principal for organizing NSS camp in nearby village. Preparation of the budget, permission letters and report submission in the University "जवळच्या गावात एनएसएस शिबिर आयोजित करण्यासाठी मुख्याध्यापकांना पत्र लिहा. विद्यापीठात बजेट, परवानगी पत्रे आणि अहवाल सादर करणे." b.Write a letter for internship sponsorship to any organization. कोणत्याही संस्थेला इंटर्नशिप प्रायोजकत्वासाठी पत्र लिहा."
4	Book Review – Students are expected to read any novel, fiction or literature book of their choice and write a review on post it on social media of their choice. "पुस्तक पुनरावलोकन - विद्यार्थ्यांनी त्यांच्या आवडीचे कोणतेही कादंबरी, काल्पनिक कथा किंवा साहित्य पुस्तक वाचावे आणि त्यावर पुनरावलोकन लिहून ते त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावे अशी अपेक्षा आहे."
5	Participation in Competitions (in college/outside the college) debate, declamation, elocution – A Report should be submitted स्पर्धेमध्ये (महाविद्यालयात/महाविद्यालयाबाहेर) सहभाग वादविवाद, भाषण, वक्तृत्व – अहवाल सादर करावा.
6	Group Activity: Road show, skit play, one-act play गट क्रियाकलाप : रोड शो, स्किट प्ले, एकांकिका
7	Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak. पुष्कोतम करंडक, फिरोदिया करंडक, दाजीकाका गाडगीळ करंडक आणि श्रीतेज करंडक या स्पर्धेमध्ये सहभाग नोंदवावा.
8	Marathi film Review – Social Marathi movie available and write a review on post it on social media of their choice. मराठी चित्रपट पुनरावलोकन – सामाजिक आशयावर आधारित मराठी चित्रपट उपलब्ध आहे आणि त्या चित्रपटाची समीक्षा करून त्यावर सारांश लिहावा व तो वर्तमानपत्रे किंवा सोशल मीडियावर पोस्ट करावा पसंतीच्या सोशल मीडियावर पोस्ट करा.

संदर्भ ग्रंथ :

१. सायबर संस्कृती, डॉ. रमेश वसखेडे
२. उपयोगित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेंगई, सुजाता शेंगई
३. ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ'लिरी
४. संगणक, अच्युत गोडबोले, मोज प्रकाशन, मुंबई
५. इंटरनेट, डॉ. प्रभोध चौबे, मनोरमा प्रकाशन, मुंबई
६. व्यावहारिक मराठी, डॉ. ल. रा. नसराबादकर, फडके प्रकाशन, कोल्हापूर
७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्षापूंकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे