D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25 affiliated to

Savitribai Phule Pune University

Curriculum Structure and Syllabus of

Second Year Mechanical Engineering (2024 Pattern)

National Education Policy (NEP) based Curriculum

R1: 20 March 2025

Preface

D Y Patil College of Engineering, Akurdi, Pune (DYPCOE) has been recognized for providing quality education in Maharashtra for the past 40 years. With a commitment to academic excellence and a vision for the future, DYPCOE is now boarding a new journey towards Autonomy, in line with the latest educational reforms. The Institute is dedicated to the effective implementation of the New Education Policy (NEP) 2020, as per the guidelines by the Government of Maharashtra. This initiative is aimed at fostering the holistic development of our students, ensuring they are well-equipped to meet the challenges of the 21st century.

The present syllabus details the second-year mechanical engineering (SY B Tech) syllabus, meticulously designed to align with the NEP 2020 and effective from the academic year 2024-25. The curriculum is structured to provide a robust foundation through a total of six program core courses on mechanical design engineering, thermal engineering and manufacturing engineering domains along with two open elective courses on different advanced topics from the applied and interdisciplinary domains of mechanical engineering. It also integrates two Entrepreneurship/Economics/ Management related courses, Vocational and Skill Enhancement Courses, Value Education Courses, Ability Enhancement Courses, Community Engagement Course, and co-curricular non-credit courses. This comprehensive approach aims to cultivate well-rounded engineers who are adaptable to Internationalization.

One of the key highlights of this syllabus is its emphasis on Experiential Learning and hands- on experience. By integrating theoretical knowledge with practical laboratory sessions, we aim to enhance the learning process and foster a deeper understanding of core concepts. Additionally, the curriculum promotes research and innovation by encouraging students to engage in project-based learning.

The development of this curriculum has been a collaborative effort, and we owe a debt of gratitude to all those who have contributed to its creation. Our sincere thanks go to the Management, Steering Committee Members, Head of Department, and the Board of Studies chairperson and members for their invaluable input and dedication. Their collective expertise and commitment have been instrumental in shaping this curriculum.

We are confident that this new curriculum will pave the way for our students to achieve academic excellence and holistic development, preparing them to thrive in an ever-evolving global landscape.

Dr. Mrs. P. Malathi

Principal

Abbreviations and Definitions

NEP: National Education Policy

PEO: Program Educational Objectives

PO: Program Outcomes

PSO: Program Specific Outcomes

CO: Course Outcomes

BSC: Basic Science Courses

ESC: Engineering Science Courses

VSEC: Vocational and Skill Enhancement Courses

AEC: Ability Enhancement Courses

CC: Co-Curricular Courses

IKS: Indian Knowledge System

HSSM: Humanities Social Science and Management

PCC: Program Core Course

ISE: In Sem Examination

MSE: Mid Sem Examination

ESE: End Sem Examination

Cr: Credits

L: Lecture

T: Tutorial

P: Practical

FY: First Year
SY: Second Year
TY: Third Year
BY: Final Year

Group A: Computer, IT and AIDS
Group B: ETC, Instrumentation and Robotics and Automation,
Group C: Civil and Mechanical

Group I: Civil, Mech, Robotics and Automation
Group II: Computer, IT, AIDS, ETC, Instrumentation

Cycle I: Computer, IT and AIDS
Cycle II: Civil, Mech, Robotics and Automation, ETC, Instrumentation

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Detailed Syllabus

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D Y Patil College of Engineering, Akurdi, Pune														
Department of Mechanical Engineering														
Second Year Engineering SY B Tech Semester III (2024 Course)														
Course Code	**Course**	**Teaching Scheme**				**Evaluation Scheme**								
		L	**T**	**P**	**Cr**	**Exam**	**Theory % Marks**			**Practical % Marks**				
							Max	**Min for Pass**		**Max**	**Min for Pass**			
ME124PC301	Program Core Course 2 Engineering Thermodynamics	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
ME124PC302	Program Core Course 2 Lab Engineering Thermodynamics Lab	0	0	2	1	CCE				50	20	40		
						ESE				50	20			
ME124PC303	Program Core Course 3 Solid Mechanics	3	0	0	3	CCE	50	20	40					
						ESE	50	40						
ME124PC304	Program Core Course 4 Computational Mathematics for Mechanical Engineering	2	1	0	3	CCE	50	20	40					
						ESE	50	20						
ME124MD305	Multidisciplinary Minor 1 Electric Vehicle Technologies	2	0	0	2	CCE	50	40	40					
						ESE	50	40						
ME124OE306	Open Elective 1 Logistics and Supply Chain Management	4	0	0	4	CCE	50	20	40					
						ESE	50	20						
ME124EE307	Entrepreneurship/Economics, Management Course 1 Concepts in Technology Entrepreneurship	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
ME124VE308	Value Education Course 1 Sustainable Development 1	2	0	0	2	CCE	50	20						
ME124FP309	Field Engineering Project Rural Technology Development	0	0	4	2	CCE	100	40						
ME124NC310	Non-Credit Course 1 Design Thinking	1	0	0	0	CCE	50	20	20					
ME124NC311	Non-Credit Course 1 Lab Design Thinking Lab	0	0	2	0	CCE				50	20	20		
ME124NC312	Non-Credit Course 2 Professional and Technical Communication 1	0	0	2	0	CCE	50	20						
	Total	**19**	**1**	**10**	**22**									
				Hrs										
L	Lecture	**Theory**		**20**										
T	Tutorial	**Pract/ Lab**		**10**										
P	Practical	**Total**		**30**										
Cr	Credits													
NC	Non Credit Course (Pass/Fail)													
CCE	Continuous and Comprehensive Evaluation													
ESE	End Semester Examination													

D Y Patil College of Engineering, Akurdi, Pune															
Department of Mechanical Engineering															
Second Year Engineering SY B Tech Semester IV(2024 Course)															
Course Code	**Course**	**Teaching Scheme**				**Evaluation Scheme**									
		L	**T**	**P**	**Cr**	**Exam**	**Theory % Marks**			**Practical % Marks**					
							Max	**Min for Pass**		**Max**	**Min for Pass**				
ME124PC401	Program Core Course 5 Automobile Energy Technology	3	0	0	3	CCE	50	20	40						
						ESE	50	20							
ME124PC402	Program Core Course 5 Lab Automobile Energy Technology Lab	0	0	2	1	CCE				50	20	40			
						ESE				50	20				
ME124PC403	Program Core Course 6 Engineering Materials, Metallurgy	2	0	0	2	CCE	50	20	40						
						ESE	50	20							
ME124PC404	Program Core Course 6 Lab Engineering Materials, Metallurgy Lab	0	0	2	1	CCE				50	20	40			
						ESE				50	20				
ME124PC405	Program Core Course 7 Kinematics of Mechanisms & Machines	2	1	0	3	CCE	50	20	40						
						ESE	50	20							
ME124MD406	Multidisciplinary Minor 2 Energy Storage and Control Strategies in Electric Vehicles	2	0	0	2	CCE	50	20	40						
						ESE	50	20							
ME124OE407	Open Elective 2 Corporate Social Responsibility	2	0	0	2	CCE	50	20	40						
						ESE	50	20							
ME124VS408	Vocational and Skill Enhancement Course 3 Manufacturing Practices	1	0	0	1	CCE	50	20	20						
ME124VS409	Vocational and Skill Enhancement Course 3 Lab Manufacturing Practices Lab	0	0	2	1	CCE				50	20	20			
ME124AE410	Ability Enhancement Course 2 Soft Skills: Workplace and Life Readiness	1	0	2	2	CCE	100	40							
ME124EE411	Entreprenureship/Economics and Management 2 Entrepreneurial Value Creation	2	0	0	2	CCE	50	20	40						
						ESE	50	20							
ME124VC412	Value Education Course 2 Sustainable Development 2	2	0	0	2	CCE	50	20							
ME124NC413	Non Credit Course 3 NPTEL Course - Yoga and Positive Psychology for Managing Career and Life	0	0	2	0	CCE	50	20							
ME124NC414	Non Credit Course 4 Professional and Technical Communication 2	0	0	2	0	CCE	50	20							
	Total	**18**	**0**	**12**	**22**										
				Hrs											
L	Lecture	**Theory**		**18**		NC	Non Credit Course (Pass/Fail)								
T	Tutorial	**Pract/Lab**		**12**		CCE	Continuous and Comprehensive Evaluation								
P	Practical	**Total**		**30**		ESE	End Semester Examination								
Cr	Credits														

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B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Course Code: ME124PC301, Course Title: Engineering Thermodynamics (Group C)

Category: Program Core Course 2

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
3	0	0	3	CCE	50	20	40	-	-
Total Hours									
39	0	0	Total: 39	ESE	50	20			

Prerequisites: BSC2401L03 Engineering Physics, BSC2401P07 Engineering Physics Lab, BSC2402L06 Engineering Chemistry, BSC2402P08 Engineering Chemistry Lab

Course Objectives: Purposes of the course are

1. **Understand** fundamental principles and first law of thermodynamics, focusing on heat and work interactions in engineering systems.
2. **Apply** ideal gas equation and second laws of thermodynamics for steady flow and non-flow processes.
3. **Develop** a thorough understanding of entropy and Knowledge of Fuel Combustion.
4. **Evaluate** the thermodynamic properties of steam and performance of vapor power cycles.
5. **Understand** the functions of Boiler Mountings and Accessories and calculations of Boiler Draughts

Course Outcomes: After successful completion of the course units the student will

CO	CO Statement	BTL
CO1	**APPRAISE** the basics of thermodynamics with heat and work interactions under different thermodynamic processes.	4
CO2	**IMPLEMENT** ideal gas equations and second laws of thermodynamics to flow and non-flow processes.	3
CO3	**APPLY** entropy for an Open and Closed System and **Analysis** of Combustion of Fuels.	3
CO4	**EVALUATE** the properties of steam and vapor power cycle using steam tables and Mollier diagrams.	4
CO5	**APPLICATION** of boiler mountings and accessories and Calculation of boiler draughts.	3

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern
Syllabus

Unit I	**Fundamentals of Thermodynamics & First Law**	**9 hrs**

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, quasistatic process, Equilibrium. **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.

Unit II	**Ideal Gas and Second law of Thermodynamics**	**8 hrs**

Properties and Processes of Ideal Gas: Ideal Gas definition, Gas Laws: Boyle's law, Charle's law, Avogadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas Processes- on P-v and T-s diagrams, Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes (Open and Closed systems), Calculations of Heat transfer, Work done, Internal Energy.

Second Law of Thermodynamics: Limitations of first law of thermodynamics, Thermal reservoir, Heat Engine, Refrigerator and Heat pump: Schematic representation, Efficiency and Coefficient of Performance (COP), Kelvin-Planck & Clausius Statement of the Second law of Thermodynamics; PMM-II kind, Equivalence of the two statements.

Unit III	**Entropy and Fuel Combustion**	**6 hrs**

Entropy: Entropy as a property, Clausius Inequality, Principle of increase of Entropy Principle, Entropy changes for an Open and Closed System, Change of Entropy for an ideal gas and Pure Substance, Concept of Entropy generation. Entropy - a measure of Disorder.

Fuel Combustion : Types of fuels, 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,

Unit IV	**Properties of Pure substances & Thermodynamics of Vapour Cycle**	**8 hrs**

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.

Thermodynamics of Vapor 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.

Unit V	**Steam Generators and Boiler Draught**	**8 hrs**

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, 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.

Reference Books

Textbook:

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”, JohnWiley & Sons
4. Holman J.P, “Thermodynamics”, McGraw Hill
5. M Achuthan, “Engineering Thermodynamics”, PHI
6. Steam Tables/Data book.

Research Paper

1. Mehdi, S., & Tiwary, P. (2024). Thermodynamics-inspired explanations of artificial intelligence. *Nature Communications*, *15*(1), 7859.
2. Xamroyevna, M. B. (2024). THERMODYNAMICS OF LIVING SYSTEMS. *Multidisciplinary Journal of Science and Technology*, *4*(3), 303-308.
3. Chen, X., Xie, X., Ruan, P., Liang, S., Wong, W. Y., & Fang, G. (2024). Thermodynamics and kinetics of conversion reaction in zinc batteries. *ACS Energy Letters*, *9*(5), 2037-2056.

MOOCS

A Course on Energy Conscious Engineering

https://energyconsciousengineering.vercel.app/.

Vlab

1. https://vmt-iitg.vlabs.ac.in/Separating_and_Throttling_Calorimeter(theory).html
2. https://vmt-iitg.vlabs.ac.in/Water_cooling_tower(theory).html

NPTEL/SWAYAM

1. https://onlinecourses.nptel.ac.in/noc23_me65/preview.
2. https://es-pal.org/eltdashboard. ENERGY LITERACY TRAINING BY ENERGY SWARAJ FOUNDATION POWERED BY IITB.
3. NPTEL Course(s) applicable for credit transfer as per Institute Policy

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

For Theory CCE and ESE

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			
End Semester Examination (ESE)	**Institute**	**10**	**10**	**10**	**10**	**10**	**50**	**20**

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	2	3	3	3	3	2	3	2	2
CO2	3	2	2	3	3	2	3	3	3	3	2	3	2	2
CO3	3	2	2	2	3	2	3	3	3	3	2	3	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping

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B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Course Code: ME124PC302, Course Title: Engineering Thermodynamics Lab (Group C)

Category: Program Core Course 2 Lab

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max %	Min marks for Pass		Max %	Min marks for Pass
0	0	13	1	CCE	–	–		50	20
Total Hours									
0	0	26	Total: 26	ESE	–	–		50	20

Prerequisites: BSC2401L03 Engineering Physics, BSC2401P07 Engineering Physics Lab, BSC2402L06 Engineering Chemistry, BSC2402P08 Engineering Chemistry Lab

Course Objectives: Purposes Of the course are

1. **Understand** fundamental principles and first law of thermodynamics, focusing on heat and work interactions in engineering systems.
2. **Apply** ideal gas equation and second laws of thermodynamics for steady flow and non-flow processes.
3. **Develop** a thorough understanding of entropy and Knowledge of Fuel Combustion.
4. **Evaluate** the thermodynamic properties of steam and performance of vapor power cycles.
5. **Understand** the functions of Boiler Mountings and Accessories and calculations of Boiler Draughts

Course Outcomes: After successful completion of the course units the student will

CO	CO Statement	BTL
CO1	**APPRAISE** the basics of thermodynamics with heat and work interactions under different thermodynamic processes.	4
CO2	**IMPLEMENT** ideal gas equations and second laws of thermodynamics to flow and non-flow processes.	3
CO3	**APPLY** entropy for an Open and Closed System and **Analysis** of Combustion of Fuels.	3
CO4	**EVALUATE** the properties of steam and vapor power cycle using steam tables and Mollier diagrams.	4
CO5	**APPLICATION** of boiler mountings and accessories and Calculation of boiler draughts.	3

Syllabus

List of Practical's

The Term work shall consist of successful completion of 7 Practical's, and a Industrial Visit. Oral Examination shall be based on the term work.

1. Joule's experiment to validate, first law of thermodynamics.
2. Determination of dryness fraction of steam using combined separating and throttling calorimeter.
3. Determination of HCV of solid or gaseous fuel using Bomb or Junker's calorimeter respectively.
4. Demonstration on Orsat Apparatus.
5. Trial on boiler to determine boiler efficiency, equivalent evaporation and Energy Balance.
6. Thermodynamic Analysis of any System / Model by using any Computer Software.
7. Energy and Exergy analysis of contemporary steam generators.
8. Constructions & Working of Boilers Mounting and Accessories.

Industrial Visits

9. Visit any Process Industry/Plant having Boilers equipped with Accessories.

The visit report consists of Details about the Industry/Process Plant.
Operational description of the Equipment with specification, its use, capacity, application etc.

Textbook:

1. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill Publications
2. R. K. Rajput, "Engineering Thermodynamics", EVSS Thermo, Laxmi Publications.
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NPTEL/SWAYAM

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3. NPTEL Course(s) applicable for credit transfer as per Institute Policy

Rubrics for Continuous Evaluation

Component	Parameters	Marks	Total	Pass
Continuous Comprehensive Evaluation CCE	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Semester Evaluation (ESE)	Performance (External)	25	50	20
	Oral Examination (External)	25		

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	2	3	3	3	3	2	3	2	2
CO2	3	2	2	3	3	2	3	3	3	3	2	3	2	2
CO3	3	2	2	2	3	2	3	3	3	3	2	3	2	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | Second Year B Tech Semester III | 2024 Pattern

Course Code: ME124PC303 **Course Title: Solid Mechanics (Group C)**

Category: Program Core Course 3

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max %	Min marks for Pass		Max %	Min marks for Pass
3	0	0	3	CCE	50	20	40	-	-
Total Hours									
39	0	0	Total: 39	ESE	50	20			

Prerequisites: Applied Mechanics (ESC2401L02), Linear Algebra and Differential Calculus (BSC2401L11), Differential Equation and Integral Calculus (BSC2402L09-11)

Course Objectives:

1. **To Relate** mechanical properties of a material with its behavior under various load types.
2. **To study** forces and their effects which is essential for engineering design.
3. **To Analyze** a loaded structural member for deflections and failure strength.
4. **To apply** solid mechanics knowledge to engineering applications and design problems.
5. **To Develop** problem-solving skills for real-world engineering structures and machines

Course Outcomes: After successful completion of the course units the student will		**BTL**
CO1	**APPRAISE** stresses, strains due to various types of loading (BTL3)	**3**
CO2	**INTERPRET** Shear Force and Bending Moment Diagram for transverse loading (BTL4)	**4**
CO3	**EVALUATE** Bending, Shear stress, Slope and Deflection on Beam (BTL5)	**5**
CO4	**EVALUATE** deflection for beams, Buckling for the column and Torsional shear stress for shaft (BTL5)	**5**
CO5	**DESIGN** basic components by applying the concept of Principal Stresses and Theories of Failure (BTL6)	**6**

Syllabus

Unit I	**Simple stresses & strains**	**8 hrs**

Simple Stress & Strain: Introduction to types of loads (Static, Dynamic & Impact Loading) and various types of stresses with applications, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants, Stress-strain diagram for ductile and brittle materials, factor of safety, Stresses and strains in determinate and indeterminate beam, homogeneous and composite bars under concentrated loads and self-weight, Thermal stresses in plain and composite members

Unit II	**Shear Force & Bending Moment Diagrams**	**6 hrs**

SFD & BMD: Introduction to SFD, BMD 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

Unit III	Stresses on Beams	8 hrs

Bending Stress on a Beam: Introduction to bending stress on a beam with application, Theory of Simple bending, assumptions in pure bending, derivation of flexural formula, Moment of inertia of common cross section (Circular, Hollow circular, Rectangular, I & T), Bending stress distribution along the same cross-section

Shear Stress on a Beam: Introduction to transverse shear stress on a beam with application, shear stress distribution diagram along the Circular, Hollow circular, Rectangular, I & T cross-section

Unit IV	Deflection of Beams, Buckling of Column, Torsion	8 hrs

Slope & Deflection on a Beam: 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

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

Torsion of circular shafts: Introduction to torsion on a shaft with application, Basic torsion formulae and assumption in torsion theory, Torsion in stepped and composite shafts, Torque transmission on strength and rigidity basis, Torsional Resilience

Unit V	Principal Stresses, Theories of Failure	9 hrs

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 Elastic 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

Text Books

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

Reference Books

1. Egor. P. Popov, "Introduction to Mechanics of Solids",Prentice Hall Publication
2. G. H. Ryder, "Strength of Materials", Macmillan Publication

3. Beer and Johnston, “Strength of materials”, CBS Publication
4. James M. Gere, “Mechanics of Materials”, CL Engineering
5. Timoshenko and Young, “Strength of Materials”, CBS Publication, Singapore
6. Prof. S.K. Bhattacharyya, IIT Kharagpur

Virtual lab

1. Tensile Test on Mild Steel
   https://sm-nitk.vlabs.ac.in/exp/tensile-test- mild-steel/index.html

2. Tensile Test on Cast Iron
   https://sm-nitk.vlabs.ac.in/exp/tensile-test-cast- iron/

3. Compression Test on Cast Iron
   https://sm-nitk.vlabs.ac.in/exp/compression- test-cast-iron/

4. Compression Test on Mild Steel
   https://sm-nitk.vlabs.ac.in/exp/compression- test-mild-steel/

5. Direct Shear Test on Mild Steel Rod
   https://sm-nitk.vlabs.ac.in/exp/direct- shear-test-steel-rod/

6. Torsion Test on Mild Steel
   https://sm-nitk.vlabs.ac.in/exp/torsion-test-mild-steel/theory.html

NPTEL/SWAYAM

1. Solid Mechanics for Undergraduates by Ajeet Kumar, IIT Delhi
   https://www.youtube.com/watch?v=N68fNrRa8-M&list=PLp6ek2hDcoNALS0KiBAUiCwrTrvil2vL3

2. Mechanics of Solids - Introduction - Prof. Priyanka Ghosh, IIT Khanpur
   https://www.youtube.com/watch?v=PtEOFJGM2_I&list=PL0bRAs68fCS310qm-k2ccRa6fZTc0kxCR

3. NPTEL Courses applicable for credit transfer as per Institute Policy

Research Papers:

https://www.researchgate.net/publication/384284876_Physics-informed_Neural_Networks_PINN_for_computational_solid_mechanics_Numerical_frameworks_and_applications

B Tech in Mechanical Engineering | Second Year B Tech Semester III | 2024 Pattern

Exam Scheme

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			
End Semester Examination (ESE)	**Institute**	**10**	**10**	**10**	**10**	**10**	**50**	**20**

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	2	2	2	3	2	2
CO2	3	2	2	2	3	2	2	2	2	2	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping

Course Code: ME124PC304 Course Title: Computational Mathematics for Mechanical Engineering (Group C)
Category: Program Core Course 4

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min for Pass		Max	Min for Pass
2	1	0	3	CCE	50	20	40	-	-
Total Hours									
26	13	0	Total: 39	ESE	50	20			

Prerequisites: Linear Algebra and Differential Calculus(BSC2401L09-11), Differential Equation and Integral Calculus(BSC2402L09-11)

Course Description: This Course focuses on using computational methods and algorithms to solve complex engineering problems. It blends principles from engineering, computer science, and applied mathematics to model, simulate, and analyse systems and processes.

Course Objectives: Purposes of the course are

1. To Apply bracketing methods (e.g., Bisection and False Position methods) for root-finding. and solve mechanical engineering applications.

2. To APPLY differential equations to solve the applications in the domain of fluid mechanics, Structural, etc.

3. To Formulate and solve constrained optimization problems using graphical and simplex methods Analyze.

4. To the error behavior and accuracy of various numerical integration methods.

5. To COMPARE the system's behavior for the experimental data.

Course Outcomes: After successful completion of the course the student will be able to		BTL
CO1	**SOLVE** system of equations using direct and iterative numerical methods to determine equilibrium positions.	3
CO2	**EVALUATE** solutions for differential equations numerical techniques such as Runge kutta , Euler for ODE and Laplace for PDE to model heat conduction.	5
CO3	**ASSESS** different optimization models and justify the most suitable approach for a given real-world scenario.	5
CO4	**ESTIMATE** the work done in thermodynamics using numerical integration techniques like Simpson rule and Trapezoidal rule.	5
CO5	**CREATE** a model to make forecasts using a curve fitting and regression analysis.	6

B Tech in Mechanical Engineering | Second Year B Tech Semester III | 2024 Pattern Syllabus

Unit I	**Roots of Equation and Simultaneous Equations**	**05 hrs**
Roots of Equation: Bracketing method and Newton-Raphson method **Solution of simultaneous equations**: Gauss Elimination Method with Partial pivoting, Gauss-Seidel method, Thomas algorithm for Tri-diagonal Matrix.		
Unit II	**Numerical Solution of Differential Equations**	**06 hrs**
Ordinary Differential Equations [ODE]: Taylor series method, Euler Method, Runge-Kutta 4th order. Simultaneous equations using Runge-Kutta 2nd order method. **Partial Differential Equations [PDE]:** Simple Laplace method, PDE's Parabolic explicit solution, Elliptic explicit solution.		
Unit III	**Optimization**	**05 hrs**
Introduction to optimization, Classification, Constrained optimization: Graphical and Simplex method. Modern Optimization Techniques: Genetic Algorithm (GA),Simulated Annealing (SA), Fuzzy Logic		
Unit IV	**Numerical Integration and Statistics**	**05 hrs**
Numerical Integration (1D): Trapezoidal rule, Simpson's 1/3rdRule, Simpson's3/8thRule, Gauss Quadrature2-point and 3-point method. **Double Integration:** Trapezoidal rule, Simpson's 1/3rdRule.		
Unit V	**Curve Fitting and Regression Analysis**	**05 hrs**
Curve Fitting: Least square technique- first order, power equation, exponential equation and quadratic equation. **Regression Analysis:** Linear regression, Nonlinear regression, Multiple regressions, Polynomial regression. Lagrange's interpolation, Newton's forward method, inverse interpolation (Lagrange's method only).		
List of Tutorials [13 hrs] Group A – (Any three programs using suitable programming language) 1. Roots of equation [2 hrs] 2. Simultaneous equations [1 hrs] 3. Ordinary differential equation [1 hrs] 4. Numerical Integration [1 hrs] Group B (Any three programs for simple dataset using suitable programing) 5. Partial differential equation [1 hrs] 6. Curve fitting using least square technique [2hrs] 7. Regression analysis [2hrs] Group C (Mandatory)[3 hr] 8. One program based mini project using mechanical engineering application dataset		
Books		
Text Books: 1. Steven C. Chapra, 'Applied Numerical Methods with MATLAB for Engineers and Scientist', Tata Mc-Graw Hill Publishing Co. Ltd. 2. B. S. Grewal, 'Numerical Methods in Engineering and Science', Khanna Publication. 3. B. S. Grewal, 'Higher Engineering Mathematics', Khanna Publication. **References Books:** 1. Erwin Kreyszig, 'Advanced Engineering Mathematics', Wiley India 2. Joe D. Hoffman, 'Numerical Methods for Engineers and Scientists', CRC Press 3. Sheldon M. Ross, 'Introduction to Probability and Statistics for Engineers and Scientists', 5e, by Elsevier Academic Press 4. Deisentoth, Faisal, Ong, 'Mathematics for machine learning', Cambridge University Press.		

5. Kandasamy, 'Numerical methods', S Chand.

Research References:

1. https://www.researchgate.net/publication/300101166_Curve_Fitting
2. https://www.tandfonline.com/doi/full/10.1080/08839514.2020.1787677

NPTEL References:

1. https://onlinecourses.nptel.ac.in/noc21_ma45/preview
2. https://onlinecourses.nptel.ac.in/noc20_ge20/preview
3. NPTEL Courses applicable for credit transfer as per Institute Policy

Web References:

1. https://www.analyticsvidhya.com/blog/2022/10/optimization-essentials-for-machine-learning/

Rubrics For Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit test 1 (UT 1)			Unit test 2 (UT 2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	2	2	2	2	2	2	2	2	-
CO2	3	2	3	3	3	2	2	2	2	2	2	2	2	-
CO3	3	3	2	2	3	2	2	2	2	2	2	2	2	2
CO4	3	2	2	2	3	2	2	2	2	2	2	2	2	-
CO5	3	3	3	3	3	2	2	2	2	2	2	2	3	2

3: High, 2: Moderate, 1: Low, -: No Mapping

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Mechanical Engineering | Second Year B Tech Semester III | 2024 Pattern

Course Code: ME124MD305 Course Title: Electric Vehicle Technologies Minor (Group C)

Category: Multi-Disciplinary Minor Course 1

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max %	Min marks for Pass		Max %	Min marks for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours									
26	0	0	Total: 26	ESE	50	20			

Prerequisites: BSC2401L03 Engineering Physics, BSC2401P07 Engineering Physics Lab, BSC2402L06 Engineering Chemistry, BSC2402P08 Engineering Chemistry Lab

Course Objectives:

1. To provide fundamental knowledge of IC engines, their components, classification, and various supporting systems.
2. To understand emission norms, control strategies, and engine testing procedures for performance evaluation.
3. To explore hybrid and electric vehicle energy systems, their architecture, and the significance of EV technology.
4. To analyze different types of electric vehicles, their components, economic and environmental impacts, and technological advancements.
5. To study the role of prime movers in electric vehicles, focusing on electric motors, selection criteria, and performance characteristics.

Course Outcomes: After successful completion of the course units the student will		**BTL**
CO1	Apply the fundamental concepts of IC engines, their construction, working, and classification in real-world applications.	**3**
CO2	Demonstrate an understanding of emission control techniques, engine testing procedures, and performance analysis.	**3**
CO3	Analyze the architecture, energy flow, and significance of hybrid and electric vehicle technologies.	**4**
CO4	Compare different types of electric vehicles, their components, and evaluate their economic and environmental impacts.	**4**
CO5	Evaluate various electric motors used in EVs based on selection criteria, performance, and efficiency.	**5**

Syllabus

Unit I	**Fundamentals of IC Engine**	**5 hrs**
Components and Construction details, Terminology, Classification of IC engines, Applications, Cooling, Lubrication and Ignition system		

Unit II	**Emission & Control and Engine Testing**	**5 hrs**
Emission & Control: SI and CI Engines Emission and controlling methods, Euro Norms and Bharat Stage Norms. **Engine Testing:** Engine Testing Procedure, Measurement of indicated power, Brake power, fuel consumption, Air Consumption, various efficiencies, heat balance sheet of IC Engines and performance Characteristic curves.		
Unit III	**Hybrid and Electric Vehicle Energy Systems**	**5 hrs**
Hybrid Vehicle Architecture And Energy Flow, Types Of Hybrid Systems: Mild, Full, And Plug-In Hybrid (Phev), Electric Vehicle Battery Technologies And Charging Infrastructure, Introduction To Electric And Hybrid Vehicle, History and Evolution Of Electric Vehicles, Comparison Of Electric With Internal Combustion Engine Vehicles, Limitations of IC Engine Vehicles, Limitations of IC Engine Vehicles		
Unit IV	**Electric Vehicles and Technologies**	**5 hrs**
Battery Electric Vehicle (Bev), Hybrid Electric Vehicle (Hev), Plug-In Hybrid Electric Vehicle (Phev), Fuel Cell Electric Vehicle (Fcev), Key Components Of A Gasoline Car, Comparative Analysis Of EV Technologies, Economic And Environmental Impacts Of Using Electrical Vehicles		
Unit V	**Prime Movers for Electric Vehicles**	**6 hrs**
Electric Motor Drive for EV, AC, DC Motor, BLDC Motors, Induction Motors, Induction Motors, Switched Reluctance Motors (SRM) Motors, Motor Selection Criteria, Motor Safety and maintenance, Motor Torque and Power Rating		

Textbook:

1. V. Ganesan, “Internal Combustion Engines”, Tata McGraw-Hill.
2. Chan, C. C., & Chau, K. T. (2001). Modern electric vehicle technology. Oxford University Press.
3. Electric and Hybrid Vehicles: Design Fundamentals – Iqbal Husain, CRC Press
4. Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives – Chris Mi, M. Abul Masrur, and David Wenzhong Gao, Wiley Publication
5. Electric Vehicle Technology Explained – James Larminie and John Lowry, Wiley Publication
6. Automobile Engineering – Kirpal Singh, Standard Publishers

Reference Books:

1. Heywood, J. B. (1988). Internal combustion engine fundamentals. McGraw-Hill.
2. Husain, I. (2021). Electric and hybrid vehicles: Design fundamentals (3rd ed.). CRC Press.
3. R. Yadav, “Internal Combustion Engine”, Central Book Depot, Ahmedabad.
4. S. Domkundwar, C. P. Kothandaraman, A. Domkundwar, “Thermal Engineering”,Dhanpat Rai & Co.
5. Modern Electric, Hybrid Electric & Fuel Cell Vehicles – Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, CRC Press
6. Electric Vehicle Battery Systems – Sandeep Dhameja, Butterworth-Heinemann
7. Energy Storage Systems: Fundamentals, Materials, and Applications – Muhammad Rashid, Academic Press
8. Fundamentals of Vehicle Dynamics – Thomas D. Gillespie, SAE International
9. Automotive Electrical and Electronic Systems – Tom Denton, Routledge

Research Papers

1. Mohanty, P. K., Pradhan, R., Jena, P., & Padhy, N. P. (2025). Electric Vehicles: Exploring Types, Benefits, Challenges, Policies, and Smart Charging Innovation. In Electric Vehicle Charging Infrastructures and its Challenges (pp. 25-50). Singapore: Springer Nature Singapore.
2. Timilsina, R. R., Zhang, J., Rahut, D. B., Patradool, K., & Sonobe, T. (2025). Global drive toward net-zero emissions and sustainability via electric vehicles: an integrative critical review. Energy, Ecology and Environment, 1-20.

MOOCS

1. NOC: Fundamentals of Electric Vehicles: Technology & Economics, IIT Madras by Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan https://nptel.ac.in/courses/108106170

2. NPTEL Course(s) applicable for credit transfer as per Institute Policy

Exam Scheme

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit test 1 (UT 1)			Unit test 2 (UT 2)			
End Semester Examination (ESE)	**Institute**	10	10	10	10	10	50	20

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	2	2	2	3	2	2
CO2	3	2	2	2	3	2	2	2	2	2	2	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Mechanical Engineering |Second Year B Tech Semester III | 2024 Pattern

Course Code: ME124OE306, Course Title: Logistics and Supply Chain Management (Group C)

Category: Open Elective Course 1

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max %	Min marks for Pass		Max %	Min marks for Pass
4	0	0	4	CCE	50	20	40	-	-
Total Hours									
52	0	0	Total: 52	ESE	50	20			

Prerequisites: No Prerequisite

Course Objectives: Purposes of the course are

1) To introduce the fundamental concepts of supply chain management and its significance in the global business environment.
2) To equip students with knowledge of supply chain network design, procurement, and inventory management.
3) To develop an understanding of logistics, transportation, and distribution strategies.
4) To analyze the role of technology and information systems in supply chain management.
5) To enable students to evaluate and optimize supply chain performance using advanced techniques.

Course Outcomes: After successful completion of the course units the student will

CO	Details	BT Level
CO1	Apply the fundamental concepts of supply chain management in real-world business scenarios.	**3**
CO2	Apply supply chain network design principles, procurement strategies, and inventory management techniques for efficient operations.	**3**
CO3	Analyze different logistics, transportation, and distribution strategies to optimize the movement of goods and services.	**4**
CO4	Analyze the role of technology, information systems, and digitalization in enhancing supply chain performance.	**4**
CO5	Evaluate supply chain performance metrics and recommend optimization techniques for improving overall efficiency.	**5**

B Tech in Mechanical Engineering |Second Year B Tech Semester III | 2024 Pattern Syllabus

Unit I	**Concepts in Supply Chain Management (SCM)**	**10 hrs**
Definition, Scope, and Objectives of SCM, Importance of SCM in Global Business, Supply Chain Drivers and Performance Measures, Supply Chain Strategies and Competitive Advantage		
Unit II	**Supply Chain Network Design and Inventory Management**	**10 hrs**
Supply Chain Network Components and Structure, Demand Forecasting and Planning, Procurement and Supplier Relationship Management, Inventory Control Techniques (EOQ, JIT, ABC Analysis)		
Unit III	**Logistics and Distribution Management**	**10 hrs**
Transportation Modes and Strategies, Warehousing and Material Handling Systems, Distribution Channels and Network Optimization, Reverse Logistics and Green Supply Chain		
Unit IV	**Role of Technology in Supply Chain Management**	**10 hrs**
Information Flow and IT in SCM, Enterprise Resource Planning (ERP) in Supply Chains, Blockchain and IoT Applications in SCM, Data Analytics and Artificial Intelligence in SCM		
Unit V	**Supply Chain Performance and Optimization**	**12 hrs**
Performance Measurement Metrics (SCOR Model, KPI), Risk Management in Supply Chains, Sustainable and Resilient Supply Chains, Case Studies and Future Trends in SCM		

Reference Books

Textbook:

1. "Supply Chain Management: Strategy, Planning, and Operation" – Sunil Chopra, Peter Meindl (Pearson)
2. "Logistics and Supply Chain Management" – Martin Christopher (Pearson)
3. "Introduction to Supply Chain Management" – Robert B. Handfield, Ernest L. Nichols (Pearson)

References:

1. "Designing and Managing the Supply Chain" – David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi (McGraw-Hill)
2. "Supply Chain Management: A Global Perspective" – Nada R. Sanders (John Wiley & Sons)
3. "The Essentials of Supply Chain Management" – Michael H. Hugos (Wiley)
4. "Purchasing and Supply Chain Management" – P. J. H. Baily, David Farmer, Barry Crocker, David Jessop (Pearson)
5. "The Resilient Supply Chain: Preparing for Disruption and Operational Continuity" – Richard Wilding (Kogan Page)

Swayam/ NPTL Courses

1) "Logistics & Supply Chain Management," By Prof. Vikas Thakur, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_hs128/preview
2) NPTEL Course(s) applicable for credit transfer as per Institute Policy

Research Papers

1. Goswami, S. S., Mondal, S., Sarkar, S., Gupta, K. K., Sahoo, S. K., & Halder, R. (2025). Artificial Intelligence-Enabled Supply Chain Management: Unlocking New Opportunities and Challenges. In Artificial Intelligence and Applications (Vol. 3, No. 1, pp. 110-121).
2. Babai, M. Z., Arampatzis, M., Hasni, M., Lolli, F., & Tsadiras, A. (2025). On the use of machine learning in supply chain management: a systematic review. IMA Journal of Management Mathematics, 36(1), 21-49.

Examination Scheme

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		5	5	5	5	5		
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	2	1	1	1	1	2	1	2	2
CO2	1	1	1	1	1	2	1	1	1	1	2	1	2	2
CO3	1	1	1	1	1	2	2	1	1	1	2	1	2	2
CO4	1	1	1	1	2	2	2	2	1	1	2	1	2	2
CO5	1	1	1	1	2	2	2	2	1	1	2	1	2	2

3: High, 2: Moderate, 1: Low, -: No Mapping.

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Course Code: ME124EE307 Course Title: Concepts in Technology Entrepreneurship (Group C)

Category: Entrepreneurship/Economics and Management Course 1

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours									
26	0	0	Total: 26	ESE	50	20			

Prerequisites: N/A

Course Objectives: Purposes of the course are

1. To develop an ability to differentiate between innovation and creativity
2. To induce an understanding about a process for evolution of an entrepreneur
3. To help identify a process of converting idea into business opportunity
4. To examine concepts of financing and marketing of start-ups / small scale industries
5. To imbibe entrepreneurial competencies

Course Outcomes: After successful completion of the course units the student will

CO	Details	BT Level
CO1	Demonstrate an ability to differentiate between innovation and creativity	3
CO2	Illustrate a process for evolution of an entrepreneur	4
CO3	Analyze a process of converting idea into business opportunity	4
CO4	Evaluate concepts of financing and marketing of start-ups / small scale industries	5
CO5	Develop entrepreneurial competencies	6

Syllabus

Unit I	Innovation and Entrepreneurship	5 hrs
Technological innovations, difference between innovation and creativity, innovation types & platforms, business model innovation, service innovation		
Unit II	**Evolution of an Entrepreneur**	**5 hrs**
Entrepreneurship and entrepreneurship development, factors affecting entrepreneurship characteristics and skills of an entrepreneur, entrepreneur v/s manager, evolution of an entrepreneur – skills, and competencies		

Unit III	Ideas Generation for a Business	5 hrs
Idea generation-sources and methods, identification and classification of ideas individual creativity: roles and process, conversion of idea into business opportunity		
Unit IV	**Basics of Entrepreneurial Finance and Marketing**	**6 hrs**
Estimating Financial Funds Requirements, Sources of finance; Banks, Various Financial institutions (including IFCI, ICICI, IDBI, and SIDBI), Financing of start ups and small-scale industries, Entrepreneurial marketing vs traditional marketing, types of entrepreneurial marketing, desired outcomes for entrepreneurial marketing, importance of business pitching skills, case study on marketing for a start-up idea		
Unit V	**Building Entrepreneurial Competencies**	**5 hrs**
Concepts of Venture Survival, entrepreneurial motivation, meaning of entrepreneurial competencies, major entrepreneurial competencies, developing entrepreneurial competencies, case-study/team building exercise/interaction with an entrepreneur to understand entrepreneurial competencies.		

Reference Books

1. Bolton, B., & Thompson, J. L. (2015). The entrepreneur: The all-in-one entrepreneur-leader-manager. New York: Routledge.
2. Thomas W. Zimmerer and Norman M. Scarborough (2005). Essentials of Entrepreneurship and Small Business Management. Prentice Hall India. New Delhi
3. Peter Thiel (2014). Zero to One: Notes on Startups, or How to Build the Future, Crown Publishing Group. New York
4. Swanson, E. B. (2024). Technology entrepreneurship is more than one might think. Information and Organization, 34(2), 100512.
5. Chen, W. D., Acs, Z., & Terjesen, S. (2024). Adolescent entrepreneurial learning ecosystem and a tech entrepreneurial career—inspiration from the black swan stories. Small Business Economics, 62(3), 1157-1176.

SWAYAM / NPTEL/ MOOC Courses

1. Course on Entrepreneurship By Prof. C Bhaktavatsala Rao, IIT Madras https://onlinecourses.nptel.ac.in/noc20_mg35/preview
2. Course on Startup School by Y Combinator https://www.youtube.com/playlist?list=PLQ-uHSnFig5M9fW16o2l35jrfdsxGknNB
3. NPTEL Course(s) applicable for credit transfer as per Institute Policy

Research Paper

1. Ioannou, A., & Retalis, S. (2025). Building entrepreneurial self-efficacy in the EdTech sector: the impact of an entrepreneurship education program. *The International Journal of Information and Learning Technology*.
2. Lopez, T., Noguera, M., & Urbano, D. (2025). Institutions and entrepreneurship education: a critical analysis of the literature. Annals of Entrepreneurship Education and Pedagogy-2025, 48-72.

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			
End Semester Examination (ESE)	**Institute**	**10**	**10**	**10**	**10**	**10**	**50**	**20**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	2	1	1	3
CO2	1	2	1	1	1	1	2	1	1	3	2	1	1	3
CO3	2	1	2	1	2	1	1	2	1	2	1	1	1	3
CO4	1	1	1	1	1	2	2	2	1	1	2	1	1	3
CO5	1	1	1	1	1	1	2	1	2	1	2	1	1	3

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Course Code: ME124VE308 Course Title: Sustainable Development 1
Category: Value Education Course 1

Teaching Scheme				Evaluation Scheme				
					Theory Marks		Practical Marks	
L	T	P	Cr	Exam	Max	Min Marks for Pass	Max	Min for Pass
2	0	0	2	CCE	100	40	-	-
Total Hours								
26	0	0	Total hrs: 26					

Prerequisites:
None

Subjects Included:

Sustainable Development Goals (SDG - Basic)	2 units
Environment Studies	2 units
Intellectual Property Rights (IPR)	1 unit

Course Objectives: (Min 3)

Understand the Concept of SDGs – Introduce students to the importance of sustainable development and the role of SDGs in global and local contexts.

Explore SDG Interconnections – Analyze how various SDGs are linked and the challenges in achieving them collectively.

Understand Environmental Issues – Examine environmental challenges and their impact on sustainable development.

Study Environmental Policies – Analyze national and global policies related to environmental sustainability.

Learn Intellectual Property Rights (IPR) – Understand the basics of patents, copyrights, trademarks, and their role in innovation.
1.

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

CO1	**DEFINE** the key concepts of SDGs and LIST the 17 SDGs with their significance.
CO2	**EXPLAIN** interconnections between different SDGs and analyze their holistic impact.
CO3	**DESCRIBE** key environmental challenges and their implications for sustainable development.
CO4	**DISCUSS** major environmental policies and governance frameworks.

CO5	**UNDERSTAND** fundamental concepts of Intellectual Property Rights (IPR) and their applications.

Syllabus

Unit I	**Introduction to SDGs & Sustainability**	**6 hrs**
	Evolution from MDGs to SDGs, significance in the UN 2030 Agenda, India's contributions, real-world applications.	
Unit II	**SDG Targets & Interconnections**	**6 hrs**
	Understanding SDG indicators, interlinkages, roles of stakeholders, case studies, impact assessment frameworks.	
Unit III	**Environmental Challenges & Sustainability**	**5 hrs**
	Key environmental issues like climate change, biodiversity loss, pollution; impact on health and society, mitigation strategies.	
Unit IV	**Environmental Policies & Governance**	**5 hrs**
	National and global environmental policies, role of regulatory bodies, sustainability standards, case studies of successful interventions.	
Unit V	**Introduction to Intellectual Property Rights (IPR)**	**4 hrs**
	Basics of patents, copyrights, trademarks, importance in innovation and sustainability, protection of intellectual property in academia and industry.	

Scheme for Examination

Component	**Parameters**	**Marks**	**Total**	**Pass**
Continuous Comprehensive Evaluation CCE	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Evaluation	Performance (Internal)	25	50	20
	Oral Examination (Internal)	25		

CCE: Continuous Comprehensive Evaluation (CCE)

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3									3	3
CO2	3	3	3	3									3	3
CO3	3	3	3	3									3	3
CO4	3	3	3	3									3	3
CO5	3	3	3	3									3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping*****

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Course Code: ME124FP309, Course Title: Rural Technology Development
Category: Field Engineering Project

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
0	0	4	2	CCE	-	-	-	100	40
Total Hours									
0	0	52	Total: 52	ESE	-	-			

Prerequisites: Engineering Physics (BSC2401L03), Engineering Physics Lab (BSC2401P07), Engineering Chemistry (BSC2402L06), Engineering Chemistry Lab (BSC2402P08)

Course Objectives:

1. To provide a comprehensive understanding of rural development, including its concept, scope, and historical evolution.
2. To analyze the prevalent health issues in rural India and evaluate government initiatives aimed at improving rural healthcare.
3. To assess the effectiveness of various rural development models and programs implemented in rural areas.
4. To explore the role of technology in promoting sustainable rural development and enhancing rural livelihoods.
5. To examine the importance of agricultural finance and marketing in driving rural economic development.

Course Outcomes:		BT Level
CO1	**Apply** the basic concepts, definitions, and nature of rural society to understand the need and strategies for rural development.	**3**
CO2	**Analyze** the historical evolution of rural development in the Indian context and evaluate the causes of rural backwardness.	**4**
CO3	**Examine** the components and status of health and nutrition in rural India, and evaluate strategies for the prevention and control of communicable diseases.	**4**
CO4	**Critically** assess the planning and implementation of rural health care services, including health education and the accessibility of facilities	**5**
CO5	**Formulate** sustainable rural development strategies by applying the principles of rural development models and paradigms.	**6**

Syllabus

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Activity 1: Case Study & Group Discussion on Rural Development Strategies	**Time**
● Students will be divided into groups and assigned different case studies of successful rural development initiatives in India (e.g., Amul Cooperative Model, Kudumbashree in Kerala, Rurban Mission, etc.). ● Each group will present their findings, followed by a class discussion on the effectiveness, challenges, and possible improvements in these strategies.	**(10 Hours)**
Activity 2:Community Health Survey & Awareness Campaign	**(10 Hours)**
● Students will conduct a small survey in a selected rural or semi-urban area (or via secondary research if field visits are not feasible). The survey will include aspects such as:-Awareness about communicable diseases and prevention-Sanitation and hygiene practices-Knowledge and usage of health schemes like Arogya Sree & AYUSH-Accessibility of healthcare services ● Students will prepare and conduct a health awareness session (in-person or through posters, pamphlets, or social media) on key issues like hygiene, nutrition, and government health schemes. The session will conclude with reflections and discussions.	
Activity 3: Role-Playing & Simulation on Rural Development Models	**(10 Hours).**
● Students will be divided into groups, each assigned a specific rural development model (e.g., Lewis Model of Economic Development, Self-Help Groups (SHGs), SGSY). Each group will study its model's concept, characteristics, and impact on rural economies. ● Groups will present their model using role-playing or simulations where they act as policymakers, SHG members, or rural entrepreneurs. This will be followed by a discussion on the strengths, limitations, and real-world applications of each model	
Activity 4: Debate & Sustainable Development Action Plan	**(11 Hours)**
● Students will research and present innovative rural technologies (e.g., solar water pumps, biogas, drip irrigation, mobile banking for farmers, rural telemedicine). They will explain how these technologies contribute to sustainable rural development. ● Students will work in groups to propose an action plan for sustainable rural development based on real-world examples, incorporating economic, environmental, and social indicators. They will present their plans and receive feedback.	

Activity 5: Rural Market Analysis & Agricultural Product Marketing Plan	(11 Hours)
● Students will study rural market components, classification, demand patterns, and challenges. ● Groups will research successful cooperative marketing models (e.g., Amul, NAFED, Farmer Producer Organizations). ● Each group will develop a marketing strategy for an agricultural product (e.g., organic vegetables, dairy products, handlooms). ● Strategies will include pricing, distribution channels, role of cooperatives, and digital marketing techniques for rural markets. ● Presentations and peer feedback.	

Books and References

Textbooks:

1. Katar Singh – *Rural Development: Principles, Policies & Management*
2. G. Sreedhar and D. Rajasekhar – *Rural Development in India: Strategies and Processes*, Concept Publishing House, New Delhi, 2014
3. K. Venkata Reddy – *Rural Development in India: Poverty and Development*, Himalaya Publishing House, Mumbai, 2012

Reference Books:

1. Rajasekhar D (Ed) – *Prof G Parthasarathi's Writings on Indian Rural Economy in Transition*
2. Shamin Ahmed – *Rural Marketing in India*
3. Misra & Sarma – *Problems and Prospects of Rural Development in India*
4. H. Belshaw – *Agricultural Credit in Economically Underdeveloped Countries*
5. K Bhaskar – *Need for Linking of Regulated Markets with Cooperative Marketing Societies*, *Cooperator*, Aug 1989
6. S.C. Jain – *Rural Development*
7. SSM Desai – *Rural Banking in India*
8. N.I.R.D. – *Facets of Rural Development in India*
9. Publications of A.P. Telugu Academy – *Kurukshetra, Yojana, Jagruti, Khadi Gramodyog, Journal of Rural Development*

NPTEL & Online Resources:

1. Rural Technology Development *(IIT Mumbai)* – Prof. Pennan Chinnsamy
https://youtu.be/KFAw_h0n0q0?feature=shared

2. Rural and Urban Sociology *(IIT Kanpur)* – Dr. Anindita Chakrabarti
https://archive.nptel.ac.in/courses/109/104/109104047/

3. NPTEL Course(s) applicable for credit transfer as per Institute Policy

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern
Rubrics for Continuous Evaluation

Component	Parameters	Marks	Total	Pass
Continuous Comprehensive Evaluation (CCE)	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Evaluation	Performance (Internal)	25	50	20
	Oral Examination (Internal)	25		

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	2	3	1	1	2	3	3	1	2	2	3	3	1	2
CO2	2	3	1	2	2	3	2	1	2	2	2	3	2	2
CO3	2	3	1	2	3	3	3	1	2	2	3	2	3	2
CO4	2	3	2	2	3	3	3	1	3	3	3	2	3	2
CO5	3	3	3	3	2	3	3	1	3	3	3	3	2	3

3: High, 2: Moderate, 1: Low, -: No Mapping,

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Course Code: ME124NC310, Course Title: Design Thinking

Category: Program Non-Credit Course 1

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
1	0	0	0	CCE	50	20	-	-	-
Total Hours									
13	0	0	Total: 13	ESE	50	20	-	-	-

Prerequisites: No Pre-requisite

Course Objectives:

1. Understand the fundamental concepts of design thinking and its relevance in mechanical engineering.
2. Apply design thinking methodologies to solve engineering problems creatively.
3. Analyze user needs and synthesize design solutions using structured ideation techniques.
4. Evaluate engineering design alternatives through prototyping and testing.
5. Create innovative and sustainable solutions using an iterative design approach.

Course Outcomes: Students will be able to		**BTL**
CO1	Apply the principles of Design Thinking to understand problem-solving approaches in engineering.	3
CO2	Demonstrate the use of empathy and user research in engineering design.	3
CO3	Analyze different ideation techniques to generate innovative solutions for engineering problems.	4
CO4	Evaluate and refine engineering design concepts using prototyping and feedback loops.	4
CO5	Develop innovative and sustainable solutions for real-world mechanical engineering problems.	5

Syllabus

CO 1	**Concepts in Design Thinking**	**2 hrs**
Definition and Importance of Design Thinking, Design Thinking vs. Traditional Problem-Solving, Stages of Design Thinking (Empathize, Define, Ideate, Prototype, Test), Role of Design Thinking in Mechanical Engineering		
CO 2	**Empathy and Problem Definition**	**2 hrs**
Understanding User Needs and Pain Points, Techniques for Empathy Mapping and User Research, Problem Framing and Defining Engineering Challenges, Case Studies on Mechanical Design		
CO 3	**Ideation Techniques and Creative Problem-Solving**	**3 hrs**
Brainstorming and Mind Mapping, SCAMPER and TRIZ Techniques, Design Heuristics for Engineering Solutions, Group Ideation and Concept Sketching		
CO 4	**Prototyping and Testing in Engineering Design**	**3 hrs**
Types of Prototypes (Low-Fidelity vs. High-Fidelity), Rapid Prototyping Techniques (3D Printing, CAD, Physical Models), Testing and Feedback Loop in Design, Case Studies on Successful Prototyping		

CO 5	Innovation, Sustainability, and Iterative Design	3 hrs

Sustainability in Design Thinking, Iterative Design Process for Mechanical Systems, Design Validation and Real-World Implementation, Industry-Based Case Studies

Reference Books

Textbooks

1. Brown, T. – Change by Design: How Design Thinking Creates New Alternatives for Business and Society (Harper Business, 2009)
2. Cross, N. – Engineering Design Methods: Strategies for Product Design (John Wiley & Sons, 5th Edition, 2011)
3. Dym, C. L., Little, P., & Orwin, E. – Engineering Design: A Project-Based Introduction (John Wiley & Sons, 4th Edition, 2013)
4. IDEO – Design Thinking Toolkit for Educators (IDEO, 2012)

Reference Books

1. Brown, T. – Design Thinking: A Quick Overview (Design Council, 2017)
2. Liedtka, J., & Ogilvie, T. – Designing for Growth: A Design Thinking Toolkit for Managers (Columbia University Press, 2011)
3. Pahl, G., & Beitz, W. – Engineering Design: A Systematic Approach (Springer, 3rd Edition, 2007)

NPTEL / SWAYAM Course

1) NPTEL – Design Thinking – A Primer (IIT Madras, Prof. B. Gurumoorthy)
   Link: https://nptel.ac.in/courses/110/106/110106124/
2) NPTEL – Innovation, Business Models, and Entrepreneurship (IIT Roorkee, Prof. Anil Gupta)
   Link: https://nptel.ac.in/courses/110/104/110104116/
3) SWAYAM – Design Thinking for Engineers and Managers (IIM Bangalore, Prof. Ashwin Mahalingam)
   Link: https://swayam.gov.in/nd2_imb20_mg14/preview
4) NPTEL – Product Design and Manufacturing (IIT Kanpur, Prof. Shantanu Bhattacharya)
   Link: https://nptel.ac.in/courses/112/104/112104262/
5) NPTEL Course(s) applicable for credit transfer as per Institute Policy

Research Papers

1) Mayer, S., & Schwemmle, M. (2025). The impact of design thinking and its underlying theoretical mechanisms: A review of the literature. *Creativity and Innovation Management*, *34*(1), 78-110.
2) Ferreira, I. C. M., Zanin, L. M., Prates, C. B., da Cunha, D. T., & Stedefeldt, E. (2025). Design thinking: An effective strategy to evolve food safety culture?. Food Control, 171, 111093.

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			
End Semester Examination (ESE)	**Institute**	**10**	**10**	**10**	**10**	**10**	**50**	**20**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PS03
CO1	2	2	1	–	2	2	1	2	1	1	2	1	1	2
CO2	2	1	2	2	2	1	1	1	2	2	2	1	2	2
CO3	2	1	2	2	2	2	1	1	1	1	1	2	1	2
CO4	1	2	2	2	2	1	1	1	2	1	2	2	1	2
CO5	1	2	2	2	2	2	1	2	1	1	1	1	2	1

3: High, 2: Moderate, 1: Low, -: No Mapping

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B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern

Course Code: ME124NC311, Course Title: Design Thinking Lab

Category: Program Non-Credit Course 1 Lab

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max %	Min marks for Pass		Max %	Min marks for Pass
0	0	2	0	CCE	0	0	-	50	20
Total Hours									
0	0	26	Total: 26	ESE	0	0	-	50	20

Prerequisites: No Pre-requisite

Course Objectives:

1. Understand the fundamental concepts of design thinking and its relevance in mechanical engineering.
2. Apply design thinking methodologies to solve engineering problems creatively.
3. Analyze user needs and synthesize design solutions using structured ideation techniques.
4. Evaluate engineering design alternatives through prototyping and testing.
5. Create innovative and sustainable solutions using an iterative design approach.

Course Outcomes: Students will be able to		**BTL**
CO1	Apply the principles of Design Thinking to understand problem-solving approaches in engineering.	3
CO2	Demonstrate the use of empathy and user research in engineering design.	3
CO3	Analyze different ideation techniques to generate innovative solutions for engineering problems.	4
CO4	Evaluate and refine engineering design concepts using prototyping and feedback loops.	4
CO5	Develop innovative and sustainable solutions for real-world mechanical engineering problems.	5

Syllabus

Practical 1 – Introduction to Design Thinking & Engineering Problem-Solving (2 hrs)
Overview of the Design Thinking process, importance in mechanical engineering problem-solving, Case study discussion on innovative mechanical solutions

Practical 2 – Identifying and Defining Mechanical Engineering Problems (2 hrs)
Observing mechanical systems and identifying inefficiencies, Documenting problems and defining challenges

Practical 3 – Empathy & User Research (4 hrs)
Conducting user research through surveys & interviews, Understanding engineering problems from a user's perspective

Practical 4 – Understanding User Needs (2 hrs)
Creating Empathy Maps for identified problems, Refining problem statements using "How Might We" (HMW) questions

Practical 5 – Ideation Techniques (4 hrs)
Brainstorming and Mind Mapping, SCAMPER (Substitute, Combine, Adapt, Modify, Put to Another Use, Eliminate, Reverse), Prioritizing ideas using a decision matrix

Practical 6 – Concept Sketching & Storyboarding (2 hrs)
Translating abstract ideas into visual representations, Creating a Storyboard for design implementation

Practical 7 – Prototyping – Low-Fidelity Prototyping (4 hrs)
Building simple prototypes using paper, cardboard, tape, and glue, Testing mechanical interactions using physical models

Practical 8 – Testing, Feedback & Iterative Improvement (2 hrs)
Conducting prototype testing with peers, Collecting feedback & iterating based on test results

Practical 9 – Final Design Challenge (4 hrs)
Iteratively refining the prototype, Final presentation & demonstration of the improved solution

Reference Books

Textbooks

1. Brown, T. – Change by Design: How Design Thinking Creates New Alternatives for Business and Society (Harper Business, 2009)
2. Cross, N. – Engineering Design Methods: Strategies for Product Design (John Wiley & Sons, 5th Edition, 2011)
3. Dym, C. L., Little, P., & Orwin, E. – Engineering Design: A Project-Based Introduction (John Wiley & Sons, 4th Edition, 2013)
4. IDEO – Design Thinking Toolkit for Educators (IDEO, 2012)

Reference Books

1. Brown, T. – Design Thinking: A Quick Overview (Design Council, 2017)
2. Liedtka, J., & Ogilvie, T. – Designing for Growth: A Design Thinking Toolkit for Managers (Columbia University Press, 2011)
3. Pahl, G., & Beitz, W. – Engineering Design: A Systematic Approach (Springer, 3rd Edition, 2007)

NPTEL / SWAYAM Course

1) NPTEL – Design Thinking – A Primer (IIT Madras, Prof. B. Gurumoorthy)
   Link: https://nptel.ac.in/courses/110/106/110106124/
2) NPTEL – Innovation, Business Models, and Entrepreneurship (IIT Roorkee, Prof. Anil Gupta)
   Link: https://nptel.ac.in/courses/110/104/110104116/
3) SWAYAM – Design Thinking for Engineers and Managers (IIM Bangalore, Prof. Ashwin Mahalingam)
   Link: https://swayam.gov.in/nd2_imb20_mg14/preview
4) NPTEL – Product Design and Manufacturing (IIT Kanpur, Prof. Shantanu Bhattacharya)
   Link: https://nptel.ac.in/courses/112/104/112104262/
5) NPTEL Course(s) applicable for credit transfer as per Institute Policy

Research Papers

1) Mayer, S., & Schwemmle, M. (2025). The impact of design thinking and its underlying theoretical mechanisms: A review of the literature. *Creativity and Innovation Management*, *34*(1), 78-110.
2) Ferreira, I. C. M., Zanin, L. M., Prates, C. B., da Cunha, D. T., & Stedefeldt, E. (2025). Design thinking: An effective strategy to evolve food safety culture?. Food Control, 171, 111093.

Rubrics for Continuous Evaluation

Component	Parameters	Marks	Total	Pass
Continuous Comprehensive Evaluation (CCE)	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report of practical/s	10		
	Attendance	10		
End Semester Evaluation (ESE)	Prototype Demonstration & Testing	25	50	20
	Final Design Challenge Presentation	25		

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PS03
CO1	2	2	1	2	2	2	1	2	1	1	2	1	1	2
CO2	2	1	2	2	2	1	1	1	2	2	2	1	2	2
CO3	2	1	2	2	2	2	1	1	1	1	1	2	1	2
CO4	1	2	2	2	2	1	1	1	2	1	2	2	1	2
CO5	1	2	2	2	2	2	1	2	1	1	1	1	2	1

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | SY B Tech Semester III | 2024 Pattern
Course Code: ME124NC312, Course Title: Professional and Technical Communication 1
Category: Non Credit Course 2

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	2	0	CCE	--	--	--	50	20
Total Hours									
0	0	26	Total: 26	ESE	---	--		50	20

Prerequisites: Basic English Grammar Skills	
Course Objective: Purposes of Course are:	
1. This course is designed to equip students with essential professional and technical communication skills necessary for success in the modern workplace. 2. Emphasizing both written and verbal communication 3. The course covers a wide range of topics, including effective written communication, active listening and public speaking. 4. Develop strong aptitude & problem solving to clear company selection tests	
Course Outcomes: After Successful completion of course units, students will	
CO1	Analyse and evaluate spoken information critically for understanding the context and credibility of the source.
CO2	Demonstrate effective interpersonal communication skills for harmonious and productive interactions.
CO3	Articulate strategies for clear and coherent writing skills for personal & professional communication needs.
CO4	Develop skills for effective and authentic non-verbal communication to ace the professional communication needs.
CO5	Solve complex aptitude problems efficiently, improving selection test performance.

Syllabus

Unit I	Development of Listening and Speaking Skills	04 Hrs.
Introduction to Listening skills, Barriers to Listening skills, active Listening techniques, Listening for main ideas and details, Note taking strategies. Introduction to Speaking skills, Building vocabulary and fluency, Conversational Skills, Public speaking fundamentals. Speed and Fluency, Removing MTI.		

Unit II	**Development of Writing and Reading Skills**	**03 Hrs.**
Introduction to Effective Written Communication, fundamentals of grammar and punctuation, Paragraph Structure, Essay writing, Report writing, Formal letter writing. Importance of Reading, Comprehension and solving case studies, Synthesis writing		
Unit III	**Fundamentals of Technical Communication**	**03 Hrs.**
What is communication? Importance of communication, Communication Types – Verbal, Non-verbal, Why is non-verbal communication important? Making eye contact (or lack thereof), Shaking hands, -Crossing or uncrossing legs, Folding or unfolding arms, Fidgeting, Eye contact, Smiling or frowning, Communication styles		
Unit IV	**Business Communication**	**03 Hrs.**
Business communication theory, Email Etiquette, Digital Communication, Presentation Skills, Ethics in Business Communication, Kinesics and Pitch modulation		
Unit V	**Quantitative Aptitude**	**10 Hrs.**
1. Linear Equations, Quadratic Equations **2.** Profit and Loss **3.** Simple Interest and Compound Interest **4.** Time, Speed, and Distance - Basic **5.** Race & Game & Problem on Trains **6.** Time and Work		
Unit VI	**Verbal Ability**	**03 Hrs.**
1. Critical Reasoning & Analogies **2.** Sentence Correction - Intermediate and Advanced		
Reference Books		

1. Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson),2011, ISBN - 8131799905, 9788131799901
2. Communication Skills for Technical Students by T.M. Farhathullah (Orient Longman)2002, ISBN - 9788125022473
3. Written Communication in English by Saran Freeman (Orient Longman) 1977, 8125004262
4. Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP), 1990, ISBN 10-8175960299
5. Communication for Business: A Practical Approach by Shirley Tailor (Longman),2005, ISBN - 9780273687658
6. Developing Communication Skills by Krishna Mohan & Meera Banerji (Macmillan),2009, ISBN - 9780230638433

7. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill,2017, ISBN - 9789390113002
8. Technical communication: Principles and practice, Raman, Minakshi, and Sangita Sharma. 3rd ed. Oxford University Press, 2015, ISBN - 978-0199457496
9. https://ielts.org
10. NPTEL Course-Business English Communication IIT Madras
    Link https://youtu.be/GwF4ypDSr-A
11 NPTEL Course- Introduction to Effective Communication
    Link https://archive.nptel.ac.in/courses/109/104/109104030/

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code: ME124PC401, Course Title: Automotive Energy Technology (Group C)

Category: Program Core Course 5

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
3	0	0	3	CCE	50	20	40	-	-
Total Hours									
39	0	0	Total: 39	ESE	50	20			

Prerequisites: BSC2401L03 Engineering Physics, BSC2401P07 Engineering Physics Lab, BSC2402L06 Engineering Chemistry, BSC2402P08 Engineering Chemistry Lab

Course Objectives: Purposes of the course are

1. To understand the fundamental concepts, components, and working principles of internal combustion (IC) engines.
2. To analyze the combustion process, fuel injection systems, and factors affecting I.C. engine performance.
3. To develop skills in testing of I.C. Engine and Emission Controls.
4. To explore hybrid and electric vehicle technologies and Battery Thermal Management System.
5. To understand the working principles of Reciprocating and Rotary Air Compressor.

Course Outcomes: After successful completion of the course units the student will

CO	CO Statement	BTL
CO1	Explain the construction, classification, and applications of IC engines.	3
CO2	Analyze the combustion stages, fuel injection systems, and factors affecting detonation and knocking.	4
CO3	Analyze the IC engine performance parameters and emission control system.	4
CO4	Evaluate the architecture and Battery Thermal Management System of Hybrid and Electric Vehicle.	5
CO5	Evaluate performance characteristics of reciprocating air compressors.	5

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Syllabus

Unit I	**Fundamentals of IC Engine**	**10 hrs**
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.		
Unit II	**Internal Combustion Engine (ICE)**	**12 Hrs**
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, 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.		
Unit III	**IC Engine Testing, Emission**	**10 Hrs**
Engine Testing: Engine Testing Procedure, Measurement of indicated power, Brake power, fuel consumption, Air Consumption, Measurement of friction power by Willan's Line Method and Morse Test, calculation of mean effective pressure, various efficiencies, specific fuel consumption, heat balance sheet of IC Engines and performance Characteristic curves. **Emission & Control:** Introduction to Indian Driving Cycle (IDC), European Driving Cycle (EDC), SI and CI Engines Emission and controlling methods, Methods to measure emission such as (Non Dispersive Infrared Red (NDIR), Flame Ionization Detector (FID), Chemiluminescent Analyzer, Smoke meter), Euro Norms and Bharat Stage Norms.		
Unit IV	**Hybrid and Electric Vehicle Energy Systems**	**8 hrs**
Hybrid Vehicle Architecture and Energy Flow, Types of Hybrid Systems: Mild, Full, and Plug-in Hybrid (PHEV), Electric Vehicle (EV) Battery Technologies and Charging Infrastructure, Battery Management System (BMS) and Thermal Management.		
Unit V	**Compressor**	**10 Hrs**
Reciprocating Compressors: **Single-stage & Multi-stage Compressors** – Working, volumetric & isothermal efficiency, effect of clearance volume, Free Air Delivery (FAD). Intercoolers, after-coolers, and control mechanisms. Indicator diagram, optimum intermediate pressure. **Rotary Compressors** : Roots blower, vane-type, screw, and scroll compressors.		
Reference Books		

Textbook:

1. V. Ganesan, "Internal Combustion Engines", Tata McGraw-Hill.
2. Chan, C. C., & Chau, K. T. (2001). Modern electric vehicle technology. Oxford University Press.
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. Heywood, J. B. (1988). Internal combustion engine fundamentals. McGraw-Hill.
2. Husain, I. (2021). Electric and hybrid vehicles: Design fundamentals (3rd ed.). CRC Press.
3. Ehsani, M., Gao, Y., Longo, S., & Ebrahimi, K. (2018). Hybrid electric vehicles: Principles and applications with practical perspectives (2nd ed.). Wiley.
4. SAE International. Automotive energy and sustainability publications. SAE International.
5. Dossat Ray J, "Principles of refrigeration, S.I. version", Willey Eastern Ltd, 2000.
6. Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill
7. Domkundwar & Domkundwar, "Internal Combustion Engine", Dhanpat Rai & Co.
8. R. Yadav, "Internal Combustion Engine", Central Book Depot, Ahmedabad.
9. S.Domkundwar,C.P. Kothandaraman,A.Domkundwar,"Thermal Engineering",DhanpatRai & Co.

Research Papers

1. Bae, C., & Kim, J. (2017). Alternative fuels for internal combustion engines. *Proceedings of the Combustion Institute*, *36*(3), 3389-3413.
2. Boretti, A. (2024). A high-efficiency internal combustion engine using oxygen and hydrogen. *International Journal of Hydrogen Energy*, *50*, 847-856.

MOOCS

1.https://ocw.mit.edu/courses/2-61-internal-combustion-engines-spring-2017/

Vlab

1. http://vlabs.iitkgp.ernet.in/rtvlas/exp3/index.html
2. https://vmt-iitg.vlabs.ac.in/Water_cooling_tower(theory).html

NPTEL/SWAYAM

1. https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-me69/
2. https://es-pal.org/eltdashboard. ENERGY LITERACY TRAINING BY ENERGY SWARAJ FOUNDATION POWERED BY IITB.
3. NPTEL Course(s) applicable for credit transfer as per Institute Policy

Rubrics for Continuous Evaluation

For Theory CCE and ESE

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit test 1 (UT 1)			Unit test 2 (UT 2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO2	3	2	2	3	2	3	3	3	2	2	3	3	2	2
CO3	3	2	2	3	2	3	3	3	2	2	3	3	2	2
CO4	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO5	3	2	2	2	2	3	3	3	2	2	3	3	2	2

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code: ME124PC402, Course Title: Automotive Energy Technology Lab (Group C)

Category: Program Core Course 5 Lab

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
0	0	2	1	CCE	–	–		50	20
Total Hours									
0	0	26	Total: 26	ESE	–	–		50	20

Prerequisites: BSC2401L03 Engineering Physics, BSC2401P07 Engineering Physics Lab, BSC2402L06 Engineering Chemistry, BSC2402P08 Engineering Chemistry Lab

Course Objectives: Purposes of the course are

1. To understand the fundamental concepts, components, and working principles of internal combustion (IC) engines.
2. To analyze the combustion process, fuel injection systems, and factors affecting I.C. engine performance.
3. To develop skills in testing of I.C. Engine and Emission Controls.
4. To explore hybrid and electric vehicle technologies and Battery Thermal Management System.
5. To understand the working principles of Reciprocating and Rotary Air Compressor.

Course Outcomes: After successful completion of the course units the student will

CO	CO Statement	BTL
CO1	Explain the construction, classification, and applications of IC engines.	3
CO2	Analyze the combustion stages, fuel injection systems, and factors affecting detonation and knocking.	3
CO3	Analyze the IC engine performance parameters and emission control system.	4
CO4	Evaluate the architecture and Battery Thermal Management System of Hybrid and Electric Vehicle.	4
CO5	Evaluate performance characteristics of reciprocating air compressors.	5

Total 8 of the following list must be performed.

During Oral, the Student shall be evaluated based on the completion of Practical, Assignments, Presentations and Detailed Industrial Visit Report.

Practical

Any Four practical's are mandatory out of Sr.No. 1 to 6.

1. To calculate Friction Power by Morse Test on Petrol engine.
2. Trial on Diesel engine to calculate performance parameters.
3. Trial on Petrol engine to calculate performance and emission characteristics.
4. To plot the P-Ɵ diagram for combustion analysis in SI Engine
5. Demonstration on Exhaust Gas Analyzer and Smoke meter.
6. Trial on Positive Displacement Air Compressor.

Any Three Practical's from Sr.No 7 to 11.

7. Study the different alternative fuels for IC Engine
8. Demonstration of Hybrid Vehicle.
9. Study of Electric vehicle and its component.
10. Practical Survey of various fuel supply systems.
11. Practical Survey of supercharged and turbocharged engines.

Mandatory Industrial Visit:

12. Industrial Visit to Automotive Workshop to understand various working Components of I.C. Engine.

Reference Books

Textbook:

1. V. Ganesan, "Internal Combustion Engines", Tata McGraw-Hill
2. M. L. Mathur and R.P. Sharma, "A course in Internal combustion engines", Dhanpat Rai & Co.
3. Chan, C. C., & Chau, K. T. (2001). Modern electric vehicle technology. Oxford University Press.
4. H.N. Gupta, "Fundamentals of Internal Combustion Engines", PHI Learning Pvt. Ltd.

Reference Books:

5. Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill
6. Domkundwar & Domkundwar, "Internal Combustion Engine", Dhanpat Rai & Co.
7. R. Yadav, "Internal Combustion Engine", Central Book Depot, Ahmedabad.
8. S.Domkundwar,C.P. Kothandaraman,A.Domkundwar,"Thermal Engineering",DhanpatRai & Co.

Research Paper

9. Bae, C., & Kim, J. (2017). Alternative fuels for internal combustion engines. *Proceedings of the Combustion Institute*, *36*(3), 3389-3413.
10. Boretti, A. (2024). A high-efficiency internal combustion engine using oxygen and hydrogen. *International Journal of Hydrogen Energy*, *50*, 847-856.
11. Goyal, H., Jones, P., Bajwa, A., Parsons, D., Akehurst, S., Davy, M. H., ... & Esposito, S. (2024). Design trends and challenges in hydrogen direct injection (H2DI) internal combustion engines–A review. *International Journal of Hydrogen Energy*, *86*, 1179-1194.

MOOCS

1.https://ocw.mit.edu/courses/2-61-internal-combustion-engines-spring-2017/

Vlab

1. http://vlabs.iitkgp.ernet.in/rtvlas/exp3/index.html
2. https://vmt-iitg.vlabs.ac.in/Water_cooling_tower(theory).html

NPTEL/SWAYAM

1. https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-me69/
2. https://es-pal.org/eltdashboard. ENERGY LITERACY TRAINING BY ENERGY SWARAJ FOUNDATION POWERED BY IITB.
3. NPTEL Course(s) applicable for credit transfer as per Institute Policy

Rubrics for Continuous Evaluation

Component	Parameters	Marks	Total	Pass
CCE	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Semester Evaluation (ESE)	Performance (External)	25	50	20
	Oral Examination (External)	25		

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO2	3	2	2	3	2	3	3	3	2	2	3	3	2	2
CO3	3	2	2	3	2	3	3	3	2	2	3	3	2	2
CO4	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO5	3	2	2	2	2	3	3	3	2	2	3	3	2	2

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | Second Year B Tech Semester IV | 2024 Pattern

Course Code: ME124PC403, Course Title: Engineering Materials and Metallurgy (Group C)

Category: Program Core Course 6

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours									
26	0	0	Total: 26	ESE	50	20			

Prerequisites: (BSC2401L03) Engineering Physics, (BSC2402L06) Engineering Chemistry, (RNA2402L14) Elements of Mechanical Engineering

Course Objective: Purposes of the course are

1) To explore the generation & application of knowledge relating the composition, structure and processing of materials to their uses.

2) To apply the phase diagrams to determine the stability and transformation of phases in materials.

3) To indicate the importance of heat treatment on structure and properties of materials.

4) To explain various characterization techniques.

5) To analyze the process of identifying and choosing the most suitable materials for a particular application in engineering

	Course Outcomes: After successful completion of the course the student will be able to	**BTL**
CO1	**ANALYZE** defect in crystal structure by comparing body centered cell, face centered cell &hexagonal close packed cell crystal structures on Position of atoms or molecules.	4
CO2	**ANALYZE** different parameter of the system like phases, variables, component, grains, grain boundary& degree of freedom to find optimal condition for manufacturing process.	4
CO3	**ANALYZE** effect of heat treatment process like Annealing, Normalizing, Hardening, tempering etc. to improve the performance& longevity of components.	4
CO4	**DIFFERENTIATE** & **DETERMINE** Mechanical behavior of materials How it deforms due to external force using mechanical properties such as strength, hardness, stiffness, ductility etc.	4
CO5	**SELECT** appropriate ferrous materials, Nonferrous materials to determine thebest material for a specific job by understanding its properties and helps to identify their properties & uses.	5

B Tech in Mechanical Engineering | Second Year B Tech Semester IV | 2024 Pattern Syllabus

Unit I	**Classification and Structure of Materials**	**5 Hrs**

Classification of materials: metals, ceramics, polymers and composites.

Nature of bonding in materials: metallic, ionic, covalent and mixed bonding;

S**tructure of materials:** Study of Crystal structures BCC, FCC, HCP and lattice parameters & properties, Miller indices, Crystal imperfections, and Diffusion Mechanisms fundamentals of crystallography, crystal systems, Bravais lattices, unit cells, primitive cells, crystallographic planes and directions

Defects in crystalline materials: 0-D, 1-D and 2-D defects; vacancies, interstitials, solid solutions in metals and ceramics, point defects, line defects- edge and screw dislocations, surface defects, volume defects Frenkel and Schottky defects; dislocations; grain boundaries, twins, stacking faults; surfaces and interfaces.

Unit II	**Phase Diagrams and Iron-Carbon Diagram**	**5 Hrs**

Solid solutions: Introduction, Types, Humerothery rule for substitutional solid solutions

Solidification: Nucleation & crystal growth, solidification of pure metals, solidification of alloys.

Phase Diagrams: Cooling curves, types of phase diagrams, Gibbs phase rules

Iron-Carbon Diagram: Iron-carbon equilibrium diagrams in detail with emphasis in the invariant reactions.

Unit III	**Heat Treatments**	**5 Hrs**

Austenite transformation in steel: Time temperature transformation diagrams, continuous cooling transformation diagrams. Retained austenite and its effect

Steps in Heat treatment and Cooling Medium

Heat Treatment Processes:

Introduction, Annealing (Full annealing,Process,annealing, Spheroidise annealing, isothermal annealing, stress relief annealing),Normalising, Hardening, Tempering, Austempering, Martempering, Sub-Zero Treatment, Hardenability

Surface Hardening: Classification, Flame hardening, Induction hardening, Carburising, Nitriding, Carbonitriding.

Unit IV	**Material Testing and Characterization Techniques**	**5 Hrs**

Destructive Testing: Impact test, Cupping test and Hardness test

Non-Destructive Testing: Eddy current test, Sonic & Ultrasonic testing, X-ray Radiography testing (Principle and Applications only)

Microscopic Techniques: Sample Preparation and etching procedure, optical microscopy, Electronic microscopy - only SEM, TEM and X-ray diffraction (Principle and Applications only), Raman Spectroscopy.

Macroscopy: Sulphur printing, flow line observation, spark test

Unit V	Ferrous Materials and Non Ferrous Materials	6 Hrs

Ferrous Materials: Carbon Steel: Classification, types & their composition, properties and Industrial application

Designation of carbon steel and alloy steels as per IS, AISI, SAE Standards

Cast Iron: Classification, types & their composition, properties and Industrial application of (White CI, Gray CI, SG CI, Malleable Cast and alloy Cast Iron)

Non-Ferrous Materials:
Classification of nonferrous metals. Importance of nonferrous metals in engineering applications & compositions, study of different mechanical properties: Bearing materials: important properties & applications.

TextBooks

1. Dr.V.D.Kodgire&S.V.Kodgire,"MaterialScience&MetallurgyForEngineers",Everest Publication.
2. WilliamD.Callister,"MaterialsScienceandEngineeringanIntroduction",Jr,JohnWiley& Sons, Inc.

ReferenceBooks

1. R. Abbaschian, R.E. Reed-Hill, Physical Metallurgy Principles, 4th ed., Cengage Learning, 2009.
2. D.R. Askeland, P.P. Phule, W.J. Wright, The Science and Engineering of Materials, 6th ed., Cengage Learning, 2010.
3. A. K. Bhargava, C.P. Sharma, "Mechanical Behaviour & Testing of Materials", P H I LearningPrivate Ltd.
4. B.S. Mitchell, An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, 1st ed., Wiley- Interscience, 2003.
5. V. Raghavan, Materials Science & Engineering: A first course, 5th ed., PHI Learning, 2004

Virtual Lab

1) https://sm-nitk.vlabs.ac.in/exp/izod-impact-test/
2) https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test/

Swayam / NPTEL Courses

1)https://onlinecourses.swayam2.ac.in/nou23_me05/preview

2) NPTEL Course(s) applicable for credit transfer as per Institute Policy.

MOOC Courses

1) https://www.mooc-list.com/tags/materials-science

Research Papers

1. Wang, B., Hu, S., Teng, Y., Chen, J., Wang, H., Xu, Y., ... & Gao, X. (2024). Current advance of nanotechnology in diagnosis and treatment for malignant tumors. *Signal Transduction and Targeted Therapy*, *9*(1), 200.

2. Bobokulova, M. (2024). THE ROLE OF NANOTECHNOLOGYIN MODERN PHYSICS. *Development and innovations in science*, *3*(1), 145-153.

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit test 1 (UT 1)			Unit test 2 (UT 2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO2	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO3	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO4	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

B Tech in Mechanical Engineering | Second Year B Tech Semester IV | 2024 Pattern

Course Code: ME124PC404, Course Title: Engineering Materials and Metallurgy Lab (Group C)

Category: Program Core Course 6 Lab

<table>
<tr><th colspan="4">Teaching Scheme</th><th colspan="5">Evaluation Scheme</th></tr>
<tr><th rowspan="2">L</th><th rowspan="2">T</th><th rowspan="2">P</th><th rowspan="2">Cr</th><th rowspan="2">Exam</th><th colspan="2">Theory % Marks</th><th colspan="3">Practical % Marks</th></tr>
<tr><th>Max</th><th>Min for Pass</th><th>Max</th><th colspan="2">Min for Pass</th></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td><td rowspan="2">CCE</td><td rowspan="2"></td><td rowspan="2"></td><td>50</td><td>20</td><td rowspan="2">40</td></tr>
<tr><td colspan="4">Total Hours</td><td>50</td><td>20</td></tr>
<tr><td>0</td><td>0</td><td>26</td><td>Total: 26</td><td>ESE</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Prerequisites: (BSC2401L03) Engineering Physics, (BSC2402L06) Engineering Chemistry, (RNA2402L14) Elements of Mechanical Engineering

Course Objective: Purposes of the course are

1) To explore the generation & application of knowledge relating the composition, structure and processing of materials to their uses.
2) To apply the phase diagrams to determine the stability and transformation of phases in materials.
3) To indicate the importance of heat treatment on structure and properties of materials.
4) To explain various characterization techniques.
5) To analyze the process of identifying and choosing the most suitable materials for a particular application in engineering

Course Outcomes: After successful completion of the course the student will be able to		**BTL**
CO1	**ANALYZE** defect in crystal structure by comparing body centered cell, face centered cell &hexagonal close packed cell crystal structures on Position of atoms or molecules.	4
CO2	**ANALYZE** different parameter of the system like phases, variables, component, grains, grain boundary& degree of freedom to find optimal condition for manufacturing process.	4
CO3	**ANALYZE** effect of heat treatment process like Annealing, Normalizing, Hardening, tempering etc. to improve the performance& longevity of components.	4
CO4	**DIFFERENTIATE** & **DETERMINE** Mechanical behavior of materials How it deforms due to external force using mechanical properties such as strength, hardness, stiffness, ductility etc.	4
CO5	**SELECT** appropriate ferrous materials, Nonferrous materials to determine thebest material for a specific job by understanding its properties and helps to identify their properties & uses.	5

Syllabus

Conduct any six practical's from the following list of experiments. Kindly ensure timely completion and assessment of practical file for these experiments

1. Destructive testing - Hardness testing (Rockwell/Vickers) Hardness conversion number
2. Brinell and Poldi hardness Test
3. Impact Test for Steel, Aluminum, Brass and Copper (Charpy/Izod)
4. Non-Destructive testing - Dye Penetrant Test/ Magnetic Particle test/ Ultrasonic Test
5. Steps for Specimen Preparation for microscopic examination & Demonstration of Optical Metallurgical microscope
6. Observation and Drawing of Microstructure of Steels, Cast Iron of various compositions
7. Observation and Drawing of Microstructure of Non-Ferrous Metals of various compositions
8. Heat Treatment of steels based on relative hardness
9. Jominy End Quench Test for hardenability

Compulsory Assignments

1. Exploration of engineering Alloy (Name, composition, properties, microstructure, Heat treatment, Designation & specific application)- One student one Alloy or material

2. Examine aspects of component form material and manufacturing process point of view (Name, Material, Drawing, Manufacturing Process, properties, microstructure, Heat treatment, & specific applications) - For example spur gear, Needle etc. One student one component

Rubrics for Continuous Evaluation

Component	Parameters	Marks	Total	Pass
Continuous Comprehensive Evaluation CCE	Viva Voce for assessment of Understanding	20	50	20
	Report on (Component based study)	10		
	Timely completion and assessment of practical file	10		
	Attendance	10		
End Semester Evaluation (ESE)	Performance (External)	25	50	20
	Oral Examination (External)	25		

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO2	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO3	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO4	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code: ME124PC405 **Course Title:** Kinematics of Mechanisms & Machines (Group C)

Category: Program Core Course 7

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
02	01	0	03	CCE	50	20	40	-	-
Total Hours									
26	13	0	Total: 39	ESE	50	20			

Prerequisites:- BSC2401L03 Engineering Physics, BSC2401P07 Engineering Physics Lab,

Course Objectives: The purposes of the course are

1. To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.
2. To develop the competency to understand & apply the principles of gear theory to design various applications
3. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.
4. To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.
5. To develop the competency to design a cam profile for various follower motions.

Course Outcomes: On completion of the course, learner will be able to		
COs	COs Statement	**BT Level**
CO1	**APPLY** fundamental kinematic principles to analyze and solve problems related to motion in simple mechanisms	**3**
CO2	**APPLY** the fundamental principles and practical considerations involved in designing efficient, durable, and reliable gears.	**4**
CO3	**ANALYSIS** Velocity and acceleration the vector is extended to handle more complex and real-world mechanisms.	**4**
CO4	**SYNTHESIZE** of Four-Bar and Single Slider Crank mechanisms using type, number, and dimensional synthesis, applying graphical and analytical methods for motion, function, and path generation.	**5**
CO5	**CREATE** fundamentals of cam follower, including kinematics**,** geometry**,** performance analysis**,** and real-world applications	**6**

Syllabus

Unit I	**Fundamentals of Mechanism**	**4 hrs**
Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom, Mobility of Mechanism, Inversion, Grashoff's law, Four-Bar Chain and its Inversions, Slider crank Chain and its Inversions, Double slider crank Chain and its Conversions, Mechanisms with Higher pairs		
Unit II	**Gears**	**6 hrs**
Gear: Classification Spur Gear: Terminology, law of gearing, Involute and cycloidal tooth profile, path of contact, arc of contact, sliding velocity, Interference and undercutting, Minimum number of teeth to avoid interference, Force Analysis (theoretical treatment only) Helical and Spiral Gears: Terminology, Geometrical Relationships, virtual number of teeth for helical gears Bevel Gear & Worm and Worm Wheel: Terminology, Geometrical Relationships Gear Train: Types, simple, compound and Epicyclic gear Trains, compound Epicyclic gear Train		
Unit III	**Kinematic Analysis of Mechanisms: Analytical Method**	**6 hrs**
Analytical methods for displacement, velocity and acceleration analysis of slider crank Mechanism, Velocity and acceleration analysis of Four-Bar and Slider crank mechanisms using Vector and Complex Algebra Methods. Computer-aided Kinematic Analysis of Mechanism like Slider crank and Four-Bar mechanism, Analysis of Single and Double Hook's joint.		
Unit IV	**Synthesis of linkages**	**5 hrs**
Type synthesis, Number Synthesis, Dimensional synthesis, Tasks of Kinematic synthesis - Path, function and motion generation, Precision Positions, Chebychev spacing, Mechanical and structural errors. Graphical Synthesis Inversion and relative pole method for three position synthesis of Four-Bar and Single Slider Crank Mechanisms. Analytical Synthesis Three position synthesis of Four-Bar mechanism using Freudenstein's equation		
Unit V	**Cam and Follower**	**5 hrs**
Introduction, Classification of Followers and Cams, Terminology of Cam Displacement diagram for the Motion of follower as Uniform velocity, Simple Harmonic Motion, Uniform Acceleration and Retardation Motion, Cycloid motion, Cam Profile construction for Knife-edge Follower and Roller Follower, Cam jump Phenomenon.		

List of Tutorials [13 hrs]

Group A (Tutorial 1 is compulsory Select any one from Tutorial # 2 to 3, and 4 Tutorial is compulsory)

1. To make a model of any mechanism by using waste material by the group of 4 to 6 students and to give a presentation using PPTs. [2 hrs]
2. Speed and torque analysis of epicyclic gear train to determine holding torque. [1 hrs]
3. To study and verify cam jump phenomenon. [1 hrs]
4. To study manufacturing of gear using gear generation with rack as a cutter and to generate an involute profile. [1 hrs]

Group B (All Tutorial are compulsory)

1. Identify mechanisms in real life and Analyze for types and number of links, pairs,

obtain degrees of freedom. Submit the sheet and working video of the mechanism. [1 hrs]
2. To study various types of gearboxes. [1 hrs]
3. To draw cam profile for any two problems with combination of various follower motion with radial and off-set cam. [2 hrs]

Group C(Any 3 Tutorials)

1. To design a simple Planer Mechanism by using any software (Geogebra, SAM, Working Model, any 3D Modelling Software, etc.) [1 hrs]
2. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for Kinematic Analysis of Slider Crank Mechanism using Analytical Method. [1 hrs]
3. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for Kinematic Analysis of Hooke's joint Mechanism using Analytical Method. [1 hrs]
4. To generate a Cam Profile using any Modelling Software (Mech Analyser, any 3D Modelling Software) [1 hrs]
5. To synthesize the Four-Bar and Slider Crank Mechanism (Geogebra, SAM, any 2D/3D Modelling Software. [1 hrs]
6. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for the Synthesis of Mechanism using Chebychevs spacing, Freudensteins equation and function generation. [1 hrs]

Group D(2 VLab are Compulsory)

1. Mechanisms and Robotics - Oldham Coupling Mechanism. [1 hrs]
2. Mechanisms and Robotics - Quick Return Mechanism. [1 hrs]
3. Mechanisms and Robotics CAM Follower Mechanism. [1 hrs]

Reference Books

1. Engineering Mechanics by S. P. Timoshenko and D. H. Young, McGraw- Hill publication.
2. Engineering Mechanics by J. L. Meriam and Craige, John Willey.
3. Engineering Mechanics by F L Singer, Harper and Rowe publication.
4. Engineering Mechanics by A. P. Boresi and R. J. Schmidt, Brooks/Cole Publication.

NPTEL Courses: - NPTEL Course(s) applicable for credit transfer as per Institute Policy. https://onlinecourses.nptel.ac.in/noc20_me21/preview

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation CCE	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			
End Semester Examination (ESE)	**Institute**	**10**	**10**	**10**	**10**	**10**	**50**	**20**

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern
CO-PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2.25	3	2.25	3	3	3	3	1.5	1.8	3	3	1.5	1.5
CO2	3	3	2	3	3	3	3	3	3	2.4	3	3	2	2
CO3	3	3	2.5	3	3	3	3	3	2.5	3	3	3	2.5	2.5
CO4	3	3	2	3	3	3	3	3	2	2.4	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping.

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code:ME124MD406, Course Title: Energy Storage and Control Strategies in Electric Vehicles (Group C)

Category: Multidisciplinary Minor 2

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours									
26	0	0	Total: 26	ESE	50	20			

Prerequisites: BSC2401L03 Engineering Physics, BSC2401P07 Engineering Physics Lab, BSC2402L06 Engineering Chemistry, BSC2402P08 Engineering Chemistry Lab

Course Objectives: Purposes of the course are

1. To understand the role of supercapacitors and control strategies used in electric and hybrid vehicles.
2. To explore various hybrid electric vehicle (HEV) architectures, drive-train topologies, and power flow control strategies.
3. To analyze different driving cycles used for vehicle testing and their impact on energy consumption and fuel efficiency.
4. To study different energy storage systems, including battery technologies and their applications in electric vehicles.
5. To evaluate battery cooling systems and thermal management techniques for improving efficiency and safety in electric vehicles.

Course Outcomes: After successful completion of the course units the student will

CO	CO Statement	BTL
CO1	Apply the principles of supercapacitors, power electronics configurations, and control strategies used in electric vehicles.	3
CO2	Demonstrate an understanding of hybrid electric vehicle technologies, including architecture, working principles, and efficiency analysis.	3
CO3	Analyze different driving cycles and their impact on the energy consumption and performance of hybrid and electric vehicles.	4
CO4	Compare various energy storage systems, including different battery technologies, and evaluate their applications in electric vehicles.	4
CO5	Evaluate battery cooling systems and thermal management techniques to enhance battery safety, efficiency, and performance.	5

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Syllabus

Unit I	**Super capacitor and Control strategies used in electric vehicle**	**5 hrs**
Types of Super capacitor and its application, EV and EHV configuration based on power electronics, Series Hybrid configuration, Parallel Hybrid configuration, Control strategies used in electric vehicle, Torque and speed coupling, Battery Control Unit, A Motor Control Unit (MCU) , Modes of Control, The Stability Control System, Driver Mode System (DMS) , Electronic Control Unit [ECU], Battery/Cell Control System, Speed control for constant torque		
Unit II	**Hybrid Electric Vehicle Technologies**	**5 hrs**
Classification of HEV: Architecture, Construction, Working, Advantages and Limitations of Conventional and Gridable HEV, Classification of Conventional HEV, Types of Gridable HEV, Tractive force, Power and Energy requirements for standard drive cycles of HEV, Hybrid Electric Drive-Trains: Basic concept of Hybrid Traction, introduction to various hybrid Drive-Train Topologies, Power flow Control in Hybrid Drive-Train Topologies, Fuel Efficiency Analysis, Control Strategy: Supervisory Control, Selection of Modes.		
Unit III	**Driving Cycles for Electric Vehicles**	**5 hrs**
European driving cycles The NEDC, The Artemis driving cycle, American driving cycles FTP-75 cycle, Highway Fuel Economy Test cycle, Other test cycles such as Japanese driving cycles The 10-15 mode cycle, The JC08 cycle, Global harmonized driving cycle, Class 3 cycle, Class 2 cycle, Class 1 cycle, Heavy duty test cycles, Hybrid Electric Drive-Trains, The Series Hybrid, The Parallel Hybrid, The Power Split Hybrid, Through the Road Hybrid, Basic concept of Hybrid Traction, Fuel Efficiency Analysis, Control Strategy: Supervisory Control, Selection of Modes		
Unit IV	**Energy Storage System**	**5 hrs**
Energy storage system, Lead Acid Battery, Ni-Cd Batteries, Ni-MH Battery, Li-Po Battery, Lithium Battery Pack Assembly Process.		
Unit V	**Liquid and Air Cooling system of Batteries**	**6 hrs**
Comparative Analysis of Battery, Cooling System and Thermal Management, Battery Thermal Management System (BTMS), Cooling Medium for BTMS, PCMs, Flat Heat pipe cooling, Air Cooling and Liquid Cooling of Battery, Battery safety and maintenance, Battery parameters.		

Reference Books

Textbook:

1. Chan, C. C., & Chau, K. T. (2001). Modern electric vehicle technology. Oxford University Press.
2. Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives – Chris Mi, M. Abul Masrur, and David Wenzhong Gao, Wiley
3. Energy Storage for Sustainable Microgrid – David Wenzhong Gao, Elsevier
4. Automotive Control Systems: For Engine, Driveline, and Vehicle – Uwe Kiencke and Lars Nielsen, Springer
5. Electric Vehicle Technology Explained – James Larminie and John Lowry, Wiley

Reference Books:

1. Husain, I. (2021). Electric and hybrid vehicles: Design fundamentals (3rd ed.). CRC Press.
2. R. Yadav, “Internal Combustion Engine”, Central Book Depot, Ahmedabad.

3. Modern Electric, Hybrid Electric & Fuel Cell Vehicles – Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, CRC Press
4. Battery Systems Engineering – Christopher D. Rahn and Chao-Yang Wang, Wiley
5. Supercapacitor Technology: Fundamentals and Applications – J. M. Miller, Wiley
6. Advanced Electric Drive Vehicles – Ali Emadi, CRC Press
7. Thermal Management of Batteries for Electric Vehicles – Ibrahim Dincer and Halil S. Hamut, Elsevier

Research Papers

1. Zhang, J., Che, Y., Teodorescu, R., Song, Z., & Hu, X. (2025). Energy storage management in electric vehicles. Nature Reviews Clean Technology, 1-15.
2. Khalid, S. (2025). A Comprehensive Review of Advanced Control Strategies for Hybrid Electric Vehicles. Hybrid Electric Vehicles and Distributed Renewable Energy Conversion: Control and Vibration Analysis, 55-98.

MOOCS

1. NPTEL Course on 'Introduction to Hybrid Electric Vehicles' by IIT Guwahati https://archive.nptel.ac.in/courses/108/103/108103009/#
2. NPTEL Course(s) applicable for credit transfer as per Institute Policy

Rubrics for Continuous Evaluation

For Theory CCE and ESE

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit test 1 (UT 1)			Unit test 2 (UT 2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO2	3	2	2	3	2	3	3	3	2	2	3	3	2	2
CO3	3	2	2	3	2	3	3	3	2	2	3	3	2	2
CO4	3	2	2	3	2	3	3	3	3	2	3	3	2	2
CO5	3	2	2	2	2	3	3	3	2	2	3	3	2	2

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | Second Year B Tech Semester IV | 2024 Pattern

Course Code: ME124OE407, Course Title: Corporate Social Responsibility (Group C)

Category: Open Elective Course 2

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours									
26	0	0	Total: 26	ESE	50	20			

Prerequisites: No Prerequisite

Course Objectives: After successful completion of the course the student will be able to

1. Understand the fundamental concepts, principles, and significance of Corporate Social Responsibility (CSR).
2. Analyze the legal, ethical, and business perspectives of CSR in various industries.
3. Explore the role of CSR in sustainable development and environmental responsibility.
4. Examine global CSR initiatives and best practices adopted by corporations.
5. Develop innovative CSR strategies that align with business goals and societal expectations.

Course Outcomes:		BT Level
CO1	**Apply** CSR principles to real-world corporate scenarios and business models	3
CO2	**Implement** ethical business practices by integrating CSR into corporate governance	3
CO3	**Analyze** the impact of CSR initiatives on stakeholders and sustainable business practices	4
CO4	**Examine** global CSR frameworks and evaluate their effectiveness in different industries	4
CO5	**Design** innovative CSR strategies that balance profitability and social responsibility	5

Syllabus

Unit I	Concepts in Corporate Social Responsibility	5
Definition, evolution, and significance of CSR, Business ethics and corporate governance, CSR and its role in sustainable development, Theories and models of CSR		
Unit II	**Legal and Ethical Aspects of Corporate Social Responsibility**	**5**
CSR laws and regulations in India and globally, Ethical decision-making in business, Corporate accountability and transparency, Case studies on CSR and legal compliance		
Unit III	**Corporate Social Responsibility and Stakeholder Engagement**	**5**
Identifying and managing stakeholder expectations, Socially responsible investing (SRI), CSR reporting and communication strategies, Impact assessment of CSR activities		

Unit IV	**Global Corporate Social Responsibility Practices and Case Studies**	**5**
CSR initiatives by multinational corporations, Sustainable supply chain management, Environmental responsibility, and climate action, Comparative study of CSR strategies in different industries		
Unit V	**Corporate Social Responsibility Strategy and Implementation**	**6**
Developing a CSR strategy aligned with business objectives, Social innovation and entrepreneurship, Measuring CSR effectiveness and impact, Future trends and emerging areas in CSR		

Text Books:

1. Baxi, C.V., & Prasad, R. (2016) – Corporate Social Responsibility: Concepts and Cases (Excel Books)
2. Kotler, P., & Lee, N. (2005) – Corporate Social Responsibility: Doing the Most Good for Your Company and Your Cause (Wiley)
3. Crane, A., Matten, D., & Spence, L. J. (2019) – Corporate Social Responsibility: Readings and Cases in a Global Context (Routledge)

References Books:

1. Carroll, A. B., & Buchholtz, A. K. (2014) – Business & Society: Ethics, Sustainability & Stakeholder Management (Cengage Learning)
2. Werther, W. B., & Chandler, D. (2010) – Strategic Corporate Social Responsibility: Stakeholders in a Global Environment (SAGE Publications)
3. Blowfield, M., & Murray, A. (2019) – Corporate Responsibility (Oxford University Press)
4. Visser, W. (2011) – The Age of Responsibility: CSR 2.0 and the New DNA of Business (Wiley)
5. Chatterji, A. K., Levine, D. I., & Toffel, M. W. (2021) – Can Business Save the Earth? Innovating Our Way to Sustainability (Routledge)

Journal Papers :-

1. Uvet, H., Park, A., Dickens, J., Oh, J., & Hazen, B. (2025). How blockchain technology utilization influences corporate social responsibility through supply chain transparency and the role of supplier risk. The International Journal of Logistics Management.
2. Gagliardi, A. R., & Tomaselli, G. (2025). Aligning corporate social responsibility with artificial intelligence in healthcare in the context of the post-COVID-19 recovery: a viewpoint. Journal of Health Organization and Management.
3. Wang, C., Tang, F., Zhang, Q., & Zhang, W. (2025). How does corporate social responsibility contribute to innovation performance? The moderating role of social media strategic capability and big data analytics capability. European Journal of Innovation Management, 28(2), 631-655.

NPTEL Courses:

1. Course on ‘Corporate Social Responsibility’ By Prof. Aradhna Malik, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc21_mg54/preview
2. NPTEL courses applicable for credit transfer as per Institute Policy.

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			
End Semester Examination (ESE)	**Institute**	**10**	**10**	**10**	**10**	**10**	**50**	**20**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	2	1	1	1	1	2	1	2	2
CO2	1	1	1	1	1	2	1	1	1	1	2	1	2	2
CO3	1	1	1	1	1	2	2	1	1	1	2	1	2	2
CO4	1	1	1	1	2	2	2	2	1	1	2	1	2	2
CO5	1	1	1	1	2	2	2	2	1	1	2	1	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to SavitribaiPhule Pune University, Pune

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code: ME124VS408, Course Title: Manufacturing Practices

Category: Vocational and Skill Enhancement Course 3

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min for Pass		Max	Min for Pass
1	0	0	1	CCE	50	20	20	-	-
Total Hours									
13	0	0	Total: 13	ESE	-	-			

Prerequisites: No Prerequisites

Course Objectives: Purposes of the course are

1. Understand basic workshop processes, tools, and machines used in manufacturing.
2. Gain knowledge of operations like turning, forging, pattern making, and welding.
3. Develop practical skills in interpreting block diagrams and mechanisms of workshop machines.
4. Analyze casting processes, superfinishing techniques, and their industrial applications.
5. Evaluate welding techniques, joint testing, and defect identification for quality assurance.

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

CO1	Explain the fundamentals of workshop machines and their operations.
CO2	Demonstrate knowledge of forging, turning, pattern making, and welding processes.
CO3	Identify and interpret block diagrams and mechanisms of workshop machines.
CO4	Analyze casting processes and superfinishing techniques.
CO5	Evaluate welding processes, symbols, joint testing, and defect identification.

Syllabus

Unit I	**Turning and Forging Processes**	**3 hrs**
Plane turning, taper turning, and thread cutting, Forging and grinding of lathe tools (knife-edge and vee tools), Applications and advantages of these processes		
Unit II	**Pattern Making and Welding**	**3 hrs**
Pattern-making techniques and applications, Wood turning and design of solid patterns, Gas and arc welding principles, techniques, and applications, Safety precautions in welding		
Unit III	**Block Diagrams and Mechanisms**	**3 hrs**
Block diagrams: Lathe, milling machine, radial drilling machine, and cylindrical grinder Mechanisms: All-geared headstock of a lathe, Spindle arbor drive of a milling machine, Crank and slotted lever quick return drive of shaping machines, Spindle assembly of drilling machines		

Unit IV	**Casting Processes and Superfinishing Techniques**	**2 hrs**
Types of patterns and casting methods, Honing and buffing: Principles, methods, and applications Industrial use cases of casting and superfinishing processes		
Unit V	**Welding Symbols, Testing, and Defects**	**2 hrs**
Classification of welding processes, Types of welding symbols and joints, Techniques for testing welded joints, Welding defects: Causes and remedies		

Books & Other Resources

Text Books

1. Hajra Choudhury, S.K., & Hajra Choudhury, A.K. Workshop Technology Vol. 1 & 2. Media Promoters and Publishers.
2. Rao, P.N. Manufacturing Technology: Foundry, Forming, and Welding. Tata McGraw Hill..

Reference Books

1. Jain, R.K. Production Technology. Khanna Publishers.
2. Chapman, W.A.J. Workshop Technology for Engineers. Elsevier Science.
3. Black, Bruce J. Workshop Processes, Practices, and Materials. Routledge.

Virtual Labs:

1. Virtual Lab on Manufacturing Processes
   http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/index.html

NPTEL / SWAYAM Courses

1. NPTEL course on Fundamentals of Manufacturing Processes by Prof. D.K. Dwivedi, Department of Mechanical and Industrial Engineering, IIT Roorkee
   https://archive.nptel.ac.in/courses/112/107/112107219/#

MOOC

1. Course on Materials Processing (Casting, Forming and Welding) By Prof. Swarup Bag, IIT Guwahati
https://onlinecourses.nptel.ac.in/noc24_me108/preview

Research Papers

1. Gopal, K., Bhavana, G., Kaushik, A., Al-Jawahry, H. M., Gupta, L. R., Pahwa, S., & Bandhu, D. (2024). Review of Multiscale Modeling and Simulation Techniques in Metal Forming, Bending, Welding, and Casting Processes for Enhanced Predictive Design and Analysis. In E3S Web of Conferences (Vol. 505, p. 03004). EDP Sciences.

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern
Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	0	1	1	0	2	2	1	1	1	1
CO2	3	2	2	2	0	1	1	0	2	2	1	1	1	1
CO3	3	3	2	2	0	2	2	0	2	2	1	1	1	1
CO4	3	2	2	0	0	2	2	0	2	2	2	1	1	1
CO5	3	3	2	0	0	2	2	0	2	2	1	1	1	1

3: High, 2: Moderate, 1: Low, 0: No Mapping

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to SavitribaiPhule Pune University, Pune

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code: ME124VS409, Course Title: Manufacturing Practices Lab

Category: Vocational and Skill Enhancement Course 3 Lab

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	2	1	CCE	-	-	-	50	20
Total Hours									
0	0	26	Total: 26	ESE	-	-		-	-

Prerequisites: No Prerequisites

Course Objectives: Purposes of the course are

1. Understand basic workshop processes, tools, and machines used in manufacturing.
2. Gain knowledge of operations like turning, forging, pattern making, and welding.
3. Develop practical skills in interpreting block diagrams and mechanisms of workshop machines.
4. Analyze casting processes, superfinishing techniques, and their industrial applications.
5. Evaluate welding techniques, joint testing, and defect identification for quality assurance.

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

CO1	Explain the fundamentals of workshop machines and their operations.
CO2	Demonstrate knowledge of forging, turning, pattern making, and welding processes.
CO3	Identify and interpret block diagrams and mechanisms of workshop machines.
CO4	Analyze casting processes and superfinishing techniques.
CO5	Evaluate welding processes, symbols, joint testing, and defect identification.

Syllabus

Each candidate shall be required to complete and submit the following:	
1. Jobs a. Plane turning, taper turning, and thread cutting – one job b. Forging and grinding of lathe tool with one knife and other end vee – one job c. Making a simple solid pattern involving wood turning – one job d. Welding gas or ark – one job	06 Hours
2. Journal and demonstration: A journal containing record of following assignments based on the following topics (with sketches and relevant description) i). Block diagrams (Any two) – 02 Hours a. Lathe b. Universal milling machine c. Radial drilling machine d. Cylindrical grinder	06 Hours

ii). Mechanisms (Any two) – 04 Hours a. All geared head stock of a center lathe b. Spindle arbor (assembly) drive of a milling machine. c. Crank and slotted lever quick return drive of shaping machine d. Spindle assembly of a drilling machine	
3. Casting and super finishing processes (Any two) a. Types of pattern b. Different casting methods c. Honing d. Buffing	07 Hours
4. Welding (Any two) a. Classification of welding processes b. Different types of welding symbols and joints c. Testing of welded joints d. Welding defects	07 Hours
Note: - Industrial visit / audio visual films may be arranged for covering above topics	

Books & Other Resources

Text Books

1. Hajra Choudhury, S.K., & Hajra Choudhury, A.K. Workshop Technology Vol. 1 & 2. Media Promoters and Publishers.
2. Rao, P.N. Manufacturing Technology: Foundry, Forming, and Welding. Tata McGraw Hill..

Reference Books

1. Jain, R.K. Production Technology. Khanna Publishers.
2. Chapman, W.A.J. Workshop Technology for Engineers. Elsevier Science.

Black, Bruce J. Workshop Processes, Practices, and Materials. Routledge.

Virtual Labs:

1. Virtual Lab on Manufacturing Processes
   http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/index.html

NPTEL / SWAYAM Courses

1. NPTEL course on Fundamentals of Manufacturing Processes by Prof. D.K. Dwivedi, Department of Mechanical and Industrial Engineering, IIT Roorkee
   https://archive.nptel.ac.in/courses/112/107/112107219/#

MOOC

1. Course on Materials Processing (Casting, Forming and Welding) By Prof. Swarup Bag, IIT Guwahati

https://onlinecourses.nptel.ac.in/noc24_me108/preview

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Research Papers

Gopal, K., Bhavana, G., Kaushik, A., Al-Jawahry, H. M., Gupta, L. R., Pahwa, S., & Bandhu, D. (2024). Review of Multiscale Modeling and Simulation Techniques in Metal Forming, Bending, Welding, and Casting Processes for Enhanced Predictive Design and Analysis. In E3S Web of Conferences (Vol. 505, p. 03004). EDP Sciences.

Rubrics for Continuous Evaluation

S.N.	**Details**	Max Marks	Weightage
1	Report on four jobs turning with thread cutting job, forging with grinding of lathe tool, a solid pattern involving wood turning, and gas or arc welding	10	10
2	A journal containing record of following assignments based on block diagrams (Any two) and ii). Mechanisms (Any two), as mentioned in the syllabus	20	20
3	Report on casting and super finishing processes	10	10
4	Report on welding processes	10	10

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	0	1	1	0	2	2	1	1	1	1
CO2	3	2	2	2	0	1	1	0	2	2	1	1	1	1
CO3	3	3	2	2	0	2	2	0	2	2	1	1	1	1
CO4	3	2	2	0	0	2	2	0	2	2	2	1	1	1
CO5	3	3	2	0	0	2	2	0	2	2	1	1	1	1

3: High, 2: Moderate, 1: Low, 0: No Mapping

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern
Course Code: ME124AE410 , Course Title: Soft Skills: Workplace and Life Readiness
Category: Ability Enhancement Course 2

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
1	0	2	2	CCE	--	--	--	50	20
Total Hours									
13	0	26	Total: 39	ESE	---	--		50	20

Prerequisites: Basic English Grammar Skills

Course Objective: Purposes of Course are:

1. This course is designed to equip students with essential professional and technical communication skills necessary for success in the modern workplace.
2. Emphasizing both written and verbal communication
3. The course covers a wide range of topics, including effective written communication, active listening and public speaking.

Course Outcomes: After Successful completion of course units, students will

CO1	Express effectively through verbal or oral communication and Write precise briefs, essays, summaries or reports and technical documents for official communication.
CO2	Students will understands ethics and values for being a good professional
CO3	Learn to work in a heterogeneous and multidisciplinary teams and handle conflicting situations in corporate world
CO4	Students will develop their leadership qualities for being a successful professional
CO5	Students will be able to constructively participate in group discussion, meetings, prepare and deliver presentations

Syllabus

Unit I	Self-Introduction & SWOC Analysis	02 Hrs.

Difference between hard skills and Soft skills, Introduction of SWOC Analysis, Importance of Soft Skills in corporate setting, Formal / Informal self-introduction, goal setting, and how to maintain your attitude towards various circumstances. Applications of SWOC in domain specific Industry

Unit II	Writing Skills	02Hrs.
Practicing and understanding various formats of writing skills. Discussion on types of reports, various formats of report writing. Understanding Email etiquette and types of email. Writing emails on different topics. Practicing resume writing and its various formats. Types of application and how to write them.		
Unit III	**Professionalism & Ethics**	**03 Hrs.**
Understanding ethics and morals, Importance of Professional Ethics, hindrances due to absence of Work ethics, Professional etiquette – Introductions, with colleagues, attire, events, dinning, telephone, travelling, netiquette, social media, writing. Stress as integral part of life, Identifying signs and sources of stress, Steps to cope with stress – open communication, positive thinking, Belief in oneself, ability to handle failure, Retrospective thinking for future learning, Organizing skills to enhance time management, Focusing on goals, smart work vs hard work, Prioritizing activities, Perils of procrastination, Daily evaluation of “to-do” list. Case studies about development of ethics		
Unit IV	**Group Discussion & Personal Interview**	**03 Hrs.**
Introduction to Group Discussion, Difference between Group Discussion and debate, Etiquettes while conducting Group Discussion, Professional Phases to be used in Group Discussion, handling complexities in GD, Understanding types of Interview, Grooming and etiquette while giving an Interview, Understanding Job Description and Studying Company Profile, Strategies and techniques to ace the interview.		
Unit V	**Interpersonal & Intrapersonal Skills**	**03 Hrs.**
Differences of interpersonal and interpersonal skills, Introduction of team building, Introduction to leadership and types of Leadership, Identifying your weakness and focussing on your strength to become a good leader, Introduction to Presentation Skills, 5P’s of Presentation, Types of Presentation		

	Practical/ Lab Sessions	
Lab Session	**Activities**	**Duration (Hrs.)**
1	Speaking Skills- Self Introduction: Introduce your friend	2
2	Team Building Activity	2
3	How to study job description and company profile : "Job Detective"	2
4	Grooming and image management	2
5	Speaking Skills- JAM Session	2
6	Speaking Skills- Debate session	2

7	Group Discussion	2
8	Group Discussion	2
9	Case study analysis : Problem solving and critical thinking : "The Problem-Solvers' Challenge"	2
10	Presentation Skills	2
11	Presentation Skills	2
12	Personal Interview – Conducting of mock interview	2
13	Personal Interview – Conducting of mock interview	2

Reference Books

1. Indrajit Bhattacharya, “An Approach to Communication Skills”, Dhanpat Rai.
2. Simon Sweeney, “English for Business Communication”, Cambridge University Press.
3. Sanjay Kumar and Pushpa Lata, “Communication Skills”, Oxford University Press.
4. Atkinson and Hilgard's, “Introduction to Psychology”, 14th Edition.
5. Kenneth G. Mcgee, “Heads Up: How to Anticipate Business Surprises & Seize Opportunities First”, Harvard Business School Press, Boston, Massachusetts.
6. R. Gajendra Singh Chauhan and Sangeeta Sharma, “Soft Skills-An integrated approach to maximize personality”, Wiley Publication, ISBN: 987-81-265-5639-7

MOOC / NPTEL Courses:

1. NPTEL Course “Developing Soft skills & Personality” https://nptel.ac.in/courses/109/104/109104107/
2. NPTEL Course “Communication Skills” https://nptel.ac.in/courses/109/104/109104030/
3. NPTEL Course “Effective Writing” https://nptel.ac.in/courses/109/107/109107172/
4. NPTEL Course “Interpersonal Skills” https://nptel.ac.in/courses/109/107/109107155/

Marking Scheme for Evaluation

Marking Scheme for ISE (100)		
No	**Component**	**Marks**
1	Assignment 6 Assignments*5 Marks each = 30Marks	30
2	Quiz - Pre & Post Diagnostic Test-15 Marks Quiz on Unit 1 & 2 -15 Marks	30
3	Micro Project: Content creation- 15 Marks Presentation of the Report-15 Marks	30
4	Participation in Teaching Learning Process	10
	Total Marks:	**100**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	0	0	0	0	0	0	1	3	0	2
CO2	0	2	0	0	0	0	3	1	0	0	2
CO3	0	0	2	0	0	1	3	3	1	3	2
CO4	0	0	0	2	0	0	3	1	0	2	2
CO5	0	0	0	0	2	0	2	2	1	1	3

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Code: ME124EE411 Course Title: Entrepreneurial Value Creation (Group C)

Category: Entrepreneurship/Economics and Management Course 2

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max %	Min marks for Pass		Max %	Min marks for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours									
26	0	0	Total: 26	ESE	50	20			

Prerequisites: ME124EE307 Introduction to Entrepreneurship

Course Objectives: The purposes of the course are

1. To develop an understanding of the process of technological innovations
2. To compare and analyze different types of entrepreneurships
3. To identify a systematic procedure of creating an entrepreneurial venture
4. To examine concepts of entrepreneurial finances, government support, and marketing of entrepreneurial venture
5. To assimilate principles of venture survival and serial entrepreneurship

Course Outcomes: After successful completion of the course units the student will

CO	Details	BT Level
CO1	Demonstrate an ability to understand the process of technological innovations	3
CO2	Analyze and compare different types of entrepreneurial domains	4
CO3	Identify a process of creating an entrepreneurial venture	4
CO4	Evaluate entrepreneurial finances, government support and marketing of an entrepreneurial venture	5
CO5	Build strategies for entrepreneurial venture survival and serial entrepreneurship	6

Syllabus

Unit I	Basics of Technology Innovations	5 hrs

Design-led innovation, improvisation, large firm vs. start-up innovation, co-creation and open innovation, developing an innovation strategy, sources of innovation, innovation environment, creative destruction

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Unit II	**Choosing your Entrepreneurial Domain**	**5 hrs**
Concepts of intrapreneurship, types of entrepreneurs, functions of an entrepreneur, advantages of becoming an entrepreneur, entrepreneurial decision-process, challenges faced by entrepreneurs, common mistakes in entrepreneurship, changing role of entrepreneur, women enterprises, social entrepreneurship, rural entrepreneurship		
Unit III	**Entrepreneurial Venture Creation**	**5 hrs**
Business opportunity assessment, process of new venture and its challenges, venture capital, steps involved in launching a business (process charts), various forms of business ownership, registration of business units		
Unit IV	**Entrepreneurial Finances, Government support and Marketing for an Entrepreneurial Venture**	**6 hrs**
Role of central government and state government in promoting entrepreneurship with various incentives, subsidies, grants export-oriented units – fiscal & tax concessions, an overview of MSME policy of Government of India, role of agencies assisting entrepreneurship: DICs, SSIs, NSICs, EDII, NIESBUD, NEDB, Entrepreneurship Development Institute (EDI), new initiatives taken by the government to promote entrepreneurship in India at larger scale, Relationship marketing, search engine optimization, thought leadership in marketing, marketing automation, case study on marketing of a venture		
Unit V	**Venture Survival and Serial Entrepreneurship**	**5 hrs**
Angel investing, crowdfunding, entrepreneurial motivation, challenges of new venture start-up, reasons for failure of new venture, how to begin with low investment, developing a business plan: environmental scanning and swot analysis, the business plan as an entrepreneurial tool, start-up to going ipo, revival, exit and end to a venture, case-study/team building exercise/interaction with a serial entrepreneur to understand venture survival strategies.		

Reference Books

1. Bolton, B., & Thompson, J. L. (2015). The entrepreneur: The all-in-one entrepreneur-leader-manager. New York: Routledge.
2. Thomas W. Zimmerer and Norman M. Scarborough (2005). Essentials of Entrepreneurship and Small Business Management. Prentice Hall India. New Delhi
3. Peter Thiel (2014). Zero to One: Notes on Startups, or How to Build the Future, Crown Publishing Group. New York
4. Swanson, E. B. (2024). Technology entrepreneurship is more than one might think. Information and Organization, 34(2), 100512.
5. Chen, W. D., Acs, Z., & Terjesen, S. (2024). Adolescent entrepreneurial learning ecosystem and a tech entrepreneurial career—inspiration from the black swan stories. Small Business Economics, 62(3), 1157-1176.

SWAYAM / NPTEL/ MOOC Courses

1. Course on Entrepreneurship By Prof. C Bhaktavatsala Rao, IIT Madras https://onlinecourses.nptel.ac.in/noc20_mg35/preview
2. Course on Startup School by Y Combinator https://www.youtube.com/playlist?list=PLQ-uHSnFig5M9fW16o2l35jrfdsxGknNB
3. NPTEL Course(s) applicable for credit transfer as per Institute Policy

Research Paper

1. Ioannou, A., & Retalis, S. (2025). Building entrepreneurial self-efficacy in the EdTech sector: the impact of an entrepreneurship education program. *The International Journal of Information and Learning Technology*.
2. Lopez, T., Noguera, M., & Urbano, D. (2025). Institutions and entrepreneurship education: a critical analysis of the literature. Annals of Entrepreneurship Education and Pedagogy-2025, 48-72.

Rubrics for Continuous Evaluation

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	**Faculty**	**5**	**5**	**5**	**5**	**5**	**25**	**20**
	Department	**5**	**5**	**5**	**5**	**5**	**25**	
		Unit test 1 (UT 1)			**Unit test 2 (UT 2)**			
End Semester Examination (ESE)	**Institute**	**10**	**10**	**10**	**10**	**10**	**50**	**20**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	2	2	2	2	2	1	1	3
CO2	1	2	1	1	1	1	2	1	1	3	2	1	1	3
CO3	2	1	2	1	2	1	1	2	1	2	1	1	1	3
CO4	1	1	1	1	1	2	2	2	1	1	2	1	1	3
CO5	1	1	1	1	1	1	2	1	2	1	2	1	1	3

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code: ME124VC412 Course Title: Sustainable Development 2
Category: Value Education Course 2

Course Category	Value Education Course 2			Course Code			
Course Title	Sustainable Development - 2						
Teaching Scheme				Evaluation Scheme			
					Theory Marks		Practical Marks
L	T	P	Cr	Exam	Max	Min Marks for Pass	Max	Min for Pass
2	0	0	2	CCE	100	40	-	-
Total Hours								
26	0	0	Total hrs: 26					

Prerequisites:

None

Subjects Included:

Universal Human Values (UHV) 3 units

Constitution of India 1 unit

Corporate Laws 1 unit

Course Objectives: (Min 3)

Understand Universal Human Values (UHV) – Develop ethical, moral, and professional values in students.

Apply UHV in Personal and Professional Life – Explore human relationships, harmony, and responsible behavior.

Develop Ethical Decision-Making Skills – Analyze real-life scenarios and case studies to build decision-making abilities.

Study Constitutional Rights and Duties – Understand fundamental rights, directive principles, and governance structure.

Understand Corporate Laws – Explore the regulatory framework governing businesses and corporate ethics.

1.

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

CO1	**DEFINE** the fundamental concepts of Universal Human Values (UHV).
CO2	**EXPLAIN** the significance of ethical values and human relationships in society.
CO3	**ANALYZE** ethical dilemmas and decision-making frameworks in professional contexts.
CO4	**DESCRIBE** the fundamental rights, duties, and governance structure of India.
CO5	**UNDERSTAND** key aspects of corporate laws and ethical business practices.

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Syllabus

Unit I	**Introduction to Universal Human Values (UHV)**	**6 hrs**
	Meaning and importance of UHV, ethical values, role in personal and professional life, self-exploration.	
Unit II	**Human Relationships & Harmony**	**6 hrs**
	Role of relationships in family, society, and workplace; conflict resolution; social responsibility; sustainability in human interactions.	
Unit III	**Ethical Decision-Making**	**6 hrs**
	Case studies on ethical dilemmas, corporate ethics, moral reasoning, frameworks for ethical decision-making.	
Unit IV	**Constitution of India**	**4 hrs**
	Fundamental rights and duties, directive principles, governance structure, significance of constitutional amendments, case laws.	
Unit V	**Corporate Laws & Business Ethics**	**4 hrs**
	Overview of business laws, corporate governance, ethical leadership, corporate social responsibility (CSR), impact of regulations on industries.	

Scheme for Examination

Component	Parameters	Marks	Total	Pass
Continuous Comprehensive Evaluation CCE	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Evaluation	Performance (Internal)	25	50	20
	Oral Examination (Internal)	25		

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	3

3: High, 2: Moderate, 1: Low, -: No Mapping*****

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern

Course Code: ME124NC413, Course Title: Yoga and Positive Psychology for Managing Career and Life

Category: Program Non-Credit Course 3

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max %	Min marks for Pass		Max %	Min marks for Pass
0	0	2	0	CCE	-	-	-	50	20
Total Hours									
0	0	26	Total: 26	ESE	-	-	-	50	20

Prerequisites: VEC2401L01 Value Education Course 1, PNC2401L01 Design Thinking

Course Objectives:

1. Understand the core principles of Positive Psychology and Yoga for enhancing personal and professional well-being.
2. Develop practical skills and tools for managing stress, improving mental health, and fostering resilience.
3. Cultivate a holistic approach to self-improvement by integrating physical, mental, and emotional practices.
4. Apply techniques from Positive Psychology and Yoga to enhance productivity, relationships, and life satisfaction.
5. Foster long-term habits that support continuous personal growth and professional development.

Course Outcomes: Students will be able to		**BTL**
CO1	**Apply** yogic techniques to improve focus, concentration, and emotional intelligence.	3
CO2	**Critically** analyze the impact of positive emotions and mindfulness on personal and professional well-being.	4
CO3	**Critically evaluate** the role of yogic practices in managing stress and enhancing mental health.	4
CO4	**Evaluate** the philosophical foundations of Positive Psychology and Yoga, and synthesize their integration for holistic well-being.	5
CO5	**Design** and **implement** personalized sequences of yoga asanas, pranayama techniques, and meditation practices to achieve specific well-being goals effectively.	6

Syllabus

Activity 1	**Application of Positive Psychology and Yoga Concepts**	**6 hrs**
In this activity, students will be divided into small groups and assigned one key topic such as Positive Psychology waves, Yogic perspectives on governance, or Micro-Macro Integration of Life. Each group will define their concept, identify a real-life scenario where it applies (personal, professional, or societal), and explain how Positive Psychology and Yoga principles can enhance the situation. Groups will create a simple visual representation (like a mind map or poster) or perform a short skit to illustrate their ideas. The activity will conclude with brief presentations from each group, followed by a Q&A session. This will help students connect theoretical concepts to practical life, fostering both understanding and engagement.		
Activity: 2	**Personal Wellbeing Blueprint**	**6 hrs**
Students will create a personalized wellbeing plan by integrating concepts from Positive Psychology, Yoga, and Ayurveda. The activity includes three steps: (1) Self-Assessment of physical, mental, and emotional health through guided reflections; (2) Mapping Personal Growth using the Ladder of Joy,		

TattvaBodh (self-knowledge), and Indriyajaya (sense control) to identify areas for improvement; and (3) Action Plan Creation with techniques from DharmahKriya and Sukhayu-Hitayu, such as mindfulness, yoga, gratitude practices, or Ayurvedic routines. Students will present their plans in a brief session, followed by peer feedback and group reflection.

Activity: 3	**Overcoming Obstacles to Wellbeing**	**4 hrs**

Students will reflect on personal obstacles (Kleshas) affecting their wellbeing and career, identifying at least two challenges such as stress or negative thinking. In small groups, they will discuss strategies to overcome these obstacles using Shat Sampatti (six virtues: calmness, self-control, endurance, faith, concentration, and detachment), along with self-management techniques, career interventions, and dietary changes (Food as the First Intervention). Each group will present their findings through a role-play, poster, or short presentation, illustrating how these holistic approaches can enhance personal and professional growth. The session will conclude with a class reflection on applying these strategies in daily life

Activity: 4	**Integrating Asanas, Pranayama, and Pratyahara for Self and Career Management**	**6 hrs**

In this activity, students will explore how Asanas, Pranayama, and Pratyahara can be used as interventions for managing both self and career. Students will first participate in a guided session of basic Asanas (yoga postures) to experience their effects on physical and mental well-being. Then, they will learn about different types of Pranayama (breathing techniques) and practice a few, focusing on how they help reduce stress and enhance focus. Finally, students will discuss Pratyahara (withdrawal of the senses) and its role in improving concentration and productivity in professional settings. In groups, they will create a personalized intervention plan combining Asanas, Pranayama, and Pratyahara to manage stress, improve career focus, and maintain well-being. Each group will present their plan in a short session, sharing how these practices can be incorporated into daily life.

Activity: 5	**Yogic Practices for Emotional Management and Mind Mastery**	**4 hrs**

In this activity, students will explore how Yogic practices can be used to manage emotions and transform the mind into a supportive ally. The session will begin with a discussion on common emotional challenges (e.g., anxiety, frustration, sadness) and how these can impact personal and professional life. Students will then practice specific Yogic interventions for emotional management, such as calming Asanas (postures), Pranayama (breathing techniques), and Dhyana (meditation). They will also learn techniques to cultivate a positive and focused mindset, turning the mind into a "friend" through mindfulness practices and self-awareness exercises. Afterward, students will create a personalized emotional management plan, incorporating these Yogic techniques, and present their plans to the class, sharing how these practices can support emotional balance and mental clarity in everyday life.

Reference Books

1. Lopez, S. J., Pedrotti, J. T., & Snyder, C. R. (2021). Positive psychology: The scientific and practical explorations of human strengths. Sage Publications.

2. Rao, K. R., & Paranjpe, A. C. (2016). Psychology in the Indian tradition. Springer India.

3. Parker, S. (2015). Clearing the Path: The Yoga Way to Clear and Pleasant Mind. Lotus Press.

4. Keyes, C. L. (2002). The mental health continuum: From languishing to flourishing in life.

Textbooks:

1. Singh, S.P., & Chattopadhyaya, D.P. (2010). History of Yoga. MLBD, New Delhi.

2. Saraswati, Swami Satyananda, & Muktibodhananda (1993). Hathapradipika. Bihar School of Yoga.

3. Sen Gupta, Ranjana (2001). B.K.S. Iyengar Yoga. Dorling Kindersley Limited.

NPTEL Courses: NPTEL Course(s) applicable for credit transfer as per Institute Policy
Psychology and Wellbeing (https://onlinecourses.nptel.ac.in/noc23_hs74/preview).

Rubrics for Continuous Evaluation

Component	Parameters	Marks	Total	Pass
CCE	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Evaluation	Performance (Internal)	25	50	20
	Oral Examination (Internal)	25		

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PS03
CO1	2	2	1	–	2	3	2	2	2	2	3	3	1	2
CO2	2	3	2	2	2	3	2	3	2	2	3	3	2	2
CO3	2	3	2	2	3	3	3	3	2	2	3	2	3	2
CO4	3	3	2	2	2	3	3	3	2	3	3	2	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3	1	2	1

3: High, 2: Moderate, 1: Low, -: No Mapping

B Tech in Mechanical Engineering | SY B Tech Semester IV | 2024 Pattern
Course Code: ME124NC414, Course Title: Professional and Technical Communication 2

Category: Program Non Credit Course 4

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0		2	0		--	--	--	50	20
Total Hours							-		
0		26	Total: 26		---	--			

Prerequisites: Basic English Grammar Skills

Course Objective: Purposes of Course are:

1. This course is designed to equip students with essential professional and technical communication skills necessary for success in the modern workplace.
2. Emphasizing both written and verbal communication
3. The course covers a wide range of topics, including effective written communication, active listening and public speaking.
4. Develop strong logical reasoning aptitude & problem solving to clear company selection tests

Course Outcomes: After Successful completion of course units, students will

CO1	Analyse and evaluate spoken information critically for understanding the context and credibility of the source.
CO2	Demonstrate effective interpersonal communication skills for harmonious and productive interactions.
CO3	Articulate strategies for clear and coherent writing skills for personal & professional communication needs.
CO4	Develop skills for effective and authentic non-verbal communication to ace the professional communication needs.
CO5	Solve complex logical reasoning aptitude problems efficiently, improving selection test performance.

Syllabus

Unit I	Development of Listening and Speaking Skills	04 Hrs.

Introduction to Listening skills, Barriers to Listening skills, active Listening techniques, Listening for main ideas and details, Note taking strategies. Introduction to Speaking skills, Building vocabulary and fluency, Conversational Skills, Public speaking fundamentals. Speed and Fluency, Removing MTI.

Unit II	**Development of Writing and Reading Skills**	**03 Hrs.**
Introduction to Effective Written Communication, fundamentals of grammar and punctuation, Paragraph Structure, Essay writing, Report writing, Formal letter writing. Importance of Reading, Comprehension and solving case studies, Synthesis writing		
Unit III	**Fundamentals of Technical Communication**	**03 Hrs.**
What is communication? Importance of communication, Communication Types – Verbal, Non-verbal, Why is non-verbal communication important? Making eye contact (or lack thereof), Shaking hands, -Crossing or uncrossing legs, Folding or unfolding arms, Fidgeting, Eye contact, Smiling or frowning, Communication styles		
Unit IV	**Business Communication**	**03 Hrs.**
Business communication theory, Email Etiquette, Digital Communication, Presentation Skills, Ethics in Business Communication, Kinesics and Pitch modulation		
Unit V	**Quantitative Aptitude**	**02 Hrs.**
1. Recap & Time and Work		
Unit VI	**Reasoning Ability**	**08 Hrs.**
1. Analytical Reasoning - I 2. Clock & Calendars 3. Coding and Decoding & Odd Man Out 4. Data Interpretation - Advanced **5.** Cubes & Dices		
Unit VII	**Career Skills**	**03 Hrs.**
1. Networking Skills 2. Linked In Profile Building & Internship Outreach **3.** ATS Resume		
Reference Books		

1. Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson),2011, ISBN - 8131799905, 9788131799901
2. Communication Skills for Technical Students by T.M. Farhathullah (Orient Longman)2002, ISBN - 9788125022473

3. Written Communication in English by Saran Freeman (Orient Longman) 1977, 8125004262
4. Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP), 1990, ISBN 10-8175960299
5. Communication for Business: A Practical Approach by Shirley Tailor (Longman),2005, ISBN - 9780273687658
6. Developing Communication Skills by Krishna Mohan & Meera Banerji (Macmillan),2009, ISBN - 9780230638433
7. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill,2017, ISBN - 9789390113002
8. Technical communication: Principles and practice, Raman, Minakshi, and Sangita Sharma. 3rd ed. Oxford University Press, 2015, ISBN - 978-0199457496
9. https://ielts.org
10. NPTEL Course-Business English Communication IIT Madras
    Link https://youtu.be/GwF4ypDSr-A

11 NPTEL Course- Introduction to Effective Communication
    Link https://archive.nptel.ac.in/courses/109/104/109104030/