



**Mahatma Gandhi Mission's
COLLEGE OF ENGINEERING**

Near Air-port, Off Hingoli Road, Nanded-431605

(An Autonomous Institute, Accredited by NAAC & NBA)

**Department of
Mechanical Engineering**

**Curriculum for
Second Year B.Tech Program**

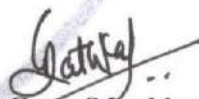
**w.e.f.
Academic Year 2026-27
(NEP- 2020 Compliant)**

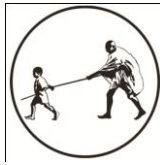

Dr. Jasbeer Singh Sidhu

Head

Department of Mechanical Engineering.


Dr. Archana M. Rajurkar
Dean Academics


Dr. Geeta S. Lathkar
Director



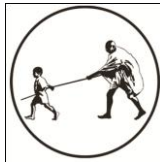
**Mahatma Gandhi Mission's
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Department of Mechanical Engineering

Department Profile Vision, Mission, PEOs and PSOs



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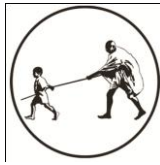
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Mechanical Engineering: Introduction

Mechanical Engineering have seen an unprecedented growth, in the recent times. Conventional practices are overtaken by CAD/CAM/CIM/CAE/FEA/CFD/Nano-Technology/ Micromachining etc. All these technologies cater to the needs of today's rapidly changing Industrial scenario. Mechanical Engineering focuses on the design, development and testing of mechanical systems. Our Institute provides excellent infrastructure, facilities and ambience to students of UG, PG for studies and Research activities. Our labs are equipped with state of the art technology HAAS CNC machines and JANATICS Pneumatic equipments with DY kits.

Department of Mechanical Engineering is always working hard in imparting quality education to the students through Research and projects, Industry-Institute Interactions, Skill development and invited talks by experts from India and Abroad. Department has signed MOU with IGTR and MITCON where students are exposed to latest technologies and hands on experience in doing their Projects. The Department has a recognized Research Center of Swami Ramanand Teerth Marathwada University, Nanded.



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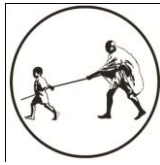
Vision & Mission of Mechanical Engineering Department

Vision

To be one of the leading Departments for Mechanical Engineering education to develop proficient engineers with global acceptance in the service of mankind.

Mission

1. Providing quality education in Mechanical Engineering with cutting edge technologies like Computer Numerical Control, Coordinate Measuring Machine, Additive manufacturing with multidisciplinary as well as green manufacturing approach on sustainable basis.
2. Developing competent engineers to solve real life problems related to Mechanical Engineering and facilitate continuous learning based on the changing needs of the Industry.
3. Cultivating leadership qualities, employability skills, with ethical values, through learner-centric approach among Mechanical Engineering graduates.
4. 4) Nurturing communication with research and development organizations, Industries and alumni leading to excellence in teaching-learning covering Automation technologies, Advanced manufacturing and allied Mechanical research to enhance creativity.



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Program Educational Objectives (PEOs)

Graduates of Mechanical Engineering employed should be able to

PEO1 : Implement technological expertise to design, formulate and address complex Mechanical Engineering problems providing Green manufacturing solutions on sustainable basis.

PEO2 : Apply their knowledge, professional competence and skills acquired in Higher education and Research emphasizing automation based technologies to meet the current trends in manufacturing, design and power sector

PEO3 : Practice work ethics, teamwork and multi disciplinary approach for professional development in Mechanical Engineering through lifelong learning.

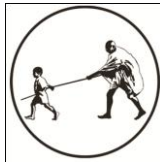
PEO4 : Demonstrate competencies to pursue the research and development activities in allied Mechanical Engineering fields to meet the demands of changing Industry needs.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1: Ability to develop and implement new ideas on product design and development using Modern Tools, with focus on energy efficiency and environmental issues.

PSO 2: Capability to work in industries on advanced Pneumatics, Computer Numerical Control, Coordinate Measuring Machines, Automation based technologies and Robotics to meet the changing needs of the Industry.

PSO 3: Agility to get updated with Additive Manufacturing, Mechatronics, advanced tools in Industry / Research settings and propose innovative solutions to real life problems.

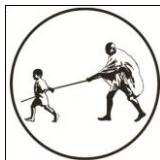


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Department of Mechanical Engineering
Curriculum Structure
(Effective from A.Y. 2026-27)



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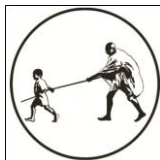
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Department of Mechanical Engineering Curriculum Structure (Effective from AY 2026-27)

Semester wise Credit distribution structure for Four Year UG Engineering Program - One Major, One Minor

Course Category	Sub Category	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	07	07	03	--	--	--	--	--	17
Engineering Science Course		08	11	--	--	--	--	--	--	19
Program Core Course (PCC)	Program Courses	--	--	11	12	11	12	07	--	53
Program Elective Course (PEC)		--	--	--	--	03	06	06	06	21
Multidisciplinary Minor (MD M)	Multidisciplinary Courses	--	--	As per the respective MDM courses taken by the students				--	-	16
Open Elective (OE) Other than a particular program		--	--	03	02	03	--	--	--	08
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	02	--	--	02	01	01	01	--	07
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	03	--	02	--	04	02	--	--	11
Entrepreneurship/Economics/Management Courses		--	--	02	--	--	--	--	--	02
Indian Knowledge System (IKS)		--	02	--	--	--	--	--	--	02
Value Education Course (VEC)		--	--	02	02	--	--	--	--	04
Research Methodology	Experiential Learning Courses	--	--	--	--	--	01	--	-	01
Comm. Engg. Project (CEP)/Field Project (FP)		--	02 (OA)	--	--	--	--	-	-	00
Project		--	--	--	--	--	01	02	--	03
Internship/OJT		--	--	--	02(OA)	--	2(OA)	--	06	06
Co-curricular Courses(CC)	Liberal Learning Courses	02	02	--	02	--	--	--	-	04
Total Credits (Major)		22	22	23	20	22	23	16	12	160



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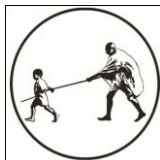
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Mechanical Engineering Curricular Structure (Effective from A.Y. 2026-27)

Semester - III

Sr. No	Course Category	Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credits
				L	P	CA	MSE	ESE	Total	
1	BSC	BSC-MECH-201	Engineering Mathematics -III	3	--	20	30	50	100	3
2	PCC	PCC-MECH-202	Manufacturing Technology-I	3	--	20	30	50	100	3
3	PCC	PCC-MECH-203	Materials Science and Metallurgy	3	--	20	30	50	100	3
4	PCC	PCC-MECH-204	Thermodynamics	3	--	20	30	50	100	3
5	OE	MGM-OE-233	Open Elective -I	3	--	20	30	50	100	3
6	MDM	MDM-MECH-205	Multidisciplinary Minor							
7	VEC	MGM-VEC-CI-231	Constitution of India	2	--	20	30	50	100	2
8	HSSM	MGM-HSSM-ED-232	Entrepreneurship Development	2	--	20	30	50	100	2
9	AEC	AEC-MECH-206	Personality Development	2	--	20	30	50	100	2
10	PCC	PCCL-MECH-207	Manufacturing Technology-I Lab		2	50		50	100	1
11	PCC	PCCL-MECH-208	Materials Science and Metallurgy Lab	--	2	50		50	100	1
12	Internship	INT-MECH--209	Internship-I	--	--	--		50	50	
Total				21	04	260	240	550	1050	23

MDM: Multidisciplinary Minor, OE : Open Elective



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Mechanical Engineering Curricular Structure

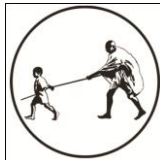
(Effective from A.Y. 2026-27)

Semester - IV

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credits
				L	P	CA	MSE	ESE	Total	
1	PCC	PCC-MECH-251	Strength of Materials	3	--	20	30	50	100	3
2	PCC	PCC-MECH-252	Manufacturing Technology - II	3	--	20	30	50	100	3
3	PCC	PCC-MECH-253	Fluid Mechanics & Hydraulic Machines	3	--	20	30	50	100	3
4	MDM	MDM-MECH-254	Multidisciplinary Minor							
5	VEC	MGM-VEC-UHV-281	Universal Human Values	2	--	20	30	50	100	2
6	OE	MGM-OE-283	Open Elective - II	2	--	20	30	50	100	2
7	CC	MGM-CC-AEL-282	Asian-European Languages: A. French B. German C. Spanish D. Japanese E. Sanskrit	2	--	20	30	50	100	2
8	PCC	PCCL-MECH-255	Strength of Materials Lab	--	2	50	--	50	100	1
9	PCC	PCCL-MECH-256	Fluid Mechanics & Hydraulic Machines Lab	--	2	50	--	50	100	1
10	VSEC	VSEC-MECH-257	Machine Drawing & CAD Lab	1	2	50	--	50	100	2
11	PCC	PCCL-MECH-258	Manufacturing Technology-II Lab	--	2	50	--	50	100	1
12	Internship	INT-MECH-259	Internship-II							2 (OA)*
Total				15	12	320	180	500	1000	20

MDM: Multidisciplinary Minor, OE : Open Elective,, OA: Over &Above

• **Note: Student is expected to work for (two to four weeks, minimum four to five hours per day) in Industries / NGO/Govt. organizations on understanding/solving their problems/awareness programs (understanding the HR processes, Products, Services and other issues related to program of study).**



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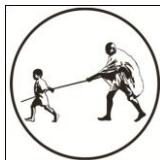
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Mechanical Engineering Curricular Structure

(Effective from A.Y. 2027-28)

Semester - V

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credits
				L	P	CA	MSE	ESE	Total	
1	PCC	PCC-MECH-301	Heat Transfer	3	--	20	30	50	100	3
2	PCC	PCC-MECH-302	Machine Design	3	--	20	30	50	100	3
3	PCC	PCC-MECH-303	Theory of Machines	3	--	20	30	50	100	3
4	PEC	PEC-I-MECH-304	Program Elective-I A. Robotics B. Marketing Management C. Industrial Instrumentation D. Automobile Engineering E. Solar Energy System	3	--	20	30	50	100	3
5	MDM	MDM-MECH-305	Multidisciplinary Minor							
6	OE	MGM-OE-332	Open Elective -III	3	--	20	30	50	100	3
7	AEC	MGM-AEC-332	AI Tools and Prompt Engineering	2	--	20	30	50	100	2
8	AEC	MGM-AEC-VARD-331	Verbal Ability and Reading Comprehension	2	--	20	30	50	100	2
9	PCC	PCCL-MECH-307	Heat Transfer Lab	--	2	50	--	50	100	1
10	VSEC	VSECL-MECH-308	Mechanical Measurement & Metrology Lab	--	2	50	--	50	100	1
11	PCC	PCCL-MECH-309	Theory of Machines Lab	--	2	50	--	50	100	1
12	Internship	INT-MECH-310	Internship-II	-			--	50	50	² (OA)*
Total				19	6	290	210	550	1050	22



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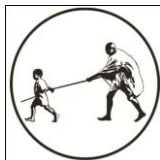
Mechanical Engineering Curricular Structure

(Effective from A.Y. 2027-28)

Semester - VI

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credits
				L	P	CA	MS E	ESE	Total	
1	PCC	PCC-MECH-351	Applied Thermodynamics	3	--	20	30	50	100	3
2	PCC	PCC-MECH-352	Computer Aided Design	3	--	20	30	50	100	3
3	PCC	PCC-MECH-353	Mechatronics & Sensors	3		20	30	50	100	3
4	PEC	PEC-II-MECH-354	Program Elective -II A.Smart Manufacturing & IOT B.Total Quality Management C.Additive Manufacturing D.Electric Vehicles E.Power Plant Engineering	3	--	20	30	50	100	3
5	PEC	PEC-III-MECH-355	Program Elective -III A.MEMS & Micro Systems Technology B.Human Resource Management C.Composite Materials D.Autonomous Vehicle Systems E.Refrigeration and Air Conditioning	3	--	20	30	50	100	3
6	MDM	MDM-MECH-356	Multidisciplinary Minor							
7	AEC	MGM-AEC-QACT-381	Quantitative Aptitude and Critical Thinking	2	--	20	30	50	100	2
8	VSEC	VSEC-MECH-357	CNC Lab	--	2	50	--	50	100	1
9	PCC	PCCL-MECH-358	Computer Aided Design Lab	--	2	50	--	50	100	1
10	PCC	PCCL-MECH-359	Applied Thermodynamics Lab	--	2	50	--	50	100	1
11	PCC	PCCL-MECH-360	Mechatronics & Sensors Lab	--	2	50	--	50	100	1
12	Seminar	RM-MECH-361	Seminar	--	2	50	--	50	100	1
13	Project	PROJ-MECH-362	Minor Project	--	2	50	--	50	100	1
14	Internship	INT-MECH-363	Internship - III	--	--					2 (OA)*
Total				17	12	420	180	600	1200	23

MDM: Multidisciplinary Minor, OE : Open Elective, OA: Over & Above*Note: Student is expected to work for (two to four weeks, minimum four to five hours per day) in Industries /NGO/Govt. organizations on understanding/solving their problems/awareness programs (understanding the HR Processes, Products, Services and other issues related to program of study).



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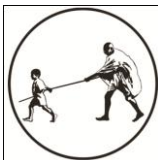
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Mechanical Engineering Curricular Structure

(Effective from A.Y. 2028-29)

Semester - VII

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credits
				L	P	CA	MSE	ESE	Total	
1	PCC	PCC-MECH-401	Production Operations Management	3	--	20	30	50	100	3
2	PCC	PCC-MECH-402	Robotics & Automation	3	--	20	30	50	100	3
3	PEC	PEC-IV-MECH-403	Program Elective -IV A. Computer Integrated Manufacturing B. Financial Management C. Finite Element Methods D. Automotive Safety Systems E. Cryogenics Engineering	3	--	20	30	50	100	3
4	PEC	PEC-V-MECH-404	Program Elective -V A. Hydraulics, Pneumatics and Fluid Power B. Technology Management C. Design of Experiments D. Hydrogen and Fuel Cell Vehicle Technology E. Energy Audit and Management	3	--	20	30	50	100	3
5	VSEC	VSECL-MECH-405	Product Development and Modeling Lab	--	2	50		50	100	1
6	PCC	PCCL-MECH-406	Robotics & Automation Lab	--	2	50		50	100	1
7	Project	PROJ-MECH-407	Major Project - I	--	4	50		50	100	2
8	Internship	INT-MECH-408	Internship - III					50	50	2 (OA)*
Total				12	8	230	120	400	750	16



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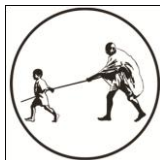
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Mechanical Engineering Curricular Structure

(Effective from A.Y. 2028-29)

Semester - VIII

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme		Evaluation Scheme				Credits
				L	P	CA	MSE	ESE	Total	
1	PEC	PEC-VI-MECH-451	Program Elective-VI (NPTEL Course) A. Advanced Manufacturing Processes B. Non -Conventional energy resources C. Mechanical behavior of Materials D. Automatic Control E. Strategies for sustainable design	3	-	20	30	50	100	3
2	PEC	PEC-VII-MECH-452	Program Elective-VII (NPTEL Course) A. Autotronics B. Advances in Additive manufacturing C. Introduction to Mechanical Micromachining D. Material Characterization E. Computer Integrated Manufacturing	3	-	20	30	50	100	3
3	Internship/Project	INT-MECH-453	Internship-IV/ Major Project II	-	12	50		50	100	6
Total				6	12	90	60	150	300	12

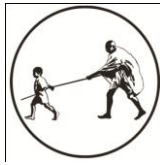


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Mechanical Engineering Curricular Structure Open Electives		
Course Code	Subject Name	Semester
MGM-OE-233	Open Elective-I	III
	A. Product Design & Engineering	
	B. Energy Conservation and Management	
	C. Disaster Risk Detection and Management	
	D. Agriculture Entrepreneurship Development	
	E. Medical Informatics	
MGM-OE-283	Open Elective-II	IV
	A. Economics	
	B. Biology for Engineers	
	C. Sustainable Developments Goals	
	D. Industrial Safety	
	E. Organizational Behavior	
MGM-OE-332	Open Elective-III	V
	A. Project Management	
	B. Electric Vehicle Technology	
	C. Drone Technologies	
	D. Financial Accounting	
	E. Introduction to Operations Research	

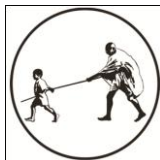


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Department of Mechanical Engineering
Curriculum Structure
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Detailed Syllabus SEM-III



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Second Year Mechanical Engineering (2026-2027)

Semester-III

Course Code	BSC-MECH-201		
Category	Basic Science Course		
Course Title	Engineering Mathematics -III		
Scheme and Credits	L	P	No. of Credits
	3	0	3

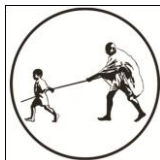
Prerequisite Courses, if any: Engineering Mathematics I & Engineering Mathematics II

Course Objectives:

1. To study Laplace Transform and their applications to solve ODE.
2. To study Inverse Laplace transform and their applications.
3. To understand the concept of measures of central tendency and dispersions.
4. To understand concepts of probability, conditional probability and independence and probability distributions
5. To apply numerical methods to obtain approximate solutions to mathematical problems.
6. To understand the concept of Z-transform and analyze the behavior of discrete time systems using ROC, stability and casual concepts.

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

COs	Statement
CO1	Use the knowledge of Laplace Transform of customary functions arising in network analysis and control systems and solve ODE
CO2	Understand the concept of the Inverse Laplace Transform and its significance in engineering and mathematics.
CO3	Compute descriptive statistics and use least-squares linear and multiple regression to relate input variable to output response
CO4	Compute permutation and combination and use Bayes' theorem to update beliefs given new evidence.
CO5	Apply the numerical techniques to obtain approximate solution to mathematical problems.
CO6	Use the knowledge of Z-transform to solve difference equations and explain the region of convergence(ROC).



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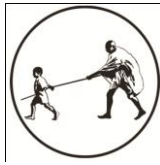
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Unit No.	Unit Title & Contents	Hours
1	Laplace Transform: Definition and conditions for existence; Transforms of elementary functions; Properties of Laplace Transforms – Linearity, First Shifting, Second Shifting, Transforms of functions multiplied by (t^n), Scale Change Property, Transforms of functions divided by (t), Transforms of integrals and derivatives; Evaluation of integrals using Laplace Transform; Transforms of special functions – Periodic Function, Error Function, Unit Step Function.	7
2	Inverse Laplace Transform: Introductory remarks; Inverse transforms of elementary functions; General methods of finding inverse transforms; Partial Fraction Method; Convolution Theorem for inverse transforms; Applications to solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.	8
3	Statistics: Measures of Central Tendency – Mean, Median, Mode; Measures of Dispersion – Variance and Standard Deviation; Linear Regression; Hypothesis Testing – z-test, t-test, and Chi-Square Test.	8
4	Probability Distributions: Permutations and Combinations; Basic Concepts of Probability and its Properties; Conditional Probability; Bayes' Theorem; Independent Events; Mathematical Expectation; Random Variables – Discrete and Continuous; Probability Distributions – Binomial, Poisson, and Normal Distributions.	8
5	Numerical Methods: Solutions of Polynomial and Transcendental Equations – Bisection Method, Newton-Raphson Method, and Regula Falsi Method; Finite Differences; Relations between Operators; Interpolation using Newton's Forward and Backward Difference Formulae; Interpolation with Unequal Intervals using Lagrange's Formula; Numerical Differentiation; Numerical Integration – Trapezoidal Rule, Simpson's 1/3 Rule, and Simpson's 3/8 Rule.	7
6	Z-Transform: Definition; Properties of Z-Transforms (without proof); Sequences – Causal, Anti-causal, and Non-causal; Region of Convergence (ROC); Inverse Z-Transform using Partial Fraction Method and Residue Method; Solution of Linear Constant Coefficient Difference Equations	7

Textbooks:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI learning Pvt. Ltd, Ed. 5th.
2. B.S. Grewal, Numerical methods in Engineering & Science, Khanna Publications, Ed. 9th.
3. S. C. Gupta, Fundamentals of Mathematical Statistics



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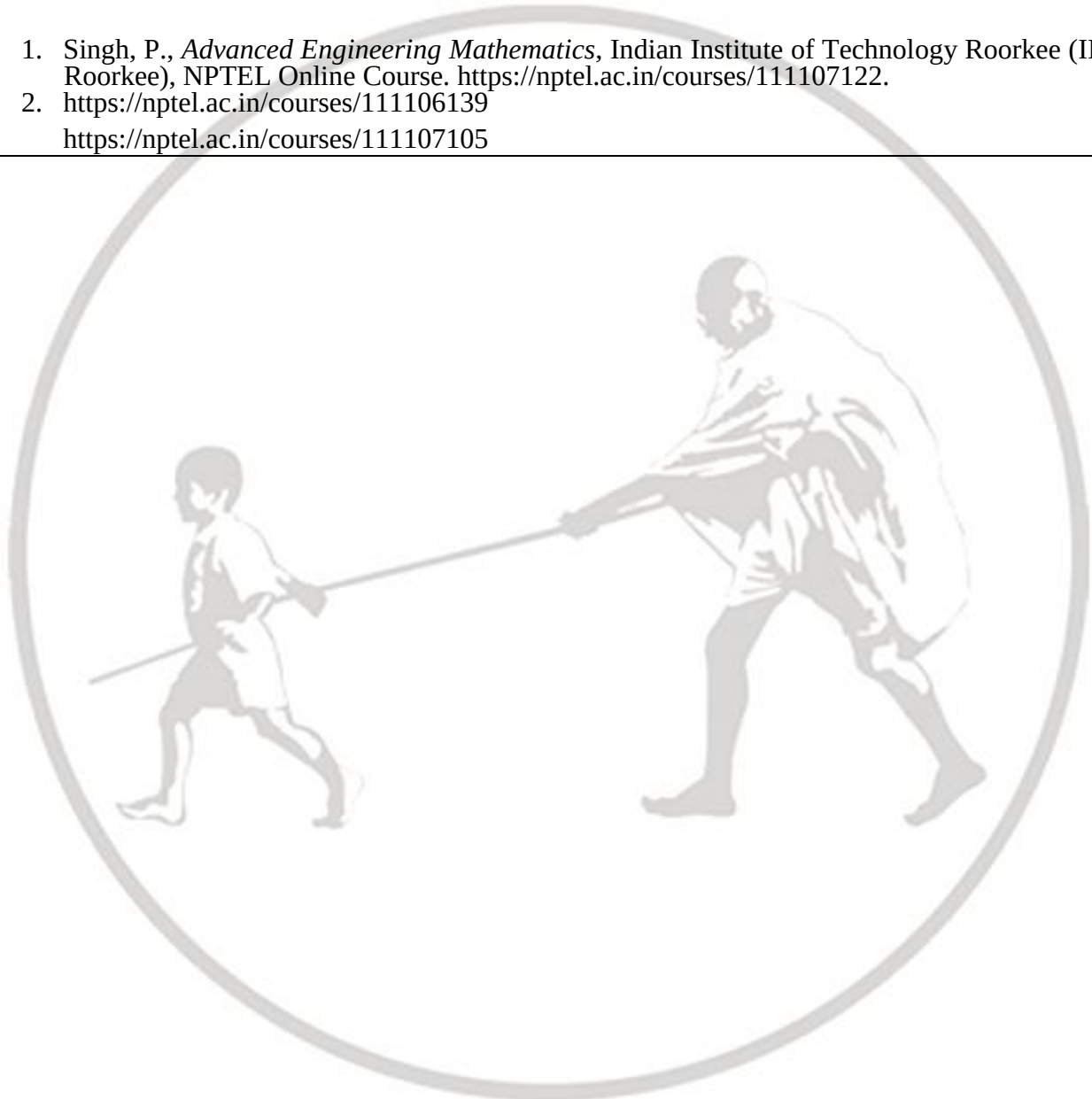
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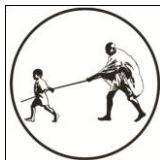
Reference Books:

1. S. C. Gupta, Fundamentals of Mathematical Statistics
2. Mukul Bhatt, Engineering Mathematics

MOOC/NPTEL Courses:

1. Singh, P., *Advanced Engineering Mathematics*, Indian Institute of Technology Roorkee (IIT Roorkee), NPTEL Online Course. <https://nptel.ac.in/courses/111107122>.
2. <https://nptel.ac.in/courses/111106139>
<https://nptel.ac.in/courses/111107105>



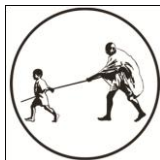


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Second Year Mechanical Engineering (2026-2027)			
Semester-III			
Course Code	PCC-MECH-202		
Category	Program Core Course		
Course Title	Manufacturing Technology-I		
Scheme and Credits	L	P	No. of Credits
	3	0	3
Prerequisite Courses, if any: Workshop Practice, Engineering Graphics			
Companion Course ,if any: Material Science and Metallurgy			
Course Objectives: 1. To develop practical skills in pattern making, mould and core making, and welding operations. 2. To understand foundry practices, sand testing equipment, and melting furnaces. 3. To identify casting defects and their prevention methods. 4. To study metal working processes such as hot working, cold working, and sheet metal operations. 5. To understand various welding processes and their industrial applications.			
Course Outcomes: After successful completion of the course, learner will be able to:			
COs	Statement		
CO1	Explain the fundamental concepts of manufacturing processes with emphasis on casting, moulding materials, pattern design, gating systems, melting, pouring, and solidification of metals.		
CO2	Define different casting methods, foundry practices, and casting defects and select suitable casting processes for specific engineering applications.		
CO3	Describe the principles of metal forming processes including hot working, cold working, forging, and rolling, and relate process parameters to material behavior and product quality		
CO4	Study of wire drawing, extrusion, press working, and advanced forming processes to identify appropriate manufacturing methods for engineering components.		
CO5	Examine different joining processes including welding, brazing, soldering, adhesive bonding, solid-state welding, and recommend suitable joining techniques for industrial applications		
CO6	Study of different fusion welding processes with their industrial application .		

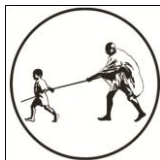


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Unit No.	Unit Title & Contents	Hours
1	Casting: 1.1 Casting –Introduction, History of the technology. Definition and major classification Casting materials, Sand mould casting:- Basic principles with simple examples of a solid casting and a hollow casting. Patterns; types, material and design including pattern allowances; 1.2 Moulding sands; composition, preparation, properties and testing; Core; Purpose, definition, materials, preparation and applications; Design of gating system; pouring basin, sprue, runner and risers. 1.3 Foundry equipment and furnaces. Melting, pouring and solidification.	6
2	Advance Casting: 2.1 Principles, method, relative advantages and applications of floor mould casting, shell mould casting, pit mould and loam mould casting CO2 mould casting; centrifugal casting (pure, semi and centrifuging types) investment casting ; Permanent mould casting. Die casting; types, methods, relative advantages and applications, Slush casting; principle and use. 2.2 Casting defects; types, causes and remedy	8
3	Metal Forming: 3.1 Forming Processes - Introduction; General principles; major classification with typical Examples; Hot working and cold working; principle, purpose, relative advantages and applications. 3.2 Forging:-Definition and classification giving few example of application; work materials different forging operations, tools and equipment ; Smithy, drop forging and press forging (pressing) methods and use. 3.3 Rolling:-Introduction, basic principles and general applications, Characteristics and applications of hot rolling and cold rolling; various rolling processes and applications and rolled products.	8
4	Drawing &Extursion: 4.1 Wire drawing and Extrusion:- Basic principles and requirements; Classification, methods and Applications, Work materials and products. 4.2 Press tool works; Basic principles, system, operations and	7



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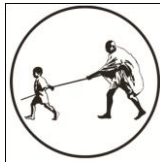
	applications. Shearing; Parting, notching, blanking and piercing. Cupping (drawing) and deep drawing. Coining and embossing; basic principle and methods. 4.3 Other forming processes: - Principles, methods, essential requirements and applications of Spinning, Bulging, Hydro forming, Magneto forming, Explosive forming.	
5	Welding: 5.1 Welding- Introduction: Major classes of joining; Mechanical joining; temporary, semi-permanent and permanent Giving examples; Welding; Brazing and soldering; Adhesive bonding. 5.2 Welding in Liquid state. Fusion welding: - Introduction; basic principle, definition and major classification; characteristics and applications of different fusion welding processes using different heat-sources. Heat source:- chemical; gas welding; thermit welding; Heat source:-electrical; Arc welding, Submerged arc welding; TIG and MIG, Plasma arc welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding.	8
6	Advanced Welding Techniques: 6.1 Solid state welding: - Principles. Methods, requirements and application of the different types; Solid state welding in hot condition; Forge welding; Friction welding; Diffusion welding; Solid state welding in cold condition; Ultrasonic welding. Pressure welding, Explosive welding	8

Textbooks:

1. Rao.P.N. 2001. Manufacturing technology: foundry, forming and welding: McGraw-Hill.
2. HajraChoudhary – “Elements of Workshop Technology- Vol. I Manufacturing Processes
3. 3.SeropeKalpakJian and Steven R. Schmid, “Manufacturing Engineering and Technology”,
4. Addison Wesley Longman (Singapore) Pte. India Ltd., 6th edition, 2009.

Reference Books:

1. Milkell P. Groover, “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley and Sons, New Jersey, 4th edition, 2010.
2. Paul DeGarmo, J.T. Black, Ronald A. Kohser, “Materials and Processes in Manufacturing”, Wiley, 10th edition, 2007.
3. Ghosh, A., & Mallik, A. K. 1986. Manufacturing science: Ellis Horwood.
4. Kalpakjian, S., & Schmid, S. R. 2008. Manufacturing processes for engineering materials: Pearson Education.
5. Campbell, J. S. Principles of manufacturing materials and processes: Tata McGraw-Hill



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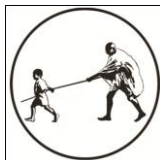
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MOOC/NPTEL Courses:

1. Prof. Shantanu Bhattacharya, Manufacturing Process Technology I & II, IIT Kanpur, Swayam NPTEL Online Course.

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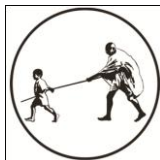


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Second Year Mechanical Engineering (2026-2027)			
Semester-III			
Course Code	PCC-MECH-203		
Category	Program Core Course		
Course Title	Material Science & Metallurgy		
Scheme and Credits	L	P	No. of Credits
	3	0	3
Prerequisite Courses, if any: Engineering Physics; Engineering Mechanics			
Companion Course, if any: Manufacturing Processes I			
Course Objectives: 1. To understand the crystal structure, atomic arrangement, and defects in engineering materials and relate them to material behavior and properties. 2. To Explain the mechanisms of plastic deformation and evaluate the mechanical properties of 3. metals using standard testing methods. 4. To analyze equilibrium diagrams, phase transformations, and micro structural changes in steels and alloys for engineering applications. 5. To select suitable heat treatment and surface hardening processes to obtain desired properties in ferrous materials. 6. To Develop knowledge of engineering non-ferrous alloys, powder metallurgy concepts, and modern non-destructive testing techniques used in industry.			
Course Outcomes: After successful completion of the course, learner will be able to			
COs	Statement		
CO1	Analyze the crystal structures of materials.		
CO2	Understand the mechanism of plastic deformation and evaluate the mechanical properties of metals		
CO3	Evaluate phase diagram of steels.		
CO4	Suggest appropriate heat treatment process for a given application.		



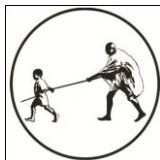
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CO5	Recognize the importance and applications of special alloy steels and non-ferrous alloys used in modern industrial applications.
CO6	Select suitable composite and polymeric materials for specific industrial and manufacturing Applications

Unit No.	Unit Title & Contents	Hours
1	Structure of Materials: Crystal Structures: Atomic arrangement: crystalline vs. amorphous materials; unit cell, space lattice, 7 crystal systems; BCC, FCC, and HCP structures, Introduction to Miller indices, Crystal Imperfections: Importance, Classification: Point defects: vacancy, interstitials, impurities, Frenkel, Schottky defects, Line defects: definition, types, edge, screw, mixed dislocations, characteristics of each type, planar defects: external surfaces, grain boundaries: high and low angle, tilt and twist boundaries; twin boundaries, stacking faults: intrinsic, extrinsic; Volume defects: examples.	6
2	Plastic Deformation and Mechanical Properties: Mechanism of plastic deformation: Slip: slip direction, slip plane, slip systems for cubic structures, Mechanism of slip: movement of dislocations; Twinning: twin direction and plane; types: deformation and annealing twinning; slip vs twinning; Deformation of single crystal by slip: Schmid's law, calculation of critical resolved shear stress, sliding and rotation of slip planes; Strain hardening: mechanism, Frank-Read source; Plastic deformation of polycrystalline materials: piling up of dislocations, effect of grain size on stress-strain curve, preferred orientation of slip systems. Mechanical Properties and their Testing: Engineering stress-strain curves, True stress- strain curves, true strain, relationship between engineering and true stress – strain, corrected and uncorrected true stress-strain curves, Evaluation of properties: proportional stress, elastic limit, ultimate tensile strength, breaking or fracture stress, yield stress, proof stress, resilience, toughness, stiffness, ductility, hardness testing, different hardness tests: Brinell, Rockwell and Vickers tests.	8

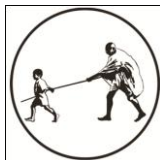


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3	Equilibrium Diagrams: Introduction: Importance, Definitions of terms, Hume-Rothery rules of solid-solubility, Gibb's phase rule, solidification of a pure metal, types of cooling curves for pure metals and binary solid solutions, plotting of equilibrium diagrams, Lever rule, Iron-iron carbide equilibrium diagram, phases present, different transformations, critical temperatures, non-equilibrium cooling of steels, property variation with microstructures, classification and applications of steels, specification of steels (as per Indian, American and British standards), Introduction to tool steels, transformation products of austenite: pearlite, bainite and martensite, TTT diagrams: determination, effect of carbon, critical cooling rate, CCT diagram: determination of CCT curves.	8
4	Heat Treatment: Introduction, Heat treatment of steels, Objectives/purposes, Heating: media, soaking; cooling media, polymer quenchant, mechanism of heat removal, Annealing processes: full annealing: purposes, process details and mechanism; isothermal annealing, spheroidize annealing, sub-critical annealing: types; Normalizing: comparison with annealing, Hardening: purpose, types, Tempering: purposes, process details and types; hardenability: Jominy end quench test, Jominy curves for different materials Surface hardening processes: Carburizing: solid, gas, and liquid carburizing; Nitriding: mechanism, white layer, advantages and limitations; Carbo-nitriding: process details; Flame hardening: various methods; Induction hardening: principle, types, advantages and drawbacks	7
5	Engineering Non-Ferrous Metals & NDT: Copper and copper alloys, Brasses, Aluminum and Aluminum alloys, Nickel and Nickel alloys, Tin and tin alloys and Bearing materials. Non-destructive testing: Introduction, dye penetrant test, magnetic particle inspection, ultrasonic test, and eddy current test. Phased Array Ultrasonic Testing (PAUT), Time of Flight Diffraction (TOFD), Digital Radiography (DR), Computed Tomography (Industrial CT), Acoustic Emission Testing (AET), Infrared Thermography Testing, Laser Shearography.	8

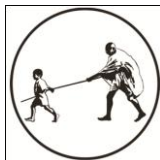


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6	Powder Metallurgy: Sintered structural components, Advantages and Limitations of powder metallurgy, Powder manufacture, Testing and Characterization, Manufacturing of typical P/M Products: Self-lubricating bearings, Cemented carbides, Cermets	8
Textbooks: 1. V. D. Kodgire, S.V. Kodgire, "Material Science and Metallurgy for Engineers", Everest Publishing House, Pune, 24th edition, 2008. 2. W. D. Callister, "Materials Science and Engineering: An Introduction", John Wiley and Sons, 5th edition, 2001. 3. V. Raghvan, "Material Science Engineering", Prentice Hall of India Ltd., 1992. 4. S. H. Avner, "Introduction to Physical Metallurgy", Tata McGraw Hill, 2nd edition, 1997. 5. R. A. Higgins, "Engineering Metallurgy: Part I", ELBS, 6th edition, 1996.		
Reference Books: 1. V. B. John, "Introduction to Engineering Materials", ELBS, 6th edition, 2001. 2. F. Carter, D. E. Paul, "Materials Science and Engineering", ASM International, 3rd edition, 2000.		
MOOC/NPTEL Courses: 1. Prof. Vivek Pancholi, Materials Science and Engineering, Indian Institute of Technology Roorkee, NPTEL Online Course. https://onlinecourses.nptel.ac.in/noc24_mm33/preview		



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Second Year Mechanical Engineering (2026-2027)

Semester-III

Course Code	PCC-MECH-204		
Category	Program Core Course		
Course Title	Thermodynamics		
Scheme and Credits	L	P	No. of Credits
	3	0	3

Prerequisite Courses, if any: Basic Mechanical Engineering

Companion Course, if any: Fluid Mechanics

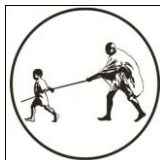
Course Objectives:

1. To develop understanding of thermodynamic properties, heat transfer and work interactions in various systems.
2. To enable students to apply the First and Second Laws of Thermodynamics for analysis of engineering devices and processes.
3. To develop the ability to analyze the behavior of ideal and real gases under different thermodynamic processes.
4. To study the working and performance of power cycles used in thermal engineering systems.
5. To familiarize students with refrigeration and air conditioning cycles and their practical applications.
6. To familiarize students with refrigeration and air conditioning cycles and their practical applications.

Course Outcomes:

After successful completion of the course, learner will be able to

COs	Statement
CO1	Explain the basic concepts, laws and terminology of thermodynamics including systems, Properties, processes and equilibrium conditions.
CO2	Apply the First Law of Thermodynamics to closed and open systems and analyze the Performance of various thermodynamic devices.
CO3	Interpret the Second Law of Thermodynamics and evaluate entropy changes, heat engines, refrigerators and heat pumps.
CO4	Analyze the behavior of ideal and real gases and solve problems related to thermodynamic processes and gas laws.
CO5	Evaluate the performance of thermodynamic power cycles such as Otto, Diesel, Brayton and Rankine cycles.
CO6	Explain the working principles and performance of refrigeration and air conditioning Systems including vapor compression and Bell-Coleman cycles.

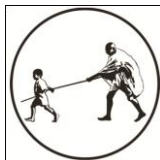


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Unit No.	Unit Title & Contents	Hours
1	Fundamentals of Thermodynamics: Introduction, scope and applications of thermodynamics Microscopic and macroscopic approach, Thermodynamic systems, surroundings and boundary, Types of systems: closed, open and isolated systems, Thermodynamic properties: intensive and extensive properties, State, path, process and cycle, Thermodynamic equilibrium, Zeroth law of thermodynamics, Temperature measurement and temperature scales, Work and heat transfer, Quasi-static and reversible processes	8
2	First Law of Thermodynamics: Energy and its forms, Internal energy and enthalpy, First law of thermodynamics for closed systems , PMM-I (Perpetual Motion Machine of First Kind) , Specific heats and relation between CP and CV, Steady flow energy equation (SFEE), Applications of first law to engineering devices: Nozzle Turbine Compressor Pump Boiler Condenser Throttle valve	8
3	Second Law of Thermodynamics: Limitations of first law, Heat engine, refrigerator and heat pump, Kelvin-Planck and Clausius statements, Reversible and irreversible processes , Carnot cycle and Carnot theorem, Thermodynamic temperature scale, Entropy: concept and significance, Clausius inequality, Entropy change in different processes, Entropy principle and applications.	8
4	Properties of Gases and Thermodynamic Processes: Ideal gas laws: Boyle's law, Charles's law and Avogadro's law, Universal gas constant and characteristic gas constant, Equation of state for ideal gases Thermodynamic processes for ideal gases:	8



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	Isobaric process Isochoric process Isothermal process Adiabatic process Polytropic process Real gases and Van der Waal's equation		
5	Power Cycles: Air standard cycles and assumptions ,Otto cycle, Diesel cycle, Dual cycle, Brayton cycle ,Rankine cycle, Thermal efficiency and mean effective pressure , Comparison of thermodynamic cycles.	8	
6	Introduction to Refrigeration and Air Conditioning: Introduction to refrigeration ,Refrigeration effect and COP , Bell-Coleman cycle , Vapor compression refrigeration cycle , Refrigerants and desirable properties ,Basics of air conditioning systems , Applications of refrigeration and air conditioning systems	6	

Textbooks:

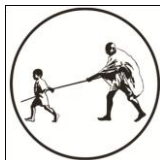
1. P. K. Nag; Engineering Thermodynamics, Tata McGraw Hill, New Delhi, 3rd edition, 2005.
2. Y. A. Cengel, M. A. Boles; Thermodynamics - An Engineering Approach, Tata McGraw Hill, 5th edition, 2006.
3. Engineering Thermodynamics by R. K. Rajput, Laxmi Publications.
4. Fundamentals of Engineering Thermodynamics by Michael J. Moran and Howard N. Shapiro, Wiley India.
5. Basic Engineering Thermodynamics by Rayner Joel, Pearson Education.
6. Thermodynamics by J. P. Holman, McGraw Hill Education.

Reference Books:

1. J. Van Wylen, R. E. Sonntag; Fundamental of Thermodynamics, John Wiley and Sons, 5th edition, 1998.
2. J. Moran, H. N. Shapiro; Fundamentals of Engineering Thermodynamics, John Wiley and Sons, 4th edition, 2004.

MOOC/NPTEL Courses:

1. Prof. Jayant K. Singh, *Engineering Thermodynamics*, IIT Kanpur, Swayam NPTEL Online Course.
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Second Year Mechanical Engineering (2026-2027)

Semester-III

Course Code	MGM-VEC-CI-231		
Category	Value Education Course		
Course Title	Constitution of India		
Scheme and Credits	L	P	No. of Credits
	2	0	2

Prerequisite Courses, if any: IKS Bucket, Communication Skills

Companion Course ,if any:

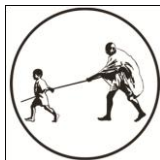
Course Objective

1. To Understand the basic features and philosophy of the Indian Constitution.
2. To develop awareness about Fundamental Rights, Duties, and Directive Principles of State Policy.
3. To understand the structure and functioning of Parliament and Judiciary in India.
4. To understand the role of the Election Commission, electoral process, and welfare commissions for SC/ST/OBC and women.
5. To understand Union–State relations and key constitutional bodies in India.
6. To examine Dr. B. R. Ambedkar's role in promoting social justice, women empowerment, and labour welfare.

Course Outcomes:

After successful completion of the course, learners will be able to:

COs	Statement
CO1	Explain the historical background, philosophy, and salient features of the Indian Constitution.
CO2	Describe Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties.
CO3	Understand the structure and functions of Parliament and Judiciary in India.
CO4	Describe the functions of the Election Commission, electoral process, and welfare commissions for SC/ST/OBC and women
CO5	Describe Union–State relations and the functions of key constitutional bodies in India.
CO6	Discuss Dr. B. R. Ambedkar's contribution to social justice, women empowerment, and labour welfare.

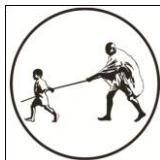


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Unit No.	Unit Title & Contents	Hours
1	Introduction to the Constitution of India: Historical Background of the Constitution, Constituent Assembly, Making of the Constitution Preamble and Philosophy of the Constitution, Salient Features of the Constitution Federal Structure and Parliamentary Democracy.	5
2	Fundamental Rights, DPSP and Fundamental Duties: Fundamental Rights: Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Directive Principles of State Policy and role of Government, Fundamental Duties of Citizens of India.	5
3	Parliament and Judiciary of India: Union Government and its Administration Structure: President and Vice President: Election, qualification, powers, and the process of impeachment. Prime Minister: Election, qualification, powers. Lok Sabha, Rajya Sabha, Legislative Process and Passing of Bills. Supreme Court and High Courts: Composition, appointment of judges, jurisdiction, powers, functions, Judicial Review and impeachment Process.	5
4	Election Commission of India: Election Commission: Role and responsibilities of Chief Election Commissioner, Electoral Process and Democratic Governance, State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women.	5
5	Relations between the Union and the States: Legislative relation, administrative relation, financial Relations, Emergency provision, freedom of trade commerce, comptroller and auditor general of India, public service commission, special provisions relating to certain classes, amendment of the Constitution.	5

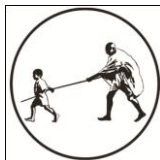


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6	Dr. B. R. Ambedkar and Social Transformation: Women Empowerment: Advocacy for Gender Equality, Hindu Code Bill, Women's Rights in Education and Employment, Constitutional Safeguards for Women. Labour Empowerment: Labour Welfare Policies, Reduction of Working Hours, Maternity Benefits, Minimum Wages and Social Security, Reservation Policy and Inclusive Development	5
Text Books: 1. Basu, D. D. Introduction to the Constitution of India. 26th edition., LexisNexis ButterworthsWadhwa, 2021. 2. Kashyap, Subhash C. Our Constitution. National Book Trust, India, 2019.		
Reference Books: 1. Bakshi, P. M. Constitution of India. Universal Law Publishing Co., 2023. 2. Jain, M. P. Indian Constitutional Law. 8th ed., LexisNexis ButterworthsWadhwa, Nagpur, 2018. 3. Kashyap, Subhash C. Our Constitution. National Book Trust, India, 2019. 4. Rao, B. Shiva. Framing of India's Constitution. Universal Law Publishing Co., Reprint Edition, 2012. 5. Austin, Granville. The Indian Constitution: Cornerstone of a Nation. Oxford University Press, Reprint Edition, 1999. 6. Ambedkar, B. R. Annihilation of Caste and Selected Speeches. Navayana Publishing, 2014.		
MOOC/NPTEL Courses: 1. Prof. Sudhir Krishnaswamy, <i>Constitutional Studies</i>, National Law School of India University, Swayam NPTEL Online Course. https://onlinecourses.nptel.ac.in/noc20_lw03/preview		

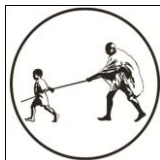


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Second Year Mechanical Engineering (2026-2027)			
Semester-III			
Course Code	MGM-HSSM-ED-232		
Category	Humanities Social Science and Management		
Course Title	Entrepreneurship Development		
Scheme and Credits	L	P	No. of Credits
	2	0	2
Prerequisite Courses, if any: Design Thinking			
Companion Course ,if any:			
Course Objectives: 1. To introduce the fundamental principles of entrepreneurship, forms of business organizations, and the startup ecosystem. 2. To identify, evaluate, and select viable business opportunities using structured techniques. 3. To explore business models, financial planning, and market validation strategies. 4. To study key marketing strategies, customer acquisition techniques, and branding essentials for startups. 5. To develop entrepreneurial mindset and ability to communicate and pitch business ideas effectively using structured storytelling techniques.			
Course Outcomes: After successful completion of the course, learner will be able to			
COs	Statement		
CO1	Describe the role of entrepreneurship in economic growth and the startup ecosystem		
CO2	Apply creative techniques to viable business ideas based on customer needs.		
CO3	Develop a basic business model using tools like the Business Model Canvas through market research.		
CO4	Implement basic marketing strategies for startups.		
CO5	Identify Customer acquisition strategies.		
CO6	Deliver a concise business pitch using storytelling and effective communication techniques		

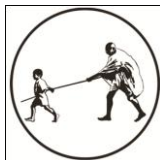


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Unit No.	Unit Title & Contents	Hours
1	Introduction to Entrepreneurship: Entrepreneurship: Definition and evolution, Role of entrepreneurship in economic development. Role of entrepreneurship in economic development – Role in job creation, GDP, and innovation. Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Intrapreneurship (corporate entrepreneurship), Lifestyle and small business entrepreneurship Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited. Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking Overview of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems Case Study: 1. Ritesh Agarwal – Founder of OYO Rooms (India) 2. Falguni Nayar – Founder of Nykaa (India) 3. Nandan Nilekani – Co-founder of Infosys & Architect of Aadhaar (India) etc.	5
2	Idea Generation & Opportunity Recognition: Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneurship. Brainstorming, Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping. Understanding Customer Needs and Pain Points, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user interviews, and empathy mapping, Evaluating Opportunities: Difference between an “idea” and an “opportunity.” Basic filters: Desirability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends, market gaps. Feasibility Analysis Basics, Scalability Check: Geographically or vertically growth of the idea, Barriers to scaling. Introduction to the “Lean Canvas”. Case Study : Analyzing how “Dunzo” or “BigBasket” identified urban pain points and How “Zerodha” scaled in India with a digital-first approach.	5

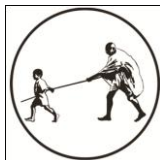


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3	Business Model Development: Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups. Key Components of BMC: Value Proposition: Defining what unique value the product/service offers. Customer Segments, Creating customer personas, Revenue Models: Direct sales, subscriptions, freemium, licensing, etc. Basic Market Research for Validation: Importance of market research in early-stage business development. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops. Case study: Map the BMC for a well-known startup (e.g., Uber or Zomato).	5
4	Marketing Strategies : Brand – Elements of brand identity: name, logo, voice, tone, and values. Positioning – How to create a unique space in the customer's mind. Positioning maps, Value-based positioning vs. competitor-based positioning Startup Branding Challenges – Limited budget, building trust, clarity in messaging. Costing & Pricing Strategies – Fixed vs. variable costs, break-even analysis. Introduction to Digital Marketing: Distribution Channels: Traditional vs. digital distribution. Social Media Marketing: Platforms overview (Instagram, LinkedIn, Facebook, X/Twitter) Creating a content strategy and calendar Organic vs. paid reach Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and content optimization, On-page vs. off-page SEO Importance of Digital Presence –Website essentials, blogs, and analytics tools.	5
5	Customer Acquisition Strategies Understanding the Customer Journey – Awareness, interest, decision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer marketing (micro-influencers), Email marketing basics, building a landing page and collecting leads Retention vs. Acquisition – Importance of building long-term customer relationships. Case Studies : 1. Zomato – Branding & Positioning in a Competitive Market 2. Mamaearth – Digital-First Customer Acquisition 3. Nykaa – Customer Segmentation and Channel Strategy	5

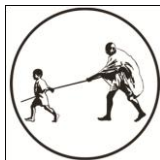


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6	Pitching & Business Communication: Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value proposition, target audience, Delivery tips: Clarity, brevity, confidence Storytelling & Communication: Importance of Storytelling in Business, Structure of a Business Story: Setup, Conflict, Resolution. Communication Skills: Verbal and Non-verbal Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks, Angel investors: Role, expectations, approach, Brief on incubators, government schemes, crowd funding. Case study: 1. Shark Tank India – Pitch Analysis (Any Season) 2. Airbnb – The Original Pitch Deck 3. Dropbox – Storytelling Through Demonstration 4. Dunzo – Investor Pitch Evolution	5
Textbooks: 1. Zacharakis, Andrew, Corbett, Andrew C., and Bygrave, William D., Entrepreneurship, 6th Edition, Wiley, 2025. 2. Drucker, Peter F., Innovation and Entrepreneurship: Practice and Principles, Reprint Edition, Harper Business, 2006. 3. Osterwalder, Alexander and Pigneur, Yves, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. Reference Books: 1. Ries, Eric, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Reprint Edition, Crown Business, 2011. MOOC/NPTEL Courses: 1. Dr. Nilam Panchal, <i>Entrepreneurship Development</i>, B.K. School of Business Management, Gujarat, Swayam NPTEL Online Course. https://onlinecourses.swayam2.ac.in/cec25_cm16/preview		

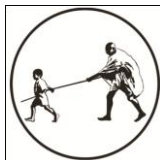


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Second Year Mechanical Engineering (2026-2027)			
Semester-III			
Course Code	AEC-MECH-206: Personality Development		
Category	Ability Enhancement Course		
Course Title	Personality Development		
Scheme and Credits	L	P	No. of Credits
	2	0	2
Prerequisite Courses, if any: Communication Skills			
Companion Course ,if any: Universal Human Values			
Course Objectives: 1. To develop self-awareness, confidence, and a growth mindset for personal and professional success. 2. To enhance interpersonal, communication, and teamwork skills required in modern workplaces. 3. To develop leadership, problem-solving, and decision-making abilities. 4. To equip students with professional ethics, workplace etiquette, and time management skills. 5. To prepare students for employment opportunities through resume building, group discussions, and interviews.			
Course Outcomes: After successful completion of the course, learner will be able to			
COs	Statement		
CO1	Explain self-awareness, personality traits, and goal-setting techniques for personal development.		
CO2	Demonstrate positive attitude, motivation, emotional intelligence, and resilience in personal and professional situations.		
CO3	Apply effective interpersonal and communication skills in academic and workplace environments.		
CO4	Utilize leadership, teamwork, problem-solving, decision-making, and time-management skills effectively.		
CO5	Demonstrate professional ethics, workplace etiquette, and responsible professional conduct.		
CO6	Apply employability skills including resume preparation, professional networking, group discussions, and interview techniques for career advancement.		



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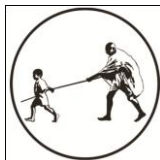
Unit No.	Unit Title & Contents	Hours
1	Self-Awareness and Personal Effectiveness: Understanding personality and self-awareness, personal strengths and weaknesses, SWOT analysis, growth mindset, goal setting, success habits, overcoming barriers to success, self-reflection and continuous improvement.	5
2	Attitude, Motivation and Emotional Intelligence: Positive attitude and professional behavior, self-motivation techniques, intrinsic and extrinsic motivation, emotional intelligence, self-confidence, resilience, handling setbacks and maintaining work-life balance	5
3	Interpersonal Skills and Communication: Interpersonal relationships, assertive communication, active listening, verbal and non-verbal communication, body language, professional communication, collaboration and networking skills	5
	Leadership and Workplace Competencies: Leadership qualities, teamwork and collaboration, problem-solving techniques, decision-making skills, conflict resolution, stress management, time management and adaptability in dynamic work environments.	5
5	Professional Ethics and Career Readiness: Professional ethics, workplace etiquette, corporate behavior, digital professionalism, responsible use of technology and social media, lifelong learning and career planning	5
6	Employability Skills and Placement Preparation: Resume and LinkedIn profile development, group discussions, HR and technical interviews, aptitude awareness, psychometric assessment, mock interviews, personal branding and career opportunities	5

Textbooks:

1. Barun K. Mitra, Personality Development and Soft Skills, 2nd Edition, Oxford University Press, New Delhi, 2019.
2. Stephen P. Robbins, Timothy A. Judge and Neharika Vohra, Organizational Behavior, 19th Edition (Global Edition), Pearson Education, 2023.

Reference Books:

1. Sudhir Andrews, How to Succeed at Interviews, Revised Edition, McGraw Hill Education India, 2020.
2. Robert Heller, Effective Leadership: Essential Managers Series, Revised Edition, DK



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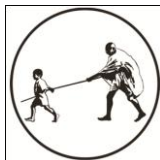
Publishing, 2022.

3. Tim Hindle, Manage Stress: Essential Managers Series, Updated Edition, DK Publishing, 2022.
4. Stephen E. Lucas, The Art of Public Speaking, 14th Edition, McGraw Hill Education, 2023.
5. Norman Vincent Peale, The Power of Positive Thinking, Latest Reprint Edition, Prakash Books / Fingerprint Publishing, 2023.
6. Pravesh Kumar, All About Self-Motivation, Revised Edition, Goodwill Publishing House, 2019.
7. Allan and Barbara Pease, The Definitive Book of Body Language, Revised Edition, Manjul Publishing, 2021.
8. M. S. Rao, Soft Skills: Enhancing Employability and Career Growth, Revised Edition, I.K. International Publishing House, 2021.
9. ShaliniVerma, Development of Life Skills and Professional Practice, 2nd Edition, Sultan Chand & Sons, 2021.
10. K. Alex, Soft Skills: Know Yourself and Know the World, 3rd Edition, S. Chand Publishing, 2022.
11. Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practice, 4th Edition, Oxford University Press, 2024.
12. M. S. Rao, 21 Success Sutras for Leaders, Latest Edition, Notion Press, 2023.

MOOC/NPTEL Courses:

1. Prof. T. Ravichandran, Developing Soft Skills And Personality, IIT Kanpur, Swayam NPTEL Online Course.

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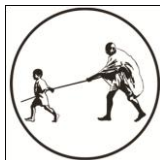


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Second Year Mechanical Engineering (2026-2027)			
Semester-III			
Course Code	PCCL-MECH-207		
Category	Program Core Course Laboratory		
Course Title	Manufacturing Technology - I Laboratory		
Scheme and Credits	L	P	No. of Credits
	0	2	1
Pre requisite Courses, if any: Workshop Practice			
Companion Course, if any: Manufacturing Technology-I			
Course Objectives: 1. To develop practical skills in pattern making, mould and core making, and welding operations. 2. To understand foundry practices, sand testing equipment, and melting furnaces. 3. To identify casting defects and their prevention methods. 4. To study metal working processes such as hot working, cold working, and sheet metal operations. 5. To understand various welding processes and their industrial applications.			
Course Outcomes: After successful completion of the course, learner will be able to			
COs	Statement		
CO1	Demonstrate the ability to prepare patterns, moulds and cores used in basic foundry operations.		
CO2	Perform arc welding and gas welding operations by following standard workshop practices and safety precautions		
CO3	Identify and explain the working principles of sand testing equipment, cupola furnace and other furnaces used in manufacturing industries		
CO4	Analyze common casting defects and classify metal working and welding processes used in manufacturing applications		
CO5	Prepare workshop reports and practical journals based on laboratory experiments, industrial visits and study assignments		



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Practical's

The term work should consists of Practical Jobs Mentioned in (A) and a journal consisting of contents in (B)

(A) Jobs

1. Pattern making
2. Mould and Core Making
3. Arc Welding
4. Gas Welding

(B)

1. Study of Sand Testing Equipments
2. Study of Cupola and other Furnaces
3. Study of Casting Defects
4. Study of Metal working processes: Hot, Cold and Sheet metal
5. Study of Welding Processes: Fusion, Pressure and Solid state

(Two processes in each Category)

(While writing study assignments it is desirable to visit laboratory/workshop/industrial set up in addition to referring the text and reference books.)

Practical Exam:

Any one job of 4 hours duration.

Textbooks:

1. Rao.P.N. 2001. Manufacturing technology: foundry, forming and welding: McGraw-Hill.
2. HajraChoudhary – “Elements of Workshop Technology- Vol. I Manufacturing Processes
3. 3.SeropeKalpakJian and Steven R. Schmid, “Manufacturing Engineering and Technology”,
4. Addison Wesley Longman (Singapore) Pte. India Ltd., 6th edition, 2009.

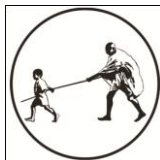
Reference Books:

1. Milkell P. Groover, “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley and Sons, New Jersey, 4th edition, 2010.
2. Paul DeGarmo, J.T. Black, Ronald A. Kohser, “Materials and Processes in Manufacturing”, Wiley, 10th edition, 2007.
3. Ghosh, A., &Mallik, A. K. 1986. Manufacturing science: Ellis Horwood.
4. Kalpakjian, S., &Schmid, S. R. 2008. Manufacturing processes for engineering materials: Pearson Education.
5. Campbell, J. S. Principles of manufacturing materials and processes: Tata McGraw-Hill

MOOC/NPTEL Courses:

1. Prof. Shantanu Bhattacharya, Manufacturing Process Technology I & II, IIT Kanpur, Swayam NPTEL Online Course.

https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_me51



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Second Year Mechanical Engineering (2026-2027)

Semester-III

Course Code	PCCL-MECH-208		
Category	Program Core Course Laboratory		
Course Title	Material Science and Metallurgy Laboratory		
Scheme and Credits	L	P	No. of Credits
	0	2	1

Pre requisite Courses, if any: Engineering Physics & Engineering Mechanics

Companion Course, if any: Manufacturing Processes I

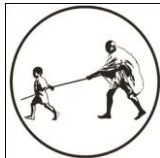
Course Objectives:

1. To Perform hardness tests on engineering materials and interpret the results for evaluating material properties.
2. To Prepare metallographic specimens and examine microstructures using standard microscopy techniques.
3. To Identify ferrous and non-ferrous materials through micro structural analysis.
4. To Correlate heat treatment processes with changes in microstructure and material properties of steels.
5. To Demonstrate basic knowledge and practical skills in non-destructive testing methods used for defect detection in materials.

Course Outcomes:

After successful completion of the course, learner will be able to

COs	Statement
CO1	Determination of Hardness using different tests.
CO2	Detect and evaluate various defects in metal components using Non Destructive and Destructive Testing Techniques
CO3	Preparation of steel specimen for micro structural examination using Microscope and its hardenability testing.



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List of Experiments:

1. Brinell Hardness Test
2. Rockwell Hardness test
3. Erichson Cupping Test
4. Magnaflux Test
5. Dye Penetrant Test
6. Specimen Preparation for Microscopy
7. Sulphur Print Test
8. Spark Test
9. Study and drawing of micro structures of plain carbon steels of varying carbon percentage
10. Jominy End Quench Test

Textbooks:

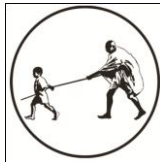
1. V. D. Kodgire, S.V. Kodgire, "Material Science and Metallurgy for Engineers", Everest Publishing House, Pune, 24th edition, 2008.
2. W. D. Callister, "Materials Science and Engineering: An Introduction", John Wiley and Sons, 5th edition, 2001.
3. V. Raghvan, "Material Science Engineering", Prentice Hall of India Ltd., 1992.
4. S. H. Avner, "Introduction to Physical Metallurgy", Tata McGraw Hill, 2nd edition, 1997.
5. R. A. Higgins, "Engineering Metallurgy: Part I", ELBS, 6th edition, 1996.

Reference Books:

1. V. B. John, "Introduction to Engineering Materials", ELBS, 6th edition, 2001.
2. F. Carter, D. E. Paul, "Materials Science and Engineering", ASM International, 3rd edition, 2000.

MOOC/NPTEL Courses:

1. Prof. Vivek Pancholi, Materials Science and Engineering, Indian Institute of Technology Roorkee, NPTEL Online Course.
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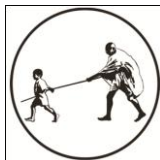


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Department of Mechanical Engineering
Curriculum Structure
Detailed Syllabus Semester IV
(Effective from A.Y. 2026-27)



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Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	PCC-MECH-251		
Category	Program Core Course		
Course Title	Strength of Materials		
Scheme and Credits	L	P	No. of Credits
	3	0	3

Prerequisite Courses, if any: Engineering Mechanics, Mathematics

Companion Course ,if any: - Strength of Materials Lab

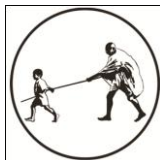
Course Objectives:

1. To Apply stress-strain principles, elastic constants, and thermal effects to analyze deformation in structural members.
2. To Analyze principal stresses, strain energy, and thin pressure vessels under various loading conditions.
3. To Construct and interpret shear force and bending moment diagrams for statically determinate beams.
4. To Evaluate bending and shear stresses and design beam sections using simple bending theory.
5. To Analyze torsion in shafts and assess column stability using relevant theories and formulas.
6. To Determine beam slope and deflection using analytical and graphical methods.

Course Outcomes:

After successful completion of the course, learner will be able to:

COs	Statement
CO1	Apply the principles of simple stresses, strains, elastic constants, and thermal effects to analyze deformation and stress in structural and composite members
CO2	Analyze principal stresses, strain energy, and thin pressure vessels using analytical and graphical methods under different loading conditions
CO3	Construct and interpret shear force and bending moment diagrams for statically determinate beams subjected to various loading conditions
CO4	Evaluate bending and shear stresses in beams and design beam sections using the theory of simple bending
CO5	Analyze torsional behavior of shafts and stability of columns using torsion theories and column formulas
CO6	Determine slope and deflection of beams using analytical and graphical methods for statically determinate structures.

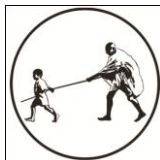


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Unit No.	Unit Title & Contents	Hours
1	Simple Stresses and Strains: Mechanical properties of materials, analysis of internal forces, simple stresses and strains, stress-strain curve, Hooke's law, modulus of elasticity, shearing, thermal stress, Poisson's ratio, volumetric stress, bulk modulus, shear modulus, relationship between elastic constants, Stresses of varying section, stresses in composite members..	8
2	Principal Stresses and Strains, Strain energy, thin pressure vessels: Normal & shear stress on any oblique plane, concept of principal plane, determination of Principal planes by analytical methods & graphical methods- Mohr's circle. Strain energy (resilience): Load-deflection diagram, strain energy, proof resilience, stresses due to gradual, sudden and impact loadings Thin pressure vessels: Circumferential (Hoop stress) and longitudinal stresses in thin cylindrical and spherical vessels. Effect of weld joint efficiency.	8
3	Shear Force and Bending Moment Diagram: Introduction to different types of beams, different types of supports & loads. Concept and definition of shear force and bending moment in determinant beams due to concentrated loads, UDL, UVL and couple. Relation between SF, BM and intensity of loading, construction of shear force and bending moment diagram for cantilever, simple and compound beams, defining critical and maximum value and position of point of contra flexure. Construction of BMD and load diagram from SFD, Construction of load diagram and SFD from BMD.	7
4	Stresses in Beams: Moment of inertia of different sections, bending and shearing stresses in a beam, theory of simple bending, derivation of flexural formula, economic sections, distribution of shear stress for different geometrical sections-rectangular, solid circular, I-section, other sections design for flexure and shear.	8
5	Torsion of Shafts, Axially Loaded Columns: Torsion: Introduction and assumptions, derivation of torsion formula, torsion of circular shafts, stresses and deformation in determinate solid/homogeneous/composite shafts, torsional strain energy. Columns and Struts: Concept of short and long Columns, Euler and Rankine's formulae, limitation of Euler's formula, equivalent length, eccentrically loaded short compression members.	8

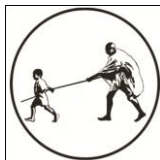


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6	Deflection of beams: Differential equation of deflected beam, slope and deflection at a point, calculations of deflection for determinate beams by double integration, Macaulay's method, theorem of area moment method (Mohr's theorems), moment diagram by parts, deflection of cantilever beams, deflection in simple supported beams, mid-span deflection, conjugate beam method, deflection by method of superposition.	6
Textbooks: 1. S. Ramamrutham, "Strength of Materials", Dhanpat Rai and Sons, New Delhi. 2. R. K. Bansal, "A Textbook of Strength of Materials", Laxmi Publications, New Delhi. 3. R. K. Rajput, "Strength of Materials (Mechanics of Solids)", S. Chand Publishing, New Delhi.		
Reference Books: 1. F. L. Singer and A. Pytel, "Strength of Materials", Harper Collins Publishers, 2002. 2. S. Timoshenko, "Strength of Materials: Part-I (Elementary Theory and Problems)", CBS Publishers, New Delhi. 3. CBS Publishers, New Delhi. 4. E. P. Popov, "Introduction to Mechanics of Solids", Prentice Hall, 2nd Edition, 2005. 5. S. B. Punmia, "Strength of Materials", Laxmi Publications, New Delhi.		
MOOC/NPTEL Courses: 1. Mishra, B., Strength of Materials, Indian Institute of Technology Guwahati (IIT Guwahati), NPTEL Online Course. https://nptel.ac.in/courses/112103024 2. Whiteman, J. R., Mechanics of Materials I: Fundamentals of Stress & Strain and Axial Loading, Georgia Institute of Technology, Coursera. https://www.coursera.org/learn/mechanics-of-materials-1 3. Strength of Materials (Mechanics of Materials) for Engineering Students, Udemy. https://www.udemy.com/topic/strength-of-materials/		



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Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	PCC-MECH-252		
Category	Program Core Course		
Course Title	Manufacturing Technology-II		
Scheme and Credits	L	P	No. of Credits
	3	0	3

Prerequisite Courses, if any: Manufacturing Technology-I

Companion Course ,if any: Strength of Materials

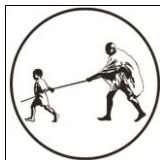
Course Objectives:

1. To introduce the fundamentals of machine tools, methods of surface generation, machine tool elements, work holding methods, and machining accuracy and surface finish.
2. To develop understanding of metal cutting principles, cutting tool geometry, chip formation, tool wear, tool failure, and the influence of cutting parameters on tool life.
3. To familiarize students with the construction, working, operations, accessories, and machining time calculations of lathe, milling, shaping, planning, and slotting machines.
4. To provide knowledge of drilling, boring, grinding, and surface finishing processes used for machining engineering components.
5. To develop understanding of gear manufacturing and non-conventional machining processes for selecting suitable machining methods in industrial applications.

Course Outcomes:

After successful completion of the course, learner will be able to:

COs	Statement
CO1	Explain the fundamentals of machine tools, methods of surface generation, machine tool elements, machining accuracy and surface finish.
CO2	Describe the principles of metal cutting, chip formation, cutting tool nomenclature, tool wear, tool life, and the effect of cutting parameters on machining performance
CO3	Study of lathe & its construction, working, operations, accessories, and machining time calculations of lathe, milling, shaping, planning, and slotting machines.



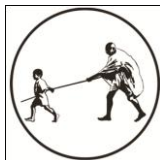
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CO4	Interpret the principles of drilling, boring, grinding, and surface finishing processes for machining engineering components.
CO5	Define gear manufacturing and non-conventional machining processes, and select suitable machining methods for specific industrial applications.
CO6	Explain the principles, working, equipment, and applications of major non-conventional machining processes and select suitable processes for different machining requirements.

Unit No.	Unit Title & Contents	Hours
1	Machine Tools & Metal Cutting: 1.1 Machine Tools : Introduction, classification of machine tools, generation & forming, methods of generation surfaces, accuracy & finish achievable, basic elements of machine tools, support structures, guide ways, general work holding methods. 1.2 Metal Cutting: Types of cutting tools orthogonal and oblique cutting, mechanism of chip formation, types of chips, chip breakers, cutting tool nomenclature. Tool wear and tool failure, tool life effect of cutting parameters on tool life	8
2	Lathe & It's Accessories: 2.1 Lathe: Types of Lathe, construction of centre Lathe, tool holding and work piece holding devices, operations performed on Lathe. 2.2 Lathe accessories and Attachments, cutting speed, feed, depth of cut and machining time calculations for Lathe. Construction and working of capstan and turret Lathes. Simple Problems on Machining time calculations.	8
3	Milling Machines: 3.1 Milling Machine: Classification, constructional features, milling cutter nomenclature, various milling operations. Milling cutters, cutter holding devices, milling machine attachments, cutting speed, feed, depth of cut and machining time calculation for milling machine. 3.2 Simple problem on machining time calculations. Shaping, Planning and slotter machines. Types, construction, operations	7
4	Drilling Machine: 4.1 Drilling Machine: Classification, constructional features, drilling machine parts, work holding work holding and tool holding devices. Twist drill geometry. Operations performed on drilling machine. 4.2 Boring machine: Horizontal, Vertical and jig boring machine, parts, tools and operations.	8

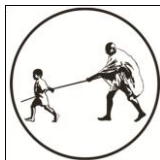


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5	Grinding Machine & Gear: 5.1 Grinding machine: types of abrasives, grain size, bonding process, grit, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machine (Center less, cylindrical and surface grinding) Dressing and truing of grinding wheels, marking system. Surface finishing process: Lapping, honing, super finishing, polishing, buffing etc. 5.2 Gear manufacturing: Gear cutting processes – Gear hobbing, gear shaping, gear milling, gear shaving & gear grinding, construction & working of the machine	8
6	Non-Conventional Machining: 6.1 Non conventional machining, principle, equipment & operations of Laser beam, Plasma Arc machining, Electro Chemical machining, electron discharge machining, ultra sonic machining, Abrasive jet machining, water jet machining	6
Textbooks: 1. Hazara Choudhary – Workshop technology vol – II – media promoters and publishers Pvt. 2. Ltd. Mumbai. 3. P. N. Rao – Manufacturing technology. Metal cutting and machine tools.		
Reference Books: 1. P. C. Sharma – Production Engineering (Khanna Publishers) 2. R. K. Jain - Production Engineering (Khanna Publishers) 3. HMT Handbook - Production Technology (TATA McGraw Hill Publisher) 4. Chapman W. A. – “Workshop Technology” vol – I, II, III (Edward Arnold Publisher Ltd.)		
MOOC/NPTEL Courses: 1. Prof. Shantanu Bhattacharya, Manufacturing Process Technology I & II, IIT Kanpur, Swayam NPTEL Online Course. https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_me51		



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Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	PCC-MECH-253		
Category	Program Core Course		
Course Title	Fluid Mechanics & Hydraulic Machines		
Scheme and Credits	L	P	No. of Credits
	3	0	3

Prerequisite Courses, if any: Engineering mechanics, Engineering Physics

Companion Course ,if any: Thermodynamics, Engineering Mechanics

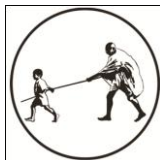
Course Objectives:

1. To introduce the fundamentals of machine tools, methods of surface generation, machine tool elements, work holding methods, and machining accuracy and surface finish.
2. To develop understanding of metal cutting principles, cutting tool geometry, chip formation, tool wear, tool failure, and the influence of cutting parameters on tool life.
3. To familiarize students with the construction, working, operations, accessories, and machining time calculations of lathe, milling, shaping, planning, and slotting machines.
4. To provide knowledge of drilling, boring, grinding, and surface finishing processes used for machining engineering components.
5. To develop understanding of gear manufacturing and non-conventional machining processes for selecting suitable machining methods in industrial applications.

Course Outcomes:

After successful completion of the course, learner will be able to:

COs	Statement
CO1	Explain the effect of fluid properties on a flow system.
CO2	Identify type of fluid flow patterns and describe continuity equation.
CO3	Analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
CO4	Select and analyze an appropriate turbine with reference to given situation in power plants.
CO5	Estimate performance parameters of a given Centrifugal and Reciprocating pump.



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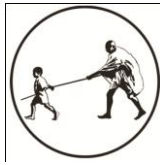
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Unit No.	Unit Title & Contents	Hours
1	Fluid Properties and Fluid Statics: Fluid Properties: Definition of fluid, Properties of fluid, Viscosity, Types of fluid, compressibility, Surface tension, Capillarity. Fluid Statics: Pascal's law, Hydrostatic law of pressure, Total Pressure, Centre of Pressure, Buoyancy, Meta center, Condition of Equilibrium of floating and submerged bodies	8
2	Fluid Kinematics and Dynamics: Fluid Kinematics: Eulerian and Lagrangian approach of fluid flow, Types of flow, Stream line, Streak line, Path line, concept of Velocity, potential & stream function flow net, Continuity equation for steady flow, Unsteady, Uniform, non-uniform, Compressible, incompressible. Fluid Dynamics: Euler's equation, Bernoulli's equation along a streamline for incompressible flow, Practical applications of Bernoulli's equation - Pitot tube, Venturi meter, Orifice meter.	7
3	Dimensional analysis: Introduction to dimensional analysis, dimensional homogeneity, methods of dimensional analysis-Rayleigh's method, Buckingham's π -theorem, dimensionless numbers.	8
4	Impact of Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes	8
5	Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel turbine, Francis turbine and Kaplan turbine- working proportions, work done, efficiencies. Hydraulic design- draft tube theory- functions and efficiency.	8
6	Centrifugal Pumps and Reciprocating Pumps: Centrifugal Pumps: Classification, working, work done – manometric head and efficiency specific speed- performance characteristic curves, NPSH. Reciprocating Pumps: Working, Discharge, slip, indicator diagrams.	6

Textbooks:

1. P. N. Modi, S. M. Seth, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, 10th edition, 1991.
2. Robert W. Fox, Alan T. McDonald, "Introduction to Fluid Mechanics", John Wile and Sons, 5th edition.
3. Fluid mechanics and Hydraulic machines, Dr. R. K. Bansal, Laxmi Publication, Delhi,



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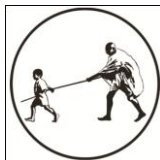
Reference Books:

1. V. L. Streeter, K. W. Bedford and E. B. Wylie, "Fluid Dynamics", Tata McGraw-Hill, 9th edition, 1998.
2. S. K. Som, G. Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 2nd edition, 2003.

MOOC/NPTEL Courses:

1. Prof. Subashisa Dutta, **Fluid Mechanics, IIT Guwahati**, Swayam NPTEL Online Course.
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ce159





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Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	MGM-VEC-UHV-281		
Category	Value Education Course		
Course Title	Universal Human Values		
Scheme and Credits	L	P	No. of Credits
	2	0	2

Prerequisite Courses, if any: Communication Skills, Design Thinking

Companion Course ,if any: Professional Ethics in engineering

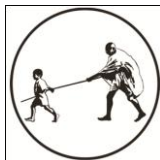
Course Objectives:

1. To make students understand
2. Value education, self-exploration, happiness, prosperity, and basic human aspirations.
3. Distinguish the needs of the self and body and achieve harmony between them.
4. Harmony in family and society through trust and respect in human relationships.
5. Interrelationship among the four orders of nature for sustainable and peaceful coexistence.
6. Human values in professional ethics, decision-making, and value-based living.

Course Outcomes:

After successful completion of the course, learner will be able to:

COs	Statement
CO1	Understand the overview of Value Education.
CO2	Explore the concept of Harmony in human being as Self and Body.
CO3	Acquire the depth knowledge of Harmony in the Family and Society.
CO4	Identify Harmony in the Nature/Existence.
CO5	Analyze professional ethics to present the sustainable solutions
CO6	Apply universal human values and ethics for responsible and sustainable living.

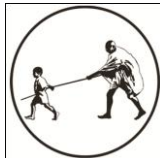


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Unit No.	Unit Title & Contents	Hours
1	Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity, Current Scenario, Method to Fulfill the Basic Human Aspirations.	5
2	Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health.	5
3	Harmony in the Family and Society Harmony in the Family, the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order.	5
4	Harmony in the Nature (Existence): Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	5
5	Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics- Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	5
6	Application of Universal Human Values in daily life and profession: Application of Universal Human Values in personal life, social life, and professional practices, Value-based decision making, Ethical responsibilities of engineers and professionals, Role of human values in	5



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	sustainable development, Environmental responsibility and social commitment, Case studies on ethical issues in professional life, Importance of responsible citizenship and value-based leadership.	
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Textbooks:

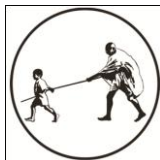
1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P
2. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
3. A Textbook on Professional Ethics and Human Values – R. S. Naagarazan (ISBN:9788122439717).

Reference Books:

1. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004, ISBN-13: 9788122425895.
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi, ISBN-13: 9788172290085.
3. Small is Beautiful - E. F Schumacher ISBN-13: 9780099225614

MOOC/NPTEL Courses:

1. P. Ravi Kiran, Mishra, Abhishek, Universal Human Values - Understanding Harmony and Ethical Human Conduct, eGyanKosh
https://egyankosh.ac.in/handle/123456789/121607?utm_source



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Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	MGM-CC-AEL-282-A		
Category	Co-curricular Courses		
Course Title	French Language		
Scheme and Credits	L	P	No. of Credits
	2	0	2

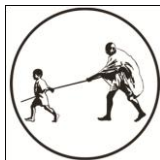
Course Objectives:

1. To introduce the students to French as an education hub and career destination.
2. To introduce the basic structure of French Language.
3. To make the students understand the character set of French
4. To understand the French Culture
5. To understand basic vocabulary
6. To understand basic Grammar

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

COs	Statements
CO1	Understand the basic info about French for job/ higher education
CO2	Understand basic French Alphabets.
CO3	Know additional symbols and alphabet combination
CO4	Learn French phonetic rules and exceptions
CO5	Learn basic vocabulary , grammar , and self-introduction in French

Unit No.	Unit Title & Contents	Hours
1	Introduction to French Language Definition and importance of language, Structure of French Language, Basic Info about French, French Alphabets	6
2	Greeting and Self Introduction Basic Greetings, Self introduction, Weekdays , months etc, Grammer 1 The articles	6



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3	Basic Vocabulary and Numbers Vocab – Family, Professions, Numbers , Ordinal numbers	6
4	Basic Grammar and Reading Time reading, Grammar – Personal Pronouns, Vocab – Job, modes of Transport, Vocab – Colours	6
5	Sentence Formation Sentence structure, Declarative sentences, Interrogative -A – WH Questions, Interrogative -B – yes/no questions	6

Textbooks:

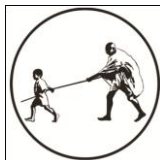
1. Berthet, Annie, Hugot, Catherine, Kizirian, Véronique, Waendendries, Monique, and Sampsonis, Béatrix, Alter Ego A1 & Alter Ego D'Activités, Level A1, Hachette, Goyal Publishers & Distributors Pvt. Ltd., ISBN-10: 8183075452, 2013.
2. Cocton, Marie-Noëlle, Dintilhac, Anneline, Oliveira, Anouchka, Ripaud, Delphine, and Dupleix, Dorothee, Saison – Méthode de Français 1 A1, Level A1, Didier Publisher, ISBN: 9782278112708, 2024.

Reference Books:

1. Pécheur, Jacques and Girardet, Jacky, Écho – Méthode de Français A1, Level A1, Goyal Publishers & Distributors Pvt. Ltd., ISBN-13: 9782090385885, 2013.
2. Andant, Christine, À Propos – Livre de l'Élève, Level A1, French and European Publications Inc., ISBN-13: 9782706122866, 2015.

MOOC/NPTEL Courses:

1. Jagannathan, Ramya, Foundations of French, Indian Institute of Management Bangalore (IIMB), SWAYAM, 6-Week Online Course, 2025.
https://onlinecourses.swayam2.ac.in/e-learning/preview/imb25_mg88

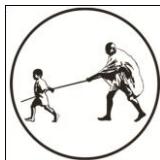


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Second Year Mechanical Engineering (2026-2027)			
Semester-IV			
Course Code	MGM-CC-AEL-282-B		
Category	Co-curricular Courses		
Course Title	German Language		
Scheme and Credits	L	P	No. of Credits
	2	0	2
Course Objectives: 1. To introduce the students to Germany as an education hub and career destination. 2. To introduce the basic structure of German Language. 3. To make the students understand the character set of German 4. To understand the German Culture 5. To understand basic vocabulary 6. To understand basic Grammar			
Course Outcomes: After successful completion of the course, learner will be able to			
COs	Statements		
CO1	Understand the basic info about Germany for job/ higher education		
CO2	Understand basic German Alphabets.		
CO3	Know additional symbols and alphabet combinations.		
CO4	Learn German phonetic rules and exceptions		
CO5	: Learn basic vocabulary , grammar , and self-introduction in German		

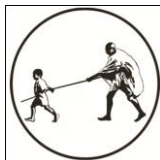


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Unit No.	Unit Title & Contents	Hours
1	Introduction to German Language Definition and importance of language, Structure of German Language, Basic Info about Germany, German Alphabet – 1	6
2	Alphabets and Greetings German Alphabet – 2, Vocabulary- 1 basic Greetings, Self introduction, Vocabulary 2, Weekdays, months etc, Grammar 1 The articles	6
3	Basic Vocabulary and Numbers Vocab – Family, Professions, Numbers -1, Numbers- 2, Ordinal numbers	6
4	Basic Grammar and Reading Time reading, Grammar – Personal Pronouns, Vocab – Job, modes of Transport, Vocab – Colours	6
5	Sentence Formation Sentence structure, Declarative sentences, Interrogative -A – WH Questions, Interrogative -B – yes/no questions	6
Textbooks 1. Bettermann, Christel, Demme, Silke, Funk, Hermann, Kuhn, Christina, and Werner, Regina, Studio D A1, Goyal Publishers & Distributors, ISBN-13: 9783464207321, 2005. 2. Dengler, Stefanie, Netzwerk 1 A1, Goyal Publishers & Distributors, ISBN-10: 8183076963, 2012.		
Reference Books: 1. Coggle, Paul and Schenke, Heiner, Tech Yourself German, Teach Yourself Publications, ISBN-10: 1444177362, 2012. 2. Deutscher Sachverständiger, Towards Germany, Lingo Mastery, ISBN-10: 1951949552, 2022.		
NPTEL: 1. Jenny, Introduction to German Language, Lingoni German (YouTube Channel). This video provides a beginner-friendly introduction to the German language, covering basic vocabulary, pronunciation, and essential conversational phrases. https://youtu.be/gz9JbZcfnrk?si=GnMsop4du_UrtJIh		

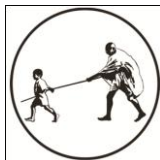


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Second Year Mechanical Engineering (2026-2027)			
Semester-IV			
Course Code	MGM-CC-AEL-282-C		
Category	Co-curricular Courses		
Course Title	Spanish Language		
Scheme and Credits	L	P	No. of Credits
	2	0	2
Course Objectives: 1. To introduce the students to Spain as an education hub and career destination. 2. To introduce the basic structure of Spanish Language. 3. To make the students understand the character set of Spanish 4. To understand the Spanish Culture 5. To understand basic vocabulary 6. To understand basic Grammar 7.			
Course Outcomes: After successful completion of the course, learner will be able to:			
COs	Statements		
CO1	Understand the basic info about Spain for job/ higher education		
CO2	Understand basic Spanish Alphabets		
CO3	Know additional symbols and alphabet combinations		
CO4	Learn Spanish phonetic rules and exceptions		
CO5	Learn basic vocabulary, grammar , and self-introduction in Spanish		
Unit No.	Unit Title & Contents	Hours	
1	Introduction to Spanish Language Use and importance of language, Basic information about Spain, Sentence structure of Spanish Language, Informal introduction	6	
2	Alphabet and Basic Grammar	6	

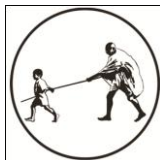


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	Spanish alphabet – 1:Salutation and expression, Subject pronouns, Verb Ser	
3	Basic Vocabulary and Asking Questions Negation,Vocabulary, Professions, Asking question using ‘¿Qué?, Asking and telling first-name and last-name	6
4	Genders and Articles Use of the question ¿Quién es? / ¿Qué hace? etc., Cardinal numbers 1-20, Noun: Gender and number, Articles: Definite	6
5	Adjectives and Numbers Adjective: Gender and number, Nationality and Country name, Numbers 21-100, Adjective: Demonstrative	6
Text Books: 1. Corpas, Jaime, Garcia, Eva, and Garmendia, Agustín, Aula Internacional 1, Level A1, Goyal Publishers & Distributors Pvt. Ltd., ISBN-13: 9788415640097, 2021. 2. Palomino, María Ángeles, Chicos Chicas 1, Edelsa, ISBN-10: 8477117728, 2002.		
Reference Books: 1. Martinez, Alex, Spanish Made Easy, Goyal Publishers & Distributors Pvt. Ltd., ISBN-13: 9788183070942, 2002.		
NPTEL: 1. Singh, Vikash Kumar, Basics of Spanish Language and Culture – I, Indira Gandhi National Open University (IGNOU), SWAYAM Online Course. The course introduces learners to basic Spanish language skills, vocabulary, grammar, pronunciation, and aspects of Spanish culture for beginners. https://onlinecourses.swayam2.ac.in/e-learning/preview/nou22_lg12		



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Second Year Mechanical Engineering (2026-2027)

Semester-IV

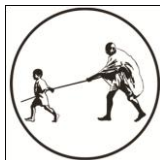
Course Code	MGM-CC-AEL-282-D		
Category	Co-curricular Courses		
Course Title	Japanese Language		
Scheme and Credits	L	P	No. of Credits
	2	0	2

Course Objectives:

1. To introduce learners to basic Japanese language structure, vocabulary, and sentence formation.
2. To develop beginner-level listening, speaking, reading, and writing skills in Japanese.
3. To enable students to understand and use common daily expressions and greetings in Japanese.
4. To familiarize learners with Hiragana, Katakana, and essential Kanji characters required for JLPT N5.
5. To prepare students for elementary-level Japanese communication and the JLPT N5 examination.

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

COs	Statements
CO1	Understand and use basic Japanese greetings, expressions, and sentence patterns in daily communication.
CO2	Read and write Hiragana, Katakana, and simple Kanji characters accurately.
CO3	: Apply elementary Japanese grammar rules to form correct sentences.
CO4	Comprehend short Japanese conversations and simple written passages.
CO5	Demonstrate beginner-level proficiency required for the JLPT N5 examination

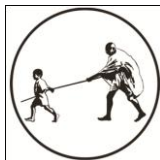


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Unit No.	Unit Title & Contents	Hours
1	Introduction to Japanese Language and Scripts Hiragana & Katakana - Reading Writing, and Basic Pronunciation, Greetings, Self-Introduction, Numbers, Days of the Week, Months	6
2	Basic Grammar and Sentence Formation Particles {wa, ga, no ,ni}, Basic usage and sentence structure, Introduction to basic verbs, Present tense and negative form	6
3	Numbers and Basic Vocabulary Describing things: Nouns + 1/0, Using negative/positive, Basic shopping vocabulary	6
4	Types of Grammar Describing people and objects using adjectives, Types Grammar: Question words {nan, itsu, doko, donna} and asking questions	6
5	Asking Questions and Practice Grammar: Question words {nan, itsu, doko, donna} and asking questions, Verb conjugation: Dictionary form and (te) form, Mock tests, Speaking practice, revision, mini quiz and vocabulary drills	6
Textbooks: 1. 3A Corporation, Minna no Nihongo 1-1, Vol. 1, Goyal Publishers, ISBN-10: 8183071708, 2007. 2. Banno, Eri, Ikeda, Yoko, Ohno, Yutaka, Shinagawa, Chikako, and Tokashiki, Kyoko, Genki I: An Integrated Course in Elementary Japanese, 3rd Edition, Japan Times Publishing Ltd., ISBN-13: 9784789017305, 2020.		
Reference Books:		
NPTEL Link: 1. Misra, Vatsala , Introduction to Japanese Language and Culture, Indian Institute of Technology Kharagpur (IIT Kharagpur), NPTEL Online Course. The course provides an introduction to basic Japanese language skills, pronunciation, vocabulary, grammar, sentence patterns, and key aspects of Japanese culture. https://nptel.ac.in/courses/121104005		



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Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	MGM-CC-AEL-282-E		
Category	Co-curricular Courses		
Course Title	Sanskrit Language		
Scheme and Credits	L	P	No. of Credits
	2	0	2

Pre requisite Courses, if any:

Companion Course, if any:

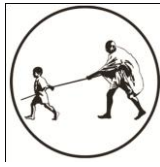
Course Objectives:

1. Understand the historical, cultural, and literary heritage preserved in ancient Sanskrit texts such as the Vedas, Upanishads, Ramayana, Mahabharata, and Puranas.
2. Develop fundamental knowledge of Sanskrit language, grammar, vocabulary, and sentence construction.
3. Acquire proficiency in reading, reciting, comprehending, and interpreting Sanskrit texts, verses, and stories.
4. Apply Sanskrit grammatical principles, number systems, and verb conjugations in written and spoken communication.
5. Enhance Sanskrit writing skills using traditional and modern scripts while appreciating the relevance of Sanskrit literature in contemporary knowledge systems

Course Outcomes:

After successful completion of the course, learner will be able to:

COs	Statements
CO1	Explain the cultural, literary, and philosophical contributions of major Sanskrit texts including Ramayana, Mahabharata, Vedas, Upanishads, and Puranas.
CO2	Read, recite, comprehend, and summarize simple Sanskrit texts, verses, stories, and literary passages with proper pronunciation and accent.
CO3	Apply Sanskrit grammar, numbers, time expressions, noun forms, and verb conjugations to construct grammatically correct sentences.
CO4	Analyze and interpret selected Sanskrit literary works such as Panchatantra, Hitopadesha, and various forms of Kāvya to derive moral and cultural insights.
CO5	Demonstrate Sanskrit writing skills by composing simple texts, messages, and letters using appropriate grammatical structures and writing conventions.



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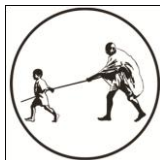
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Unit No.	Unit Title & Contents	Hours
1	Cultural Aspect Overview of आर्षमहाकाव्यम् – रामायणम् and महाभारतम्, Overview of वेद, ब्राह्मण, उपनिषद and वेदाङ्ग, Overview of पुराण – अष्टादशपुराणानि, Read and comprehend from simple texts/paragraphs, Summarizing the main points of the given texts.	6
2	Sanskrit numbers and sentence structure संस्कृतवर्णानां परिचयः- माहेश्वरसूत्राणि, उच्चारणस्थानानि, Apply सङ्ख्या (Numbers) and समयम् (Time) in sentence, Introduction to नामरूपाणि – Words related to Engineering – स्वरान्तशब्द, Introduction to verb conjugation (लट्, लङ्, लृट्, लोट्, विधिलिङ्) -1,4,6,10 गण – धातुरूपाणि	6
3	Sanskrit grammar Introduction to Sanskrit Alphabets, word and sentence, Writing simple text, short messages, letters on given topics, Correct errors in given texts, Solving grammar exercises to get elementary level sentence structure in Sanskrit.	6
4	Enhancing proficiency in Sanskrit reading through उपजीव्यसाहित्य Overview of various kinds of काव्यम् – नीतिकाव्यम्, गीतिकाव्यम्, स्तोत्रसाहित्यम्, चम्पूकाव्यम्, Overview of कथासान्दृत्यम् – बृहत्कथा, कथासरतसागर, पञ्चतन्त्रम्, हितोपदेशः etc., पञ्चतन्त्रम् सूक्तिसुधा, Selected verses from पञ्चतन्त्रम्, Discover story behind the selected verse of पञ्चतन्त्रम् and नहतोपदेशः, Read Sanskrit verses and paragraphs in appropriate accent.	6
5	Sanskrit writing skills Introduction to नामधातुरूपाणि – Related to Engineering – व्यञ्जनान्तशब्दाः, Application of verb conjugation (लट्, लङ्, लृट्, लोट्, विधिलिङ्) -(2,3,5,7,8,10 गण- धातुरूपाणि), Basic rules for Sanskrit writing, Sanskrit Writing Traditions: Devanagari, Roman (IAST).	6

Learning Resources

Textbooks:

1. Dora Ghanashyam – Saṃskṛta Vyākaraṇakaumudī, Chowkhamba Sanskrit Series Office, Varanasi, 2020. Oak Anjali – Sanskrit Grammar, PCCOE Publication, Pune 2025.
2. ओक अंजली – सुगम संस्कृत, पीसीसीओ, पुणे, २०२५.
3. मुळे रवीन्द्र – संस्कृत-व्याकरणशास्त्र-प्रवेश, ज्ञानेंद्र अंबादास मुळे प्रकाशि, संगमनेर, २००४.
4. सोमलवार नीला- कौमुदी विहार-सुबन्त – कारक प्रकरणम्, कौमुदी प्रकाशि, यवतमाळ, २०००.



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MOOC/NPTEL Courses:

1. Choudry, Anuradha, Introduction to Basic Spoken Sanskrit and Intermediate Level of Spoken Sanskrit, Indian Institute of Technology Kharagpur (IIT Kharagpur), NPTEL Online Course.
2. <https://nptel.ac.in/courses/109105135>.
3. Choudry, Anuradha, Advanced Level of Spoken Sanskrit, Indian Institute of Technology Kharagpur (IIT Kharagpur), NPTEL Online Course. <https://nptel.ac.in/courses/109105189>

Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	PCCL-MECH-255		
Category	Program Core Course Laboratory		
Course Title	Strength of Materials Laboratory		
Scheme and Credits	L	P	No. of Credits
	0	2	1

Pre requisite Courses, if any: Engineering Mechanics

Companion Course, if any: Strength of Materials

Course Objectives:

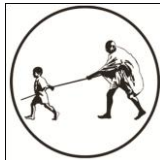
1. To provide practical exposure to mechanical testing of engineering materials and familiarize students with standard testing equipment.
2. To develop understanding of the behavior of materials and structural members under different types of loading conditions.
3. To enable students to interpret experimental results, correlate them with theoretical concepts, and build skills in technical report writing.

Course Outcomes:

After successful completion of the course, learner will be able to

COs	Statement
CO1	Conduct mechanical testing of engineering materials to determine their strength and deformation characteristics under tensile, compressive, shear, and impact loading conditions.
CO2	Investigate the behavior of structural members subjected to bending, torsion, shear force, deflection, and buckling, and compare experimental observations with theoretical principles.
CO3	Analyze stress conditions, process experimental data, and prepare technical reports to interpret the mechanical behavior of materials and structures.

Course Contents:



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List of Practical's/Experiments (Any Eight)

1. Tension test on ferrous and non-ferrous alloys (mild steel/cast iron/aluminum, etc.)
2. Compression test on mild steel, aluminum, concrete, and wood
3. Shear test on mild steel and aluminum (single and double shear tests)
4. Graphical solution method for principal stress problems
5. Impact test on mild steel, brass, aluminum, and copper specimens
6. Determination of Shear Force in a Beam
7. Flexure test on mild steel and timber beams
8. Torsion test on mild steel, cast iron solid bars
9. Deflection test on mild steel and wooden beam specimens
10. Verification of Theory of Columns (Buckling Test)

Textbooks:

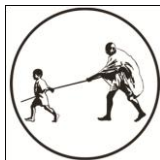
1. S. Ramamrutham, "Strength of Materials", Dhanpat Rai and Sons, New Delhi.
2. R. K. Bansal, "A Textbook of Strength of Materials", Laxmi Publications, New Delhi.
3. R. K. Rajput, "Strength of Materials (Mechanics of Solids)", S. Chand Publishing, New Delhi.

Reference Books:

1. L. Singer and A. Pytel, "Strength of Materials", Harper Collins Publishers, 2002.
2. S. Timoshenko, "Strength of Materials: Part-I (Elementary Theory and Problems)", CBS Publishers, New Delhi.
3. E. P. Popov, "Introduction to Mechanics of Solids", Prentice Hall, 2nd Edition, 2005.
4. S. B. Punmia, "Strength of Materials", Laxmi Publications, New Delhi.

MOOC/NPTEL Courses:

1. Mishra, B., Strength of Materials, Indian Institute of Technology Guwahati (IIT Guwahati), NPTEL Online Course.
<https://nptel.ac.in/courses/112103024>
2. Whiteman, J. R., Mechanics of Materials I: Fundamentals of Stress & Strain and Axial Loading, Georgia Institute of Technology, Coursera.
<https://www.coursera.org/learn/mechanics-of-materials-1>
3. Strength of Materials (Mechanics of Materials) for Engineering Students, Udemy.
<https://www.udemy.com/topic/strength-of-materials/>

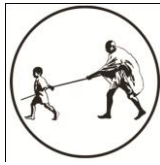


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Second Year Mechanical Engineering (2026-2027)			
Semester-IV			
Course Code	PCCL-MECH-256		
Category	Program Core Course Laboratory		
Course Title	Fluid Mechanics and Hydraulic Machines Laboratory		
Scheme and Credits	L	P	No. of Credits
	0	2	1
Prerequisite Courses, if any: Engineering mechanics, Engineering Physics			
Companion Course ,if any: Thermodynamics, Engineering Mechanics			
Course Objectives: 1. To understand the basic principles of fluid mechanics 2. To identify various types of flows 3. To evaluate the performance of hydraulic turbines 4. . To understand the functioning and characteristic curves of pumps			
Course Outcomes: After successful completion of the course, learner will be able to			
COs	Statement		
CO1	Explain the effect of fluid properties on a flow system.		
CO2	Identify type of fluid flow patterns and describe continuity equation.		
CO3	Analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.		
CO4	Select and analyze an appropriate turbine with reference to given situation in power plants.		
CO5	Estimate performance parameters of a given Centrifugal and Reciprocating pump.		
List of Practical's/Experiments/Assignments (Any eight experiments from the list)			
1. Verification of Bernoulli's theorem			
2. Determination of Critical Reynolds number using Reynolds Apparatus			
3. Determination of pressure drop in pipes of various cross-sections			
4. Viscosity measurement using viscometer			
5. Verification of momentum equation using impact of jet apparatus			
6. Determination of metacentric height of a floating body			



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7. Calibration of a selected flow measuring device
8. Gauge and differential pressure measurements using various types of manometers,
9. Performance test on Pelton Turbine.
10. Performance test on Francis Turbine.
11. Performance test on Kaplan Turbine.
12. Performance test on Single Stage / Multi-Stage Centrifugal Pump.
13. Performance test on Reciprocating Pump.

Textbooks:

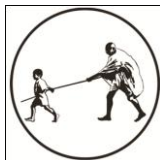
1. P. N. Modi, S. M. Seth, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, 10th edition, 1991.
2. Robert W. Fox, Alan T. McDonald, "Introduction to Fluid Mechanics", John Wile and Sons, 5th edition.
3. Fluid mechanics and Hydraulic machines, Dr. R. K. Bansal, Laxmi Publication, Delhi, 2005

Reference Books:

1. V. L. Streeter, K. W. Bedford and E. B. Wylie, "Fluid Dynamics", Tata McGraw-Hill, 9th edition, 1998.
2. S. K. Som, G. Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, 2nd edition, 2003.

MOOC/NPTEL Courses:

1. Prof. Subashisa Dutta, **Fluid Mechanics**, IIT Guwahati, Swayam NPTEL Online Course.
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ce159

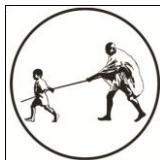


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Second Year Mechanical Engineering (2026-2027)			
Semester-IV			
Course Code	VSEC-MECH-257		
Category	Vocational and Skill Enhancement Course		
Course Title	Machine Drawing & CAD Laboratory		
Scheme and Credits	L	P	No. of Credits
	1	2	2
Pre requisite Courses, if any: Engineering Graphics, Basic Computer Applications.			
Course Objectives: 1. To provide knowledge of sectional views, engineering drawing conventions, and standard representation techniques used in mechanical engineering drawings. 2. To develop understanding of common machine elements such as screwed fastenings, riveted joints, welded joints, bearings, and shaft couplings through graphical representation. 3. To introduce the principles of interpenetration of surfaces and assembly drawing techniques used in engineering design and manufacturing. 4. To familiarize students with Computer-Aided Design and Drafting (CADD) tools and basic AutoCAD commands for creating and visualizing engineering drawings.			
Course Outcomes: At the end of the course, students will be able to:			
COs	Statement		
CO1	Apply sectional view techniques, including full, half, and partial sections, and use appropriate hatching conventions for machine elements		
CO2	Interpret and apply standard engineering drawing conventions for springs, gears, screw threads, welded joints, limits, fits, tolerances, and surface finish symbols.		
CO3	Illustrate and identify the constructional features and representations of common machine elements such as screwed fastenings, riveted joints, and welded joints.		
CO4	Draw and analyze the curves of intersection formed by the interpenetration of simple engineering solids such as prisms, cylinders, and cones.		
CO5	Prepare and interpret assembly and detail drawings of standard machine components and understand the relationship between assembled parts.		
CO6	Utilize basic Computer-Aided Design and Drafting (CADD) tools and AutoCAD commands to create, dimension, view, and develop simple 2D and		



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	3D engineering drawings.	
Unit No.	Unit Title & Contents	Hours
1	Sectional Views: Full section, half section, partial section, guidelines for hatching, examples on all above types of sections of machine elements.	5
2	Conventional Representation: Conventional representation of springs, gears, screw threads, and welded joints. Introduction to standard drawing conventions for limits, fits, and tolerances. Representation of surface roughness and surface texture symbols as per engineering drawing standards.	5
3	Study of Machine Elements : Screwed Fastenings: Locking arrangements of nuts and foundation bolts. Riveted and Welded Joints: Single- and double-riveted lap and butt joints, and basic welded joints.	5
4	Interpenetration of Surfaces: Drawing of intersection curves of penetrating solids, such as prism–prism, cylinder–cylinder, cone–cylinder, and prism–cylinder.	5
5	Drawing of Assembly and Details: Introduction to assembly and detail drawings of standard machine components, such as valves, pumps, shaft couplings, bearings, joints, pipe fittings, or engine parts.	5
6	Computer Aided Drafting: Introduction to Computer Aided Design and Drafting (CADD), Advantages of CADD, study of preliminary Auto CAD commands like drawing, dimensioning, viewing commands. Drawing 3-D views in AutoCAD.	5

Text Books:

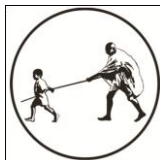
1. Dr. Dhawan, "A Text Book of Machine Drawing," S. Chand publications 2014

Reference Books:

1. N. D. Bhatt; Engineering Drawing, Charotar Publishing House, Anand, India.
2. N. D. Bhatt; Machine Drawing, Charotar Publishing House, Anand, India.
3. Ajeet Sing; Working with Auto CAD 2000, Tata McGraw Hill, New Delhi.
4. G. Pohit and G. Ghosh, Machine Drawing with AutoCAD –Pearson Education, 2005
5. P.S. Gill, Machine Drawing - S. K. Kataria and Sons, Delhi, 2002

MOOC/NPTEL Courses:

1. Prof. Asimava Roy Choudhury, Computer numerical control CNC of machine tools and processes, IIT Kharagpur, Swayam NPTEL Online Course.



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https://onlinecourses.nptel.ac.in/e-learning/preview/noc19_me46

Second Year Mechanical Engineering (2026-2027)

Semester-IV

Course Code	PCCL-MECH-258		
Category	Program Core Course Laboratory		
Course Title	Manufacturing Technology -II Laboratory		
Scheme and Credits	L	P	No. of Credits
	0	2	1

Pre requisite Courses, if any: Manufacturing Workshop

Companion Course, if any:

Course Objectives:

1. To familiarize students with the construction, working principles, and operations of basic machine tools such as lathe, drilling, milling, shaper, and grinding machines.
2. To develop practical machining skills through turning, taper turning, eccentric turning, drilling, thread cutting, milling, and shaping operations.
3. To understand the procedure for gear manufacturing by preparing a spur gear on a milling machine with proper accuracy and finish.

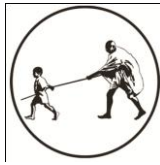
Course Outcomes: After successful completion of the course, learner will be able to

CO	Statement
CO1	Identify the constructional features, working principles and applications of various machine tools such as lathe, drilling, milling, shaping and grinding machines.
CO2	Perform machining operations including turning, taper turning, eccentric turning, drilling, threading, milling and shaping using appropriate machine tools and accessories
CO3	Develop machining skills to manufacture components and spur gears on milling machines as per given specifications and dimensions
CO4	Produce complete machining jobs involving multiple operations with accuracy, proper process planning and adherence to workshop safety practices.

List of Practicals

1. Demonstration of various machine tools like Lathe, Drilling machine, milling machine, shaper, grinding machine etc.
2. Preparing jobs involving turning, taper turning, eccentric turning, drilling, thread cutting, milling, shaping, operations (Three Jobs)
3. Prepare a spur Gear on milling machine

Practical Examination: Machining a complete job requiring operations like turning, drilling,



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boring, threading, milling/shaping

Textbooks:

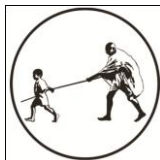
1. Hazara Choudhary – Workshop technology vol – II – media promoters and publishers Pvt.
2. Ltd. Mumbai.
3. P. N. Rao – Manufacturing technology. Metal cutting and machine tools.

Reference Books:

1. P. C. Sharma – Production Engineering (Khanna Publishers)
2. R. K. Jain - Production Engineering (Khanna Publishers)
3. HMT Handbook - Production Technology (TATA McGraw Hill Publisher)
4. Chapman W. A. – “Workshop Technology” vol – I, II, III (Edward Arnold Publisher Ltd.)

MOOC/NPTEL Courses:

1. Prof. Shantanu Bhattacharya, Manufacturing Process Technology I & II, IIT Kanpur, Swayam NPTEL Online Course.
https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_me51

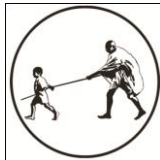


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Second Year Mechanical Engineering (2026-2027)			
Semester-IV			
Course Code	INT-MECH-259		
Category	Internship		
Course Title	Internship-II		
Scheme and Credits	L	P	No. of Credits
	0	2	1
Pre requisite Courses, if any: Communication Skills			
Companion Course, if any: Nil			
Course Objectives: After successful completion of this course, students will be able to: 1. To provide fundamental knowledge of the subject and its industrial applications. 2. To develop analytical and problem-solving skills related to engineering systems. 3. To impart practical knowledge through experiments, simulations, and case studies. 4. To enable students to apply modern tools and technologies for design, analysis, and optimization			
Course Outcomes: After successful completion of the course, learner will be able to			
CO	Statement		
CO1	Apply theoretical knowledge to solve practical industrial problems and perform operational tasks.		
CO2	Develop professional skills through the use of industry tools, technologies, teamwork, communication, and time management.		
CO3	Adapt to workplace environments while demonstrating professional ethics, responsibility, and accountability.		
CO4	Analyze and present internship experiences through structured reports and reflective evaluation for career development.		
Instructions: Minimum of 4 weeks which can be completed partially in the fourth semester or in one semester itself in the vacation period/duration. In this training, it is expected that students undergo industrial training for a variety of fields including power systems, automation, product design, and more. These fields provide practical experience in areas like electrical, mechanical, computer science, and electronics. Training often focuses on hands-on experience with equipment, software, and processes relevant to specific industries.			



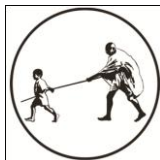
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Department of Mechanical Engineering
Criteria for Honors Degree

- In addition to the prescribed 176 credits of the B.Tech. Program (Major discipline), a student may opt for an Honors program in the same discipline/branch or in an approved emerging area related to the parent discipline.
- To earn the Honors degree, a student shall complete an additional 18 credits, distributed across Semesters III to VIII.
- Thus, the total credit requirement for the award of B.Tech. Honors shall be 194 credits (176 + 18) for students admitted in the first year.
- Students shall compulsorily pursue the Honors program within the same discipline/branch of their parent B.Tech. program.
- The Honors degree shall be awarded only after successful completion of all prescribed credits of the regular B.Tech. program along with the additional 18 Honors credits.
- For lateral entry students (admitted directly to the second year after Diploma), the minimum credit requirement shall be 132 credits for the regular program, in addition to 18 Honors credits.
- Students with CGPA of More than 8.0 at the end of First year are eligible for B Tech Honours degree. They also are required to maintain the CGPA of 8.0 in all subsequent semesters.



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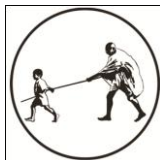
Course Structure: Honors Degree In

“Honors Degree in Product Design, Innovation, and Entrepreneurship”

Sr. No.	Course Code	Course Title	Teaching Scheme		Credits	Semester	NPTEL Link
			L	P			
1	HON-MECH-501	Product Design and Innovation	3	–	3	III	
2	HON-MECH-502	Product Engineering & Design Thinking	3	–	3	IV	
3	HON-MECH-503	Innovation, Business Models & Entrepreneurship	3	–	3	V	
4	HON-MECH-504	Product Design using Value Engineering	2	–	2	VI	
5	HON-MECH-505L	Prototyping & Design Studio Lab	–	2	1	VI	
6	HON-MECH-506	Patent Law & Intellectual Property for Engineers	3	–	3	VII	
7	HON-MECH-507L	Startup Design & Business Fundamentals Lab	–	2	1	VII	
8	HON-MECH-508P	Product Innovation Research & Venture Project- Research Project	–	4	2	VIII	
Total			14	8	18		

Reference: AICTE Model Curriculum

https://www.aicte.gov.in/sites/default/files/Minor%20Degree_Dec_2020.pdf



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Second Year Honors Product Design, Innovation & Entrepreneurship (2026-2027)

Semester-IV

Course Code	HON-MECH-501		
Category	Honors Degree		
Course Title	Product Design and Innovation		
Scheme and Credits	L	P	No. of Credits
	3	0	3

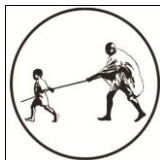
Prerequisite Courses, if any: Design Thinking

Companion Course ,if any:

Course Objectives: The course aims to

1. Understand the fundamental concepts of product design, innovation, and design thinking in engineering applications.
2. Develop the ability to identify user needs, analyze market requirements, and formulate design problems systematically.
3. Apply creative thinking and ideation techniques to generate innovative product concepts and solutions.
4. Incorporate ergonomics, human factors, sustainability, and usability considerations into product design.
5. Gain knowledge of product development processes, prototyping techniques, testing, and validation methods.
6. Understand the principles of intellectual property rights, product commercialization, and innovation management for successful product development.

Unit No.	Unit Title & Contents	Hours
1	Introduction to Product Design and Innovation: Concepts of Creativity, Invention and Innovation, Design Thinking Process, Product Design Life Cycle, Types of Innovation, Incremental and Disruptive Innovation, Role of Innovation in Engineering, Innovation Strategies, Product Success Factors, Case Studies of Innovative Products	8
2	User-Centered Design and Need Identification: User-Centered Design, Stakeholder Analysis, User Research Methods, Customer Needs Identification, Problem Identification and Definition, Design Brief Preparation, Market Research, Competitive Benchmarking,	7



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	Customer Requirement Analysis, Product Opportunity Identification	
3	Concept Generation and Creative Problem Solving: Creativity and Ideation Techniques, Brainstorming, Brainwriting, Mind Mapping, SCAMPER Technique, Morphological Analysis, Functional Decomposition, Concept Development, Concept Screening, Concept Selection, Decision Matrix Methods	8
4	Human Factors and Ergonomics in Product Design: Introduction to Ergonomics, Anthropometric Data, Physical Ergonomics, Cognitive Ergonomics, Emotional Design, Human-Machine Interaction, Usability Principles, User Comfort and Safety, Accessibility and Inclusive Design, Ergonomic Evaluation Methods	7
5	Product Development and Prototyping: Product Architecture, Product Configuration, Material Selection, Sustainable Design Considerations, Engineering Sketching, CAD-Based Product Visualization, Physical Prototyping, Digital Prototyping, Rapid Prototyping, 3D Printing, Prototype Testing and Refinement.	8
6	Product Evaluation, Commercialization and Intellectual Property Rights: Product Testing and Validation, Usability Testing, User Feedback Analysis, Product Launch Strategies, Innovation Management, Intellectual Property Rights, Patents, Trademarks, Industrial Design Registration, Technology Commercialization, Entrepreneurship and Product Development	7

Textbooks:

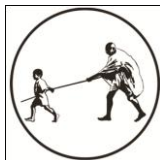
1. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, McGraw Hill.
2. Tim Brown, Change by Design, Harper Business.
3. Don Norman, The Design of Everyday Things, Basic Books.

Reference Books:

1. Vijay Kumar, 101 Design Methods, Wiley.
2. George Dieter and Linda Schmidt, Engineering Design, McGraw Hill.
3. Nigel Cross, Engineering Design Methods, Wiley.

MOOC/NPTEL Courses:

1. Prof. Shyamasree Dasgupta, *Energy Economics and Policy*, IIT Mandi, Swayam NPTEL Online Course.
https://onlinecourses.nptel.ac.in/noc21_hs77/preview



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Second Year Honors Product Design, Innovation & Entrepreneurship ((2026-2027))

Semester-IV

Course Code	HON-MECH-502		
Category	Honors Degree		
Course Title	Product Engineering & Design Thinking		
Scheme and Credits	L	P	No. of Credits
	3	0	3

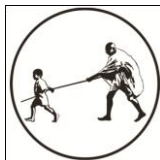
Pre requisite Courses, if any: Design Thinking

Companion Course, if any: Nil

Course Objectives: The course aims to

1. To introduce the principles of product engineering and design thinking for developing innovative engineering solutions.
2. To develop the ability to identify user needs, define problems, and generate creative product concepts.
3. To familiarize students with product design methodologies, prototyping techniques, and product development processes.
4. To enhance skills in evaluating, testing, and refining products based on user feedback and engineering requirements.
5. To provide knowledge of sustainability, manufacturability, and commercialization aspects of product development.

Unit No.	Unit Title & Contents	Hours
1	Introduction to Product Engineering and Design Thinking: Product Engineering Fundamentals, Product Development Process, Innovation and Creativity, Design Thinking Concepts, Stages of Design Thinking, Human-Centered Design, Engineering Design Process, Product Life Cycle, Role of Product Engineers, Case Studies of Successful Products.	8
2	Empathize and Define: User-Centered Design, Customer Needs Analysis, Stakeholder Identification, Observation Techniques, Interviews and Surveys, Empathy Mapping, Problem Identification, Problem Statement Formulation, Design Challenges, Value Proposition Development.	7

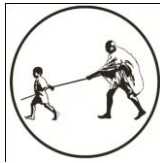


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3	Ideation and Concept Development: Creative Thinking Techniques, Brainstorming, Brainwriting, Mind Mapping, SCAMPER Technique, Morphological Analysis, Concept Generation, Functional Decomposition, Concept Screening, Concept Selection Methods, Product Specification Development.	8
4	Product Design and Prototyping: Product Architecture, Product Configuration, Design for Functionality, Sketching and Visualization, CAD-Based Design, Physical Prototyping, Digital Prototyping, Rapid Prototyping, 3D Printing, Prototype Evaluation.	7
5	Testing, Validation and Sustainable Design: Product Testing Methods, Design Verification and Validation, User Testing, Feedback Analysis, Design Iteration, Sustainable Product Design, Eco-Friendly Materials, Design for Environment, Design for Manufacturability (DFM), Design for Assembly (DFA).	8
6	Product Commercialization and Innovation Management: Product Launch Strategies, Market Analysis, Business Model Basics, Innovation Management, Intellectual Property Rights, Patents and Trademarks, Product Costing, Entrepreneurship, Startup Ecosystem, Product Commercialization Case Studies.	7
Textbooks: 1. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, McGraw Hill. 2. Tim Brown, Change by Design, Harper Business. 3. Don Norman, The Design of Everyday Things, Basic Books.		
Reference Books: 1. George E. Dieter and Linda C. Schmidt, Engineering Design, McGraw Hill. 2. Vijay Kumar, 101 Design Methods, Wiley. 3. Nigel Cross, Engineering Design Methods: Strategies for Product Design, Wiley. 4. Roger Martin, The Design of Business, Harvard Business Review Press.		
MOOC/NPTEL Courses: Prof. Pranab K Dan, Prof. Prabir Sarkar, Product Engineering & Design Thinking, IIT Kharagpur, IIT Ropar, Swayam NPTEL Online Course. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_me57		



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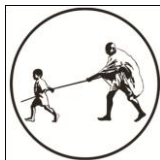
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Department of Mechanical Engineering Multiple Exit Policy

- Students shall have the flexibility to enter the program in odd semesters and exit the program after the successful completion of the First Year, Second Year, or Third Year, based on their academic and career requirements.

A student opting for exit shall:

- Earn the minimum prescribed credits as specified for the respective exit level.
- Have no active backlogs at the time of exit.
- Submit a formal exit request to the Chairman, Academic Council through the Chairman, Board of Studies (BoS), within two weeks from the date of declaration of results.
- In addition to the minimum academic credits, students shall compulsorily earn an additional 8 credits through vocational training, internships, apprenticeship, skill based courses, mini- projects, or similar activities during the summer vacation, within two months from the approval of the exit request.
- Exit options with appropriate awards shall be provided at the end of:
 - Second Semester – UG Certificate
 - Fourth Semester – UG Diploma
 - Sixth Semester – B.Voc. / B.Sc. Degree
- Students who continue and successfully complete the four-year program shall be awarded the Bachelor's Degree in Engineering/Technology as per the prescribed program structure and credit requirements.



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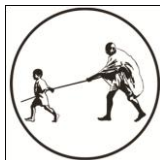
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Exit option after 2nd or 4th Semester

(As per Ref: NEP GR, Government of Maharashtra)

Exit Level	Minimum Duration Completed	Minimum Credits Earned	Qualification Awarded
Level1Exit	After 1st Year (2ndSemesters)	Approximately 44 Credits	Undergraduate Certificate
Level2Exit	After 2nd Year (4thSemesters)	Approximately 88 Credits	Undergraduate Diploma
Level3Exit	After 3rd Year (6thSemesters)	Approximately 124 Credits	B. Voc. / B.Sc. Degree



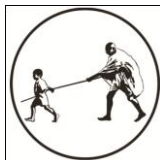
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Department of Mechanical Engineering
Multiple Exit
Exit After Second Year

Option 1	Qualification Title	Bridge Courses	Credits
Exit 1	One yr UG Certification course in Engineering / Tech	Online two skill courses Offered by IGTR/CMTI/ MKCL/ any other government approved agency Offering certification Courses 1) Certificate course in Solar PV Technology (offered by MITCON) (OR) 2) Certificate course in Welding Technology (offered by IISDT) (OR) 3) AutoCAD and 3D modeling (offered by MKCL)	4
		Technical Project	4
		Total	8



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Department of Mechanical Engineering
Multiple Exit
Exit after Second Year

Exit2	Two year Diploma in Engineering/Tech	Online two skill courses Offered by IGTR/CMTI/ MKCL/ any other government approved agency Offering certification Courses. 1) Certificate in Air Conditioning and Refrigeration Technician (offered by IISDT) (OR) 2) Certificate course in Electric Vehicle Systems (offered by MITCON) (OR) 3) Short term course in 3D Printing (offered by IGTR)	4
		Technical Project	4
		Total	8

Students shall complete the course through a certification program conducted by Skill India, MKCL, or any other Government-approved certification provider.