Sant Gadge Baba Amravati University, Amravati

Scheme of Implementation for

Four Year Undergraduate Degree Programme in

Engineering and Technology

B.E. in MECHANICAL ENGINEERING

in the faculty of

Science and Technology

ACADEMIC EVALUATION SCHEME/CREDIT SYSTEM

Year: 2024-25

(Scheme of Teaching, Learning, Examination & Evaluation w.e.f. 2024-2025 and onwards)

	Scheme for First Year Four Year Undergraduate Engineering Degree Programme Semester -I – [Common for all branches]												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs.)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Applied Mathematics -I (BSC)	1SH100BS	3	0	0	3	3	40	60			100	3 Hrs.
2	Engineering Physics (BSC)	1SH101BS	3	0	0	3	3	40	60			100	3 Hrs.
3	Computer Programming (ESC)	1CS102ES	3	0	0	3	3	40	60			100	3 Hrs.
4	Engineering Mechanics (ESC)	1CE103ES	3	0	0	3	3	40	60			100	3 Hrs.
	Laboratory Courses												
5	Engineering Physics Lab (BSC)	1SH104BL	0	2	0	2	1			25	25	50	
6	Computer Programming Lab (ESC)	1CS105EL	0	2	0	2	1			25	25	50	
7	Engineering Mechanics Lab (ESC)	1CE106EL	0	2	0	2	1			25	25	50	
8	Workshop (ESC)	1ME107EL	0	2	0	2	1			25	25	50	
	Vocational and Skill Enhancement Courses (VSEC)												
9	Design Thinking and Idea Lab.	1ME108VS	1	2	0	3	2			50	-	50	
	Ability Enhancement Courses (AEC)												
10	Professional Communication	1SH109AE	1	2	0	3	2			25	25	50	
	Co-curricular Course (CC)												
11	Co-curricular Course (CC)	1SH110CC	0	4	0	4	2			50	-	50	
	TOTAL		14	16	0	30	**22**					**750**	

L: Lecture P: Practical T: Tutorial MSE: Mid Semester Exam ESE: End Semester Exam IE: Internal Evaluation INT: Internal EXT: External

	Scheme for First Year Four Year Undergraduate Engineering Degree Programme Semester -II – [Common for all branches]												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs.)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Applied Mathematics -II (BSC)	2SH111BS	3	0	0	3	3	40	60			100	3 Hrs.
2	Engineering Chemistry (BSC)	2SH112BS	3	0	0	3	3	40	60			100	3 Hrs.
3	Basic Electrical Engineering (ESC)	2EE113ES	3	0	0	3	3	40	60			100	3 Hrs.
4	Engineering Graphics (ESC)	2ME114ES	2	0	0	2	2	40	60			100	3 Hrs.
	Laboratory Courses												
5	Engineering Chemistry Lab (BSC)	2SH115BL	0	2	0	2	1			25	25	50	
6	Basic Electrical Engineering Lab (ESC)	2EE116EL	0	2	0	2	1			25	25	50	
7	Engineering Graphics Lab (ESC)	2ME117EL	0	2	0	2	1			25	25	50	
	Vocational and Skill Enhancement Courses (VSEC)												
8	Computer Aided Design and Drafting	2ME118VS	1	2	0	3	2			50	-	50	
	Programme Core Course (PCC)												
9	Elements of Mechanical Engineering	2ME119PC	2	0	0	2	2	20	30			50	2.00 Hrs.
	Indian Knowledge System (IKS)												
10	Indian Traditional Knowledge	2SH120IK	2	0	0	2	2	20	30			50	2.00 Hrs.
	Co-curricular Course (CC)												
11	Co-curricular Course (CC)	2SH121CC	0	4	0	4	2			50	-	50	
	TOTAL		16	12	0	28	**22**					**750**	

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Scheme for Multiple Entry and Exit

Exit option -1 (L5): Award of UG Certificate in Major with 44 credits and an additional 8 credits			
Exit Courses			
1	Geometric Dimensioning and Tolerancing (GD&T)	Online Certification Course	3
2	Welding Technology/ Joining Processes	Online Certification Course	3
3	One Month Internship at Industry		2

	Scheme for Second Year Four Year Undergraduate Engineering Degree Programme B.E. in MECHANICAL ENGINEERING (Semester -III)												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs.)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Engineering Thermodynamics (PCC-I)	3ME200PC	3	0	0	3	3	40	60			100	3 Hrs.
2	Manufacturing Technology (PCC-II)	3ME201PC	3	0	0	3	3	40	60			100	3 Hrs.
3	Mechanics of Materials (PCC-III)	3ME202PC	3	0	0	3	3	40	60			100	3 Hrs.
	Laboratory Courses												
4	Comm. Engg. Project/ Field Project	3ME400FP	0	4	0	4	2			25	25	50	
5	Manufacturing Technology (PCC-II)	3ME203PL	0	2	0	2	1			25	25	50	
6	Mechanics of Materials (PCC-III)	3ME204PL	0	2	0	2	1			25	25	50	
	Multidisciplinary Minor												
7	Multidisciplinary Minor –I*	3ME205M	2	0	0	2	2	20	30	-	-	50	2.00 Hrs.
	Open Elective other than a particular Program												
8	Open Elective -I	3ME206OE	3	0	0	3	3	40	60	-	-	100	3 Hrs.
	HSSMC (Entrepreneurship/ Economics/ Management Course)												
9	Entrepreneurship Development	3ME207EM	2	0	0	2	2	20	30	-	-	50	2.00 Hrs.
	Value Education Course (VEC)												
10	Environmental Science	3SH208VE	2	0	0	2	2	20	30			50	2.00 Hrs.
	TOTAL		17	10	0	27	**22**					**700**	

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Open Elective-I: 1) Power Plant Engineering 2) Engineering Materials 3) Manufacturing Processes

***Please refer to the list of Multidisciplinary Minor courses attached separately.**

	Scheme for Second Year Four Year Undergraduate Engineering Degree Programme B.E. in MECHANICAL ENGINEERING (Semester -IV)												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs.)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Material Science (PCC-I)	4ME209PC	3	0	0	3	3	40	60			100	3 Hrs.
2	Fluid Mechanics (PCC-II)	4ME210PC	3	0	0	3	3	40	60			100	3 Hrs.
3	Energy Conversion – I (PCC-III)	4ME211PC	2	0	0	2	2	40	60			100	3 Hrs.
	Laboratory Courses												
4	Material Science (PCC-I)	4ME212PL	0	2	0	2	1			25	25	50	
5	Fluid Mechanics (PCC-II)	4ME213PL	0	2	0	2	1			25	25	50	
	Multidisciplinary Minor												
6	Multidisciplinary Minor –II*	4ME214M	2	0	0	2	2	20	30	-	-	50	2.00 Hrs.
	Vocational and Skill Enhancement Courses												
7	Computational Methods and Programming	4ME215VS	1	2	0	3	2			50	-	50	
	Open Elective other than a particular Program												
8	Open Elective- II	4ME216OE	2	0	0	2	2	20	30			50	2.00 Hrs.
	HSSMC (Entrepreneurship/ Economics/ Management Course)												
9	Principles of Economics and Management	4ME217EM	2	0	0	2	2	20	30			50	2.00 Hrs.
	(Ability Enhancement Course (AEC)												
10	Modern Indian Language	4SH218AE	2	0	0	2	2			25	25	50	.
	Value Education Course (VEC)												
11	Universal Human Values & Ethics	4SH219VE	2	0	0	2	2	20	30			50	2.00 Hrs.
	TOTAL		19	06	0	25	**22**					**700**	

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Open Elective-II: 1) Automotive Technology 2) Sustainable Energy 3) Business Planning and Project Management

***Please refer list of Multidisciplinary Minor courses attached separately.**

Scheme for Multiple Entry and Exit

Exit option -2 (L6): Award of UG Diploma in Major with 88 credits and an additional 8 credits			
Exit Courses			
1	Industrial Safety Engineering	Online Certification Course	3
2	Quality Control and Inspection	Online Certification Course	3
3	One Month Internship at Industry OR Minor Project		2

	Scheme for Second Year Four Year Undergraduate Engineering Degree Programme B.E. in MECHANICAL ENGINEERING (Semester -V)												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs.)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Heat Transfer (PCC-I)	5ME220PC	3	0	0	3	3	40	60			100	3 Hrs.
2	Theory of Machines (PCC-II)	5ME221PC	3	0	0	3	3	40	60			100	3 Hrs.
3	Measurement Systems (PCC-III)	5ME222PC	3	0	0	3	3	40	60			100	3 Hrs.
4	Programme Elective Course -I	5ME223PE	3	0	0	3	3	40	60			100	3 Hrs.
	Laboratory Courses												
5	Heat Transfer (PCC-I)	5ME224PL	0	2	0	2	1			25	25	50	
6	Theory of Machines (PCC-II)	5ME225PL	0	2	0	2	1			25	25	50	
7	Measurement Systems (PCC-III)	5ME226PL	0	2	0	2	1			25	25	50	
	Multidisciplinary Minor												
8	Multidisciplinary Minor –III*	5ME227M	2	0	0	2	2	20	30			50	2.00 Hrs.
9	Multidisciplinary Minor –IV*	5ME228M	2	0	0	2	2	20	30			50	2.00 Hrs.
10	Multidisciplinary Minor Lab. –I*	5ME229ML	0	2	0	2	1			25	25	50	
	Open Elective other than a particular Program												
11	Open Elective- III	5ME230OE	2	0	0	2	2	20	30			50	2.00 Hrs.
	TOTAL		19	08	0	26	**22**					**750**	

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PEC	**Thermal Engineering Stream (A)**	**Manufacturing Engineering Stream (B)**	**Design Engineering Stream (C)**
PEC **-I**	Non-conventional Energy Sources	Productivity Techniques	Computer Aided Design & Simulation

Open Elective –III: 1) Optimization Techniques 2) Industrial Robotics & Automation 3) Introduction to 3D Printing

***Please refer list of Multidisciplinary Minor courses attached separately.**

	Scheme for Second Year Four Year Undergraduate Engineering Degree Programme B.E. in MECHANICAL ENGINEERING (Semester -VI)												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs.)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Design of Machine Elements (PCC-I)	6ME231PC	3	0	0	3	3	40	60			100	3 Hrs.
2	Metrology & Quality Control (PCC-II)	6ME232PC	3	0	0	3	3	40	60			100	3 Hrs.
3	Hydraulic Machines (PCC-III)	6ME233PC	3	0	0	3	3	40	60			100	3 Hrs.
4	Program Elective Course -II	6ME234PE	3	0	0	3	3	40	60			100	3 Hrs.
5	Program Elective Course -III	6ME235PE	3	0	0	3	3	40	60			100	3 Hrs.
	Laboratory Courses												
6	Design of Machine Elements (PCC-I)	6ME236PL	0	2	0	2	1			25	25	50	
7	Metrology & Quality Control (PCC-II)	6ME237PL	0	2	0	2	1			25	25	50	
8	Hydraulic Machines (PCC-III)	6ME238PL	0	2	0	2	1			25	25	50	
	Multidisciplinary Minor												
9	Multidisciplinary Minor –V*	6ME239M	2	0	0	2	2	20	30			50	2.00 Hrs.
	Vocational and Skill Enhancement Courses												
10	Design Analysis and Simulation Lab	6ME240VS	1	2	0	3	2			50	-	50	
	TOTAL		18	08	0	26	**22**					**750**	

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***Please refer list of Multidisciplinary Minor courses attached separately.**

PEC	**Thermal Engineering Stream (A)**	**Manufacturing Engineering Stream (B)**	**Design Engineering Stream (C)**
PEC **-II**	Internal Combustion Engines	Computer Aided Manufacturing	Tool Design
PEC **-III**	Computational Fluid Dynamics	Project Management	Product Design and Development

Scheme for Multiple Entry and Exit

Exit option -3 (L7): Award of UG Degree in Major with 132 credits and an additional 8 credits			
Exit Courses			
1	A) CNC Programming Techniques & Practice OR B) Ventilation & Air Conditioning System Design (HVAC) OR C) Industrial Piping Engineering	Online Certification Course	3
2	Certified Mechanical Software Course on CFD or FEA Software or Solidworks or CREO or CATIA or NXCAD or INVENTOR Design Course	Online Certification Course	3
3	One Month Internship at Industry OR Minor Project		2

	Scheme for Second Year Four Year Undergraduate Engineering Degree Programme B.E. in MECHANICAL ENGINEERING (Semester -VII)												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Energy Conversion-II (PCC-I)	7ME300PC	3	0	0	3	3	40	60			100	3 Hrs.
2	Automation Engineering (PCC-II)	7ME301PC	3	0	0	3	3	40	60			100	3 Hrs.
3	Program Elective Course -IV	7ME302PE	3	0	0	3	3	40	60			100	3 Hrs.
4	Program Elective Course -V	7ME303PE	3	0	0	3	3	40	60			100	3 Hrs.
5	Program Elective Course -VI	7ME304PE	3	0	0	3	3	40	60			100	3Hrs.
	Laboratory Courses												
6	Energy Conversion-II (PCC-I)	7ME305PL	0	2	0	2	1			25	25	50	
7	Automation Engineering (PCC-II)	7ME306PL	0	2	0	2	1			25	25	50	
	Multidisciplinary Minor												
8	Multidisciplinary Minor –VI*	7ME307M	2	0	0	2	2	30	30			50	2.00 Hrs.
9	Multidisciplinary Minor Lab. –II*	7ME308ML	0	2	0	2	1			25	25	50	.
	~~Project~~												
10	Project	7ME401PR	0	4	0	4	2			50	50	100	
	TOTAL		17	10	0	27	**22**					**800**	

L: Lecture P: Practical T: Tutorial MSE: Mid Semester Exam ESE: End Semester Exam IE: Internal Evaluation INT: Internal EXT: External

PEC	**Thermal Engineering Stream (A)**	**Manufacturing Engineering Stream (B)**	**Design Engineering Stream (C)**
PEC –**IV**	Automobile Engineering	Supply Chain Management	Finite Element Analysis
PEC **-V**	Energy Conservation and Management	Operation Research and Techniques	Mechatronics
PEC **-VI**	Refrigeration and Air-conditioning	Additive Manufacturing	Robotics and Industrial Applications

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	Scheme for Second Year Four Year Undergraduate Engineering Degree Programme B.E. in MECHANICAL ENGINEERING (Semester -VIII)												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Research Methodology	8ME310RM	4*			4	4	40	60			100	3 Hrs.
2	Industry Internship	8ME402II	0	24	0	24	12			100	200	300	--
3	Project	8ME403PR	0	4	0	4	2			50	50	100	--.
	TOTAL		4	28	0	32	18					**500**	

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***The course on Research Methodology may be completed by the student in Online mode (Swayam, MOOC's, any other platform approved by AICTE OR on the LMS platform offered by the Institute).**

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B. E. Mechanical Engineering

Multi -Disciplinary Minor Courses (14 Credits)

SEM	Course Code	Course Type	Course Title	Credit	
				T	P
Sem III	3ME205M	MDM –I	Basics of Mechanical Engineering	2	0
Sem IV	4ME214M	MDM -II	Fluid Mechanics and Machines	2	0
Sem V	5ME227M	MDM -III	Engineering Thermodynamics	2	0
	5ME228M	MDM -IV	Manufacturing Technology	2	0
	5ME229ML	MDM Lab. -I	Computer Aided Design and Drafting Lab	0	1
Sem VI	6ME239M	MDM -V	*Sem. VI: PEC-II/PEC-III	2	0
Sem VII	7ME307M	MDM -VI	**Sem. VII: PEC-IV/PEC-V/PEC-VI	2	0
	7ME308ML	MDM Lab. -II	Thermal Engineering Lab.	0	1
			Total	**12**	**02**

***6ME239M: Multi-disciplinary Minor –V**

(Note: Select any one course from the below list of Program Electives: PEC-II or PEC-III)

PEC	Thermal Engineering Stream (A)	Manufacturing Engineering Stream (B)	Design Engineering Stream (C)
PEC **-II**	Internal Combustion Engines	Computer Aided Manufacturing	Tool Design
PEC **-III**	Computational Fluid Dynamics	Project Management	Product Design and Development

****7ME307M: Multi-disciplinary Minor –VI**

(Note: Select any one course from the below list of Program Electives: PEC-IV/PEC-V/PEC-VI)

PEC	**Thermal Engineering Stream (A)**	**Manufacturing Engineering Stream (B)**	**Design Engineering Stream (C)**
PEC **–IV**	Automobile Engineering	Supply Chain Management	Finite Element Analysis
PEC **-V**	Energy Conservation and Management	Operation Research and Techniques	Mechatronics
PEC **-VI**	Refrigeration and Air-conditioning	Additive Manufacturing	Robotics and Industrial Applications

Nomenclature: Name of Department offering the courses

Acronym	Discipline of engineering/Department offering the course
SH	Science and Humanities
ME	Mechanical Engineering
EE	Electrical Engineering
CS	Computer Science and Engineering
CE	Civil Engineering

Courses

Acronym	Course/Subject Vertical
BS	Basic Science Course
BL	Basic Science Laboratory
ES	Engineering Science Course
EL	Engineering Science Laboratory
PC	Program Course
PL	Program Laboratory
PE	Program Elective Course
M	Multidisciplinary Minor Course
ML	Multidisciplinary Minor Laboratory
OE	Open Elective

Acronym	Course/Subject Vertical
VS	Vocational Skill Enhancement Course
AE	Ability Enhancement Course
EM	Entrepreneurship/Economics/Management Course
IK	Indian Knowledge System
VE	Value Education Course
RM	Research Methodology
FP	Field Project
II	Industry Internship
PR	Project
CC	Co-curricular Course

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

SYLLABUS

SEMESTER -III

Year: 2025-26

Sant Gadge Baba Amravati University, Amravati Faculty of Science and Technology

Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	3
Course:	**ENGINEERING MATERIALS**	**Code:**	3M206OE

Lecture	**Tutorial**	**Hours**	**Credit**	**TA**	**CT-I**	**CT-II**	**Th. Exam**	**Total**
3	0	3	3	40	30	30	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments, Class Attendance, Quiz

Course Objectives:

I. To gain the knowledge of various materials, their classification & applications.
II. To study the basic mechanical properties of materials
III. To develop a fundamental understanding of various electrical, electronic & magnetic materials.
IV. To study the properties and application of stainless steels.
V. To study the importance of biomaterials and their applications.
VI. To study concepts, advantages, limitations and applications of powder metallurgy

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

1. Comprehend the importance of materials in engineering and society.
2. Students are able to understand and distinguish between varieties of materials based on their properties.
3. Students will get to know the different classes of materials used in engineering applications and would be able to understand the choice of right materials for specific application.

CO	**Course Outcome**	**BT Level**
CO-1	Define basic concept of process metallurgy, understand classification of material and their applications.	L1, L2
CO-2	Understand the basic mechanical properties of engineering materials and properties and applications of various metals.	L2
CO-3	Explain applications and properties of newer class materials like smart materials, piezoelectric materials, biomaterials, super conducting materials etc.	L3 ,L4
CO-4	Understand and suggest the properties and applications of various stainless steels.	L4, L2
CO-5	Explain features, classification, applications of newer class materials like biomaterials, composite materials etc.	L3, L4
CO-6	Understand the concepts of Powder Metallurgy and its industrial applications.	L2

Syllabus:

UNIT-I: **Introduction to metallurgy**: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Solid solutions, types and their formation, Alloy: its importance, list of important alloys and their uses**.** (6 Hrs)

UNIT II: Mechanical properties of materials:
Basic Mechanical Properties of Engineering Materials like Strength, Toughness, Hardenability, Brittleness, Malleability, Ductility, Creep and Slip, Resilience, Fatigue.
Elastic, Inelastic and Viscoelastic behaviour, Stress – Strain Curve for ductile and brittle materials.
General properties and applications Steel, Cast Iron, brass, bronze (6 Hrs)

UNIT III: Electrical, Electronic & Magnetic Materials: Introduction, Classification, Applications and properties of Pyro, Piezo, Ferroelectrics, Extrinsic and Intrinsic semiconductors; super conducting materials. Magnetic materials, Soft and hard magnetic materials and applications. (6 Hrs)

UNIT IV: Stainless Steels
Introduction, Types of Stainless Steel: Ferritic, Martensitic, Austenitic stainless steels and their Properties and applications (6 Hrs)

UNIT V: Biomaterials: Biomaterials definition, classification: metals, ceramics, polymer, composites- advantages, limitations and applications. (6 Hrs)

UNIT VI: **Powder Metallurgy:** Concepts, Advantages, limitations and applications of Powder Metallurgy, Methods of manufacturing of metal powders, Compaction Process, Sintering process. (6 Hrs)

Textbooks:
1. Introduction to physical metallurgy: Sidney H Avner, TATA Mc-Graw hill
2. Engineering Materials & Metallurgy: R. K. Rajput, S Chand publication.
3. Material Science & Metallurgy: V.D. Kodgire. Everest Publication House.

Reference Books:
1. Materials Science and Engineering, V. Raghavan, PHI, 2004
2. An Introduction to Materials Science and Engineering, W. D. Callister, John Wiley& Sons (2007).
3. Powder metallurgy, A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallurgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Metallurgy- C Daniel Yesudian, Scitech Publication.

NPTEL WEB VIDEOS:
1. https://nptel.ac.in/courses/112/108/112108150/
2. https://nptel.ac.in/courses/113/102/113102080/

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**III**
Course:	**Engineering Thermodynamics**	**Code:**	3ME200PC

Lecture	Tutorial	Hours	Credit	IE	ESE	Total
03	0	0	03	40	60	100

Methods of Internal Evaluation (IE): Class Tests, Assignments, Quiz, Class Attendance, etc.

Course Objectives:

1. To learn heat and work interactions between system and its surroundings, and energy balance
2. To apply I law of thermodynamics to various energy conversion devices
3. To evaluate the change in properties of substances during various energy conversion processes
4. To understand the difference between high grade and low grade
5. To comprehend the limitations imposed by II law of thermodynamics on energy conversion

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

CO	Course outcome	BT level
CO-1	Apply energy balance to systems and control volumes in situations involving heat and work interactions	L2
CO-2	Evaluate changes in properties of pure substances	L3
CO-3	Evaluate and compare the performance of energy conversion devices	L2
CO-4	Differentiate between high grade and low grade energies	L2
CO-5	Analyze the impact of energy wastage and degradation on environment	L2
CO-6	Understand concept of Entropy and analyze thermodynamic cycles for efficiency and performance	L3

SYLLABUS

Unit I - Fundamentals : System and Control volume, Properties of a system, State and Equilibrium, The State Postulate, Processes and Cycles, Steady Flow Process; Temperature and Zeroth Law of Thermodynamics, Temperature Scales, Temperature Measurement Devices, Pressure and Pressure Measurement Devices, Density and Specific Gravity.

Unit II- Energy, Energy Transfer and Energy Analysis: Energy and various forms of energy, Internal Energy, Heat and energy transfer by Heat, Mechanism of Heat Transfer; Work, Electrical Work and forms of Mechanical Work; First Law of Thermodynamics and Energy Balance, Mechanisms of energy transfer to and from a system, Flow Energy, Energy conversion efficiencies, Implications of energy conversion on environment.

Unit III - Pure Substances – Phases and Phase-Change Processes of Pure Substances, Definition of saturated states, Property diagrams for Phase-Change Processes, P-v-T Surface, Property Tables, Ideal Gas & ideal gas equation of state, Ideal gas mixtures, Real gases and Real gas mixtures, Compressibility Factor, Other equations of state, Specific heats; Internal energy, enthalpy and specific heats of ideal gases, Internal Energy, enthalpy and specific heats of liquids and solids, Use of Steam Tables and R-134a Tables, Mollier's Chart.

Unit IV - First Law for Flow Processes – Conservation of Mass Principle, Mass balance for steady-flow process, Flow work and Energy of a flowing fluid, Derivation of general equation for a control volume starting from Conservation of Mass Principle, Application of conservation of mass and conservation of energy equation to steady and unsteady-flow control volumes such as nozzles, compressors, turbines, throttle valves, mixing chambers and heat exchangers.

Unit V - Second Law – Introduction and need for Second law, Thermal energy reservoirs, reversible and irreversible processes, heat engines, refrigerators and heat pumps, Kelvin-Planck and Clausius Statements of Second law of Thermodynamics, Application of Second law to cycles and cyclic devices, Thermodynamic Temperature Scale, Carnot Cycle, Carnot Principles, idealized Carnot heat engines, refrigerators and heat pumps Thermal efficiency and COP of heat engines, refrigerators and heat pumps.

Unit VI - Entropy – Clausius Inequality, Definition of Entropy to quantify the second law effects, Increase of entropy principle, Entropy change during process for a pure substance, incompressible substances and ideal gas, Isentropic Process, Reversible Steady-flow work, Isentropic efficiency for various steady-flow devices, Entropy Balance. Irreversibility and Availability, Availability functions for systems and control volumes undergoing different processes, Lost Work, Second law analysis for a control volume, Second law efficiency. Thermodynamic Cycles – Basic Gas power and Vapor power cycles and their simple analysis.

TEXTBOOKS:

1. "Thermodynamics: An Engineering Approach", Yunus Cengel and Michael Boles, 9th Edition, Mc-GrawHill Publication, 2019.
2. "Engineering Thermodynamics", P. K. Nag, 6th Edition, McGraw-Hill, 2017
3. "Thermodynamics", C.P. Arora, Tata McGraw-Hill, 1st edition, 2001.

REFERENCE BOOKS:

1. "Basic Engineering Thermodynamics", Rayner Joel, Pearson Education India, 1996
2. "Engineering Thermodynamics", P. Chattopadhyay, Oxford University Press, 2015
3. "Fundamentals of Engineering Thermodynamics", Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, 9th Edition, 2018

E – RESOURCES:

NPTEL Online Courses – Swayam courses –

1. Thermodynamics, IIT Madras − https://nptel.ac.in/courses/127106135
2. Basic Thermodynamics, IISc Bangalore − https://nptel.ac.in/courses/112108148
3. Engineering Thermodynamics by IIT Madras − https://nptel.ac.in/courses/112106310
4. Elementary Thermodynamics for All, IIT Kharagpur − https://nptel.ac.in/courses/104105365

Sant Gadge Baba Amravati University, Amravati Faculty of

Science & Technology

Board of Studies in Mechanical Engineering

Program	**B. E. Mechanical Engineering**	**Semester :**	**3**
Course	**Manufacturing Technology**	**Code**	**3ME201PC**

Lecture	**Tutorial**	**Hours**	**Credit**	**TA**	**CT-I**	**CT-II**	**Th. Exam**	**Total**
3	0	3	3	40	30	30	60	100

Methods of Teacher Assessment (TA) : Class Tests, Assignments, Class Attendance, Quiz

Course objectives:

1. To study the pattern making and casting process.
2. To study the joining process.
3. To study the Mechanical working of metals.
4. To study theory of metal cutting and lathe operation.
5. To study the drilling, milling, broaching and boring process.
6. To study grinding and finishing process.

After completion of the course, the students will be able to-

CO	**Course Outcome**	**BT level**
CO-1	Apply knowledge of casting processes for the specified working conditions.	L3
CO-2	Apply the knowledge of basic and advanced welding processes to solve the related problem.	L3
CO-3	Apply the knowledge of various forming processes for the given operating conditions.	L3
CO-4	Apply the concept of mechanics of metal cutting for various lathe operations.	L3
CO-5	Understand the various milling, drilling, broaching and boring processes.	L2
CO-6	Apply the knowledge of grinding and finishing processes for enhancing the surface finish of given component.	L3

Syllabus:

Unit I:

Casting: Introduction to pattern making, types of patterns, pattern materials, pattern allowances, core print, core box, moulding sands & their properties, types of moulding, gating system. Melting furnaces, cupola, electric arc furnace, induction furnace. Casting processes & their principle of operation, permanent mould casting, die casting, centrifugal casting, investment casting. Casting defects.

Unit II:

Joining processes: Mechanical joining processes, mechanical fastening, riveting, soldering, brazing. Welding, types of welding processes – arc welding - principle and working, gas welding - principle and working, types and purpose of electrodes, electrode coatings (flux). TIG and MIG processes- working principles and applications, shielding gases. Advance welding processes such as – friction welding, ultrasonic welding, thermit welding, spot welding etc. Welding defects.

Unit III:

Mechanical working of metals: principle of hot working and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacturing of seamless pipe and tubing. Shearing operation, tube drawing, wire drawing, spinning, embossing, & coining, squeezing & bending operations, rotary swaging, forging, rolling and types of rolling mills.

Unit IV:

Theory of metal cutting, mechanics of metal cutting, chip formation process, tool material, classification of tools, tool geometry, tool life, tool failure, Merchant cutting force circle. Construction and working principle and accessories of lathe machine, lathe operations like- turning, facing, thread cutting, knurling, taper turning and its methods.

Unit V:

Construction & working of drilling machine, types of drilling machine, twist drill nomenclature. Milling machines: types of milling cutters, types of milling, dividing head, compound and differential indexing. Introduction of broaching and boring processes.

Unit VI:

Grinding process: Grinding wheels, wheel marking, wheel selection, wheel mounting, types of grinding machines. Honing, lapping, super finishing, buffing & burnishing processes.

Textbooks:

1. Chapman W. A.: - "Workshop Technology, Vol. II, III and I", Edward Arnold Pub. Ltd. London.
2. Hajra Chaudhary S. K. – "Elements of workshop technology Vol. I & II," Media Prom & pub, Mumbai
3. P. N. Rao :- "Manufacturing technology Vol. II" McGraw Hill 1998

Reference books:

1. "Workshop Technology" O.P Khanna, Dhanpatrai & sons.
2. "Workshop Technology Vol. II" B. S. Raghuvanshi.

Sant Gadge Baba Amravati University, Amravati Faculty of

Science & Technology

Board of Studies in Mechanical Engineering

Program	**B. E. Mechanical Engineering**	**Semester :**	**3**
Course	**Manufacturing Technology Lab**. (PCC-II)	**Code**	3ME203PL

Manufacturing Technology Lab

Following is the list of experiments to be performed by the students.

1. Pattern making: Making of patterns (anyone)
2. Foundry: Preparation of mould for various types of patterns.
3. Preparation of one job by welding process (gas or arc welding).
4. Demonstration of milling machine for gear tooth cutting.
5. Demonstration of drilling machine for preparation of hole.
6. Preparation of one job on lathe consisting of turning operation.
7. Preparation of one job on lathe consisting of facing operation.
8. Preparation of one job on lathe consisting of taper turning operation.
9. Preparation of one job on lathe consisting of screw cutting operation.
10. Preparation of one job on lathe consisting of knurling operation.
11. Preparation of one job on lathe consisting of parting off operation.

Students should complete experiment no 1 to 5 mandatorily and any 03 experiments from exp no. 6 to 11

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**III**
Course:	**Mechanics of Materials** (PCC-III)	**Code:**	**3ME202PC**

Lecture	Tutorial	Hours	Credits	TA	CT-I	CT-II	Th. Exam	Total
3	**0**	**3**	**3**	**40**	**30**	**30**	**60**	**100**

Methods of Teacher Assessment (TA): Class Tests, Assignments. Quiz, Class Attendance, etc.

Course Objectives: To understand -

1. To develop basis for study of stress and strain in various components under different types of loading.
2. To study mechanical behaviour of materials when subjected to loads and stress either parallel or perpendicular to axis.
3. To familiarize about finding shear force, bending moment on beams, slope and deflection under different loading conditions.
4. To study torsion and it's applications to different types of helical and leaf spring.
5. To develop necessary background to apply Mechanics of material to various mechanical operations.
6. To be familiarize with study of behaviour to thermal stresses and strain.

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

1. Basic terminology of Stress, Strain, Three Modulus of Elasticity, Poission's ratio, Factor of Safety.
2. They can then carry analysis of Compound Bars subjected to Uniaxial, Biaxial and Triaxial loads and change in temperature.
3. They will be able to calculate the Shear Force and Bending Moment and Slope and Deflection for different types of beams under different Loads.
4. They can then design shafts, cylindrical and spherical vessel and will have knowledge of Instantaneous stresses due to gradually, suddenly and Impact load.

CO	Course Outcome	BT Level
CO-1	To determine stresses and strain in a member subjected to axial, bending and torsional stresses.	L1, L2
CO-2	To observe different types of material behaviour such as elastic, plastic, ductile and brittle.	L1
CO-3	To study shear force and bending moment on different types of beams.	L3, L4
CO-4	To calculate slope and deflection on different types of beams and check the stability of beam.	L3, L4
CO-5	To study different types of loads and corresponding strain energy.	L1, L2
CO-6	To observe the effect of torsional stresses and its application to different types of spring.	L2, L3

Syllabus

Unit -I

Concept of direct, bending and shear stresses and strains, Stress-strain relations, Bi-axial and Tri axial loading, Elastic constants, Poission's ratio and their relationship, Stress-strain diagrams and their characteristics for mild steel, Factor of safety and its significance. Stresses and strains in compound bars in uni-axial tension and compression, Thermal stresses in simple restrained bars and compound bars of two metals.

Unit -II

Types of Beams and concept of Shear force and Bending moment. Axial force, shear force & bending moment diagrams for - Simply supported Beams, Overhanging Beams and Cantilever Beams subjected to Point load, uniformly distributed load. Relation between shear force, bending moment and loading intensity.

Unit -III

Theory of simple bending, section modulus, moment of resistance. Bending stresses in solid, hollow and built-up section. Leaf Spring - Semi elliptical and Quarter Elliptical type. Shear stress distribution on beams with Rectangular and Circular cross sections.

Unit -IV

Theory of torsion & assumptions, derivation of torsion equation. Polar modulus, Stresses in solid & hollow circular shaft. Power transmitted by solid and hollow shaft and their equivalence. Basic Terminology of Spring, Closed coiled helical spring with axial load. Strain energy under uni-axial tension and compression. Gradually, Suddenly and Impact loads and instantaneous stresses and strain.

Unit -V

Thin cylinders and thin spherical shells subjected to internal pressures. Biaxial stress system, principal stresses, principal planes. Mohr's circle of stresses, principal strains, principal planes.

Unit -VI

Slope and Deflection for Simply supported and Cantilever Beams - subjected to Point loads and uniformly distributed load by Macaulay's method. End Conditions.

TEXTBOOKS:

1. A Textbook of Strength Of Materials: By R. K. Bansal
2. Strength of Material: S.I. Units: By S. Ramamrutham
3. Strength of Materials: By R K Rajput
4. Strength of Materials: By Bhavikatti

REFERENCE BOOKS:

1. **Strength of Materials Vol. I**: By S. P. Timoshenko
2. **Strength of Materials Vol. II**: By S. P. Timoshenko
3. **Strength of Materials**: By Dr. B.C. Punmia
4. **Advanced Mechanics of Solids**: By Srinath L. N.
5. **Solid Mechanics**: By Kazimi S. M. A.

MOOC LINKS:

1. Strength of Materials - IITM - Course

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**III**
Course:	**Mechanics of Materials Lab.** (PCC-III)	**Code:**	**3ME204PL**

Practical:

Minimum Six to Eight out of the followings:

1. Tension test on metals.
2. Compression test on materials
3. Shear test on metals
4. Impact test on metals
5. Hardness test on metals
6. Torsion test on metals
7. Deflection of beams
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**III**
Course:	**Basics of Mechanical Engineering (MDM-I)**	**Code:**	**3ME205M**

Lecture	**Tutorial**	**Hours**	**Credit**	**IE**	**ESE**	**Total**
02	-	02	02	20	30	50

Methods of Internal Evaluation (IE): Class Tests, Assignments, Quiz, Class Attendance, etc.

Course Objectives:

This course introduces various streams of mechanical engineering such as thermal, design, and manufacturing. It includes the engineering materials, mechanical measurements, energy conversion systems, and various manufacturing techniques required to make the mechanical system to function efficiently. The course objectives are:

1. To introduce and define the engineering materials and concepts of mechanical engineering.
2. To enable the students to understand the details about the energy systems and its components.
3. To help the students acquire knowledge about the various manufacturing process and to demonstrate the various machine elements.

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

CO	**Course Outcome**	**BT Level**
CO-1	Understand the properties, testing and inspection of engineering materials.	L2
CO-2	Summarize fundamental techniques and process used in energy conversion systems.	L2
CO-3	Understand various casting techniques and the importance of various metal forming processes.	L2

SYLLABUS:

Unit I: Engineering Materials and Measurement

Role of Mechanical Engineering in Industries and Society- Emerging Trends and Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Classification of engineering material, composition of cast iron and carbon steels on iron-carbon diagram and their mechanical properties; Alloy steel and their applications; Stress-Strain diagram, Hooks law and modulus of elasticity.

Mechanical Measurement: Temperature, pressure, velocity, flow, strain, force and torque measurement, measurement by Vernier calliper, micrometre, dial gauges, slip gauges, sine-bar and combination set.

Unit II: Energy Conversion systems

Heat Engines: Thermal prime movers, Elementary heat engines, sources of heat, working substances, Converting machines, Classification of heat engines, heat engine cycles, Carnot cycle, Rankine cycle, Otto cycle, Diesel cycle. Power Producing Devices: Internal Combustion Engines: Introduction, Classification, Otto and Diesel four stroke cycle, Comparison of otto and diesel cycle, Indicated Power, Brake Power, Efficiencies (Elementary Treatment), Vapour compression Refrigeration Cycle, Introduction and Working Principles of prime movers: Steam turbines, Gas turbines, Hydraulic turbines (Elementary Treatment)

Unit III: Manufacturing Processes

Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications. Basic Machining operations: Turning, Drilling, Milling and Grinding.

Power Transmission Methods and Devices: Transmission -Gears – basic concepts, Chain, Pulleys and Belts. Bearings, Fasteners, Flywheels, clutches, brakes and dynamometers. Introduction to machine elements.

TEXTBOOKS

1. Basant Agarwal and C.M. Agarwal, Basic Mechanical Engineering, Wiley India Pvt. Ltd., 2008.
2. Sadhu Singh, Elements of Mechanical Engineering, S. Chand Publication, 2010.

REFERENCE BOOKS

1. G. S. Sawhney, Fundamentals of Mechanical Engineering, Prentice Hall of India Publication New Delhi, 2015.
2. R. K. Rajput, Thermal Engineering, S. Chand Publication New Delhi.2020.
3. B. K. Agrawal, Introduction to Engineering Materials, Tata McGraw hill Publication, New Delhi, 2017.

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	B. E. Mechanical Engineering	**Semester:**	**III**
Course:	**Power Plant Engineering** (Open Elective-I)	**Code:**	3ME206OE

Lecture	Tutorial	Hours	Credit	IE	ESE	Total
03	0	0	03	40	60	100

Methods of Internal Evaluation (IE): Class Tests, Assignments, Quiz, Class Attendance, etc.

Course Objectives:

1. To impart basic knowledge – components, working and performance of various types of power plants and the associated energy conversion issues.
2. To provide insights of operation and economics of power generation.

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

CO	Course Outcome	BT Level
CO-1	Discuss the energy sources and principles of operation for different power plants.	L2
CO-2	Determine the performance of the thermal power plant and its systems	L3
CO-3	Describe working principles of a gas turbine power plant and its components.	L2
CO-4	Describe the design layout and working of hydroelectric power plants.	L2
CO-5	Compare various types of nuclear reactors and recognize nuclear waste disposal issues.	L2
CO-6	Calculate power plant factors and identify parameters affecting economics of power plant.	L3

Syllabus:

UNIT I: Introduction to power plants

Energy Sources, Recent trends in power generation, Classification of power plants, Review of thermodynamic cycles related to power plants, Rankine Cycle, fuels and combustion calculations, General Layout of a modern power plant, site selection criteria, current scenario of power generation in India.

UNIT II: Coal Based Thermal Power Plants

Basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers and cooling towers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling systems, draught system, feed water treatment.

UNIT – III: Gas Turbine and Combined Cycle Power Plants

Brayton cycle analysis and optimization, components of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, combined cycle power plants.

UNIT – IV: Hydroelectric Power Plants

Hydroelectric station Hydrology, Principles of working, typical layout and components, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance.

UNIT – V: Nuclear Power Plants

Nuclear fusion and fission, comparison of fusion-fission, nuclear fuels, chain reaction, components of nuclear reactors, Classification of reactors pressurized water reactor, boiling water reactor, gas cooled reactor, CANDU reactor, liquid metal cooled reactor, fast breeder reactor, nuclear waste and its disposal, Site selection for nuclear reactor, current scenario of nuclear power generation in India.

UNIT – VI: Economics of Power Generation

Load estimation, Load curves, Load duration curves, Connected load, Maximum load, Peak load, base load and peak load power plants, Load factor, Plant capacity factor, Plant use factor, Demand factor, Diversity factor, effect of fluctuating load, Power plant economics, Performance and operating characteristics of power plant, Tariff for electric energy and cost of electric energy.

TEXTBOOKS:

1. Nag P. K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M. M., Power Plant Technology, Tata McGraw Hill, 2010.
3. V. Ganesan, Gas Turbines, Tata McGraw Hill Book Company, 2017, 3rd Edition,
4. Domkundwar S., Power Plant Engineering, Dhanpatrai & sons.
5. Rajput R. K., Power Plant Engineering, Laxmi Publications, Fifth Edition.
6. P. C. Sharma, Power plant engineering, S. K. Kataria & Sons, New Delhi, 2010

REFERENCE BOOKS:

1. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.
2. Black and Veatch, Power Plant Engineering, CBS Publisher and Distributors, 2005.

e-RESOURCES

1. https://archive.nptel.ac.in/courses/112/107/112107291/
2. https://www.plantengineering.com/

Sant Gadge Baba Amravati University, Amravati

Faculty of Science & Technology

Board of Studies in Mechanical Engineering

Program	**B. E. Mechanical Engineering**	**Semester :**	**3**
Course	**Manufacturing Processes**	**Code**	3ME206OE

Lecture	**Tutorial**	**Hours**	**Credit**	**TA**	**CT-I**	**CT-II**	**Th. Exam**	**Total**
3	0	3	3	40	30	30	60	100

Methods of Teacher Assessment (TA) : Class Tests, Assignments, Class Attendance, Quiz

Course objectives:

I. To study the various manufacturing processes.

II. To study the casting process.

III. To study the Mechanical working of metals.

IV. To study joining processes.

V. To study the theory of metal cutting and lathe operation.

VI. To study additive manufacturing process.

After completion of the course, the students will be able to-

CO	**Course outcome**	**BT level**
CO-1	Explain different types of manufacturing processes and their applications.	L2
CO-2	Describe the metal casting process and equipment used.	L2
CO-3	Apply the knowledge of various forming processes for the given operating conditions.	L3
CO-4	Explain the principles and operations of welding processes.	L2
CO-5	Identify the tool geometry of a single point cutting tool and principles of metal cutting.	L3
CO-6	Differentiate between additive and subtractive manufacturing processes.	L2

Syllabus:

Unit I:

Understanding Manufacturing: concept of manufacturing, need, scope, advantages, limitation, application, materials and manufacturing, classification of manufacturing. Heat treatment processes.

Unit II:

Casting: Working principle, steps, pattern, molding, gate and riser, melt treatment, solidification, casting processes: sand mould, shell mould, permanent mould casting, casting defect and their remedy.

Unit III:

Forming: Working principle, hot and cold forming, rolling, forging, extrusion, drawing, sheet metal forming, press, dies, types of dies and die set sheet metal operations punching, blanking, notching, nibbling.

Unit IV:

Joining: Working principle, need, principle of fusion welding, gas welding, thermit welding, arc welding common arc welding processes, resistance welding, weldability of metals, solidification of weld, weld discontinuities and their remedy.

Unit V:

Machining: Working principle, mechanism, classification, cutting tool, tool material, heat generation, cutting fluid, grinding, internal and external surface grinding, centerless grinding designation and selection of grinding wheel, trueing and balancing, honing, reaming, lapping, polishing etc.

Unit VI:

Additive Manufacturing: Introduction to Additive Manufacturing, Rapid Prototyping Technology (SLS), 3D Printing Technology (FDM, etc.)

TEXTBOOKS:

1. S. Kalpakjian and S. R. Schmid, Manufacturing engineering and technology, 7th edition of Pearson publication.
2. P. N. Rao Manufacturing technology volume-II, 3rd edition of TMH publication.
3. P. N. Rao Manufacturing technology volume-I, 3rd edition of TMH publication.

REFERENCE BOOKS:

1. “Workshop Technology” O.P Khanna, Dhanpatrai & sons.
2. “Workshop Technology Vol. I and II” B. S. Raghuvanshi.

ONLINE RESOURCES:

1. Fundamentals of Manufacturing processes by Prof. D K Dwivedi IIT Roorkee NPTEL course (https://onlinecourses.nptel.ac.in/noc20_me67/preview)

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**III**
Course:	**Comm. Engg. Project /Field Project**	**Code:**	**3ME400FP**

Laboratory Course (Internal & External Evaluation)

Practical	**Tutorial**	**Hours**	**Credit**	**IE**	**EXT**	**Total**
04	0	4	02	25	25	50

Students are expected to carry out Comm. Engg. Project /Field Project as per above stated hours/week and the evaluation to be carried out by using following mentioned criteria.

Sr. No.	**Name of Student**	**Tittle of Mini-Project/Study Project**	**Selection of Topic (5M)**	**Quality of Report & Prototype (5M)**	**Presentation & Communication Skill (5M)**	**Know-ledge of Topic (5M)**	**Response to Queries (5M)**	**Total Marks (25M)**

Name of Internal Examiner

Sign.

Sr. No.	Name of Student	Tittle of Mini-Project/Study Project	Selection of Topic (5M)	Quality of Report & Prototype (5M)	Presentation & Communication Skill (5M)	Know-ledge of Topic (5M)	Response to Queries (5M)	Total Marks (25M)

Name of External Examiner

Sign.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

SYLLABUS

SEMESTER -IV

Year: 2025-26

Sant Gadge Baba Amravati University, Amravati

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	Semester:	**IV**
Course:	**Material Science** (PCC-I)	Code:	**4ME209PC**

Lecture	Tutorial	Hours	Credit	TA	CT-I	CT-II	Th. Exam	Total
3	0	3	3	40	30	30	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments. Quiz Class, Attendance, etc.

Course Objectives:

1. To study the basic concepts of metallurgy and classification of materials.
2. To study the process of formation of microstructures of metal materials and composites.
3. To study the alloying elements, their effects and applications.
4. To study the ferrous and non-ferrous metals and respective alloys.
5. To study the various heat treatment processes and their industrial applications.
6. To study the case hardening processes and applications of Powder metallurgy.

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

1. Comprehend the importance of materials in engineering and society.
2. Apply the knowledge of materials science to analyze and solve basic engineering problems related to stress, strain of materials.
3. Select appropriate materials for various engineering applications taking into consideration of issues in cost, quality and environmental concerns.

CO	Course Outcome	BT Level
CO-1	Define basic concepts of metallurgy and classification of materials.	L1
CO-2	Understand the concept of phase & phase diagram & the basic terminologies associated with metallurgy.	L2
CO-3	Explain features, classification and Practical applications of ferrous & nonferrous materials.	L3, L4
CO-4	Explain the classification, microstructure of cast iron sand and its industrial applications.	L4
CO-5	Understand and suggest the heat treatment process & types, significance of properties Vs microstructure.	L4, L2
CO-6	Explain features, classification, applications of the Surface hardening processes and concepts of Powder Metallurgy and its industrial applications.	L3, L2

SYLLABUS

UNIT-I: Introduction to Metallurgy

- Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy.
- Classification of materials & their applications.
- Structure of metals and alloys, formation of alloys, solid solutions, types, and their formation.
- Lever rule for phase mixtures.
- Solidification of pure metals, nucleation and growth. (6 Hrs)

UNIT-II: Phase Diagrams

- Study of binary equilibrium diagram and invariant reactions.
- Construction and study of Iron-Carbon Equilibrium Diagram.
- Critical temperatures
- Introduction to composite materials, advantages and applications. (6 Hrs)

UNIT-III: Alloy Steels

- Purpose of alloying, classification of alloy steels.
- Effect of alloying elements on eutectoid composition, eutectoid temperature, and the S-curve.
- Properties and applications of Ferritic, Austenitic, and Martensitic stainless steels. (6 Hrs)

UNIT-IV: Cast Irons & Non-Ferrous Alloys

- Constitution and properties of White, Gray, Nodular and Malleable cast irons; their applications.
- Non-ferrous metals and alloys: Brasses and Bronzes. Types of Brasses: Cartridge Brass, Admiralty Brass, Muntz Metal, Leaded Brass, Types of Bronzes: Phosphor Bronze, Aluminum Bronze, Some important alloy of Aluminum: Duralumin, Tin alloy: Pewter and Zinc alloy and its applications.
- Precipitation Hardening and Season Cracking (6 Hrs)

UNIT-V: Heat Treatment of Steels

- Principles of heat treatment: Annealing, Normalizing, Hardening, Tempering.
- Iso-thermal transformation diagrams (S-curve).
- Quenching media, severity of quench.
- Austempering, Martempering, and Patenting. (6 Hrs)

UNIT-VI: Surface Hardening and Powder Metallurgy

- Methods of surface hardening: Carburizing, Nitriding, Cyaniding, Flame & Induction Hardening.
- Mechanical working of metals: Hot and cold working, work hardening, Strain aging, recrystallization, recovery, grain growth.
- Powder Metallurgy: Concept, Advantages, limitations and applications of Powder Metallurgy (6 Hrs)

TEXTBOOKS:

1. Introduction to physical metallurgy ;Sidney H Avner, TATA Mc-Grawhill
2. Engineering materials & metallurgy R.K.Rajput, S chand publication.
3. Material Science & Mettalurgy, by V.D. Kodgire. Everest Publication House.

REFERENCE BOOKS:

1. Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Physical metallurgy for engineers, Clarke and Varney, second Edn.,1987.
3. Power metallurgy,A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallugrgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Meallurgy- C Daniel Yesudian, Scitech Publication

MOOC LINKS:

1. https://onlinecourses.nptel.ac.in/noc22_mm05/preview
2. https://www.coursera.org/learn/introduction-to-materials-science

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	Semester:	**IV**
Course:	**Material Science (PCC-I)**	Code:	**4ME212PL**

Practical	Hours	Credit	Practical Evaluation		Total
			INT	EXT	
2	**2**	**1**	**25**	**25**	**50**

List of Practical's: - (At least Seven practical's out of the following list.)

1. Study of metallurgical microscope.
2. Study of Iron carbon Equilibrium diagram & Allotropic forms of iron.
3. Study of effect of alloying elements on the properties of steels.
4. Preparation of specimen for micro-examination.
5. Study of micro structures of Annealed and normalized plain carbon steels.
6. Study of micro structures of alloy steels and H.S.S.
7. Study of micro structures of various cast irons.
8. Study of micro structures of non-ferrous metals.(brasses, bronzes)
9. Study of micro structures of hardened and tempered steels.
10. Study different Heat Treatment Process for steel.
11. Study of different surface Hardening processes for steels.
12. Measurement of hardenability by Jiminy end quench test apparatus.
13. Study of hardness tester and conversion of Hardness number
14. Industrial visit to study heat treatment plant.

Practical Examination:

Note : Practical examination shall consist of viva voce/performance based on the above syllabus and practical work.

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**IV**
Course:	**Fluid Mechanics (PCC-II)**	**Code:**	**4ME210PC**

Lecture	**Tutorial**	**Hours**	**Credit**	**TA**	**CT-I**	**CT-II**	**Th. Exam**	**Total**
03	00	03	03	10	15	15	60	100

Methods of Teacher Assessment (TA): Class Tests, Assignments. Quiz, Class Attendance, etc.

Course Objectives:

1. To give fundamental knowledge of fluid, its properties
2. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow
3. To inculcate the importance of boundary layer flow and its applications
4. To determine the losses in a flow system, flow through pipes, impact of jet

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

CO	**Course Outcome**	**BT Level**
CO-1	Understand the basic properties of fluid	L-2
CO-2	Understand various forces & conditions of equilibrium of floating & submerged bodies	L-2
CO-3	Understand kinematics and dynamics of flow.	L-2
CO-4	Apply Darcy weisbach equation in various fluid flow	L-3
CO-5	Understand the concept of motion of viscous fluid	L-2
CO-6	Calculate the force exerted by the jet on surfaces	L-2

SYLLABUS

Unit -I Fundamental characteristics of fluid Density, Specific weight, Specific volume, Specific gravity, Viscosity of fluid, Surface Tension, Capillarity, vapour pressure & cavitation.
Pressure & its measurement: Pascals law, Hydrostatic law of pressure & pressure variation in fluid, measurement of pressure by Manometer.

Unit -II Buoyancy & floatation: Concept of buoyancy, Centre of buoyancy. Stability of floating body, Metacenter & metacentric height. Condition of equilibrium of floating & sub-merged body.
Hydrostatic pressure force on plane & Curved surfaces, Measurement of total pressure & Centre of pressure

Unit -III Kinematics of fluid flow, Methods of describing fluid motion, Types of flow, rate of flow, streamline, potential line, flow net, velocity & acceleration, continuity equation in three-dimensional flow.
Dynamics of fluid flow: Eulers equation of motion, Bernoulli's equation measurement of fluid flow with venturi meter.

Unit -IV Flow through pipes: Losses in pipe, major losses, Darcy- Weisbach equation, minor losses due to sudden enlargement, contraction, entry, exit & pipe fitting.
Flow through series & parallel pipes, elementary concept of water hammer in pipes

Unit -V Motion of viscous fluid: Introduction to Laminar & Turbulent flow, Concept of Boundary layer separation & its type, Boundary layer separation.
Reynolds number & its significance. Drag & Lift force on object

Unit -VI: Principle of fluid machinery: Force exerted by fluid jet on plane, curved, stationary & moving vanes. Velocity diagrams, work done & efficiency.
2) Efficiencies Volumetric efficiency, Hydraulic efficiency, Mechanical efficiency and overall efficiency.

TEXTBOOKS:

1. R. K. Bansal, Fluid Mechanics and Hydraulic Machines
2. R. K. Rajput, Engineering Fluid Mechanics
3. Kumar, K.L., Engineering Fluid Mechanics, S. Chand & Company, 2016.
4. R. W. Fox , A. T. McDonald, J. W. Mitchell, Introduction to Fluid Mechanics, Wiley, 2021.
5. Frank M. White, Henry Xue Fluid Mechanics McGraw-Hill; 9th edition, 2022.
6. Modi & Sheth, Fluid Mechanics & Machinery.

REFERENCE BOOKS:

1. S. Ramamrutham, Hydraulic, Fluid Mechanics & Fluid Machines.
2. Fluid mechanics & Machinery by CRSP. Ojha, R. Berndtsson.
3. Kundu, P., Cohen, I., and Dowling, D., Fluid Mechanics, Academic Press, 2015.
4. Streeter, Wylie and Bedford, Fluid Mechanics, McGraw Hill Education, 2017.

MOOC LINKS:

1. https://onlinecourses.nptel.ac.in/noc25_me41/preview
2. https://fm-nitk.vlabs.ac.in/

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Sant Gadge Baba Amravati University,
Amravati Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	Semester:	**IV**
Course:	**Fluid Mechanics (PCC-II)**	Code:	4ME213PL

Practical	Hours	Credit	Practical Evaluation		Total
			INT	EXT	
2	**2**	**1**	**25**	**25**	**50**

List of Experiments: - (At least Seven practical's out of the following list.)

1. Measurement of fluid viscosity
2. Verification of Bernoulli's theorem
3. Determination of the Coefficient of discharge of Orifice-meter.
4. Determination of the Coefficient of discharge of Venturi-meter.
5. Calibration of Rotameter
6. Reynold's experiment to visualize laminar-turbulent transition for flow in a tube
7. Determination of friction factors for the pipes.
8. Measurement of velocity using a pitot tube
9. Determination of Metacentric Height of a floating body.
10. Determination of various minor losses in pipes to compute the total head loss
11. Impact of Jet on flat and curved surfaces

Practical Examination:

Note: Practical examination shall consist of viva voce/performance based on the above syllabus and practical work.

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**Fourth**
Course:	**Energy Conversion -I (PCC-III)**	**Code:**	**4ME211PC**

Lecture	**Tutorial**	**Hours**	**Credit**	**TA**	**CT-I**	**CT-II**	**Th. Exam**	**Total**
02	-	02	02	40	30	30	60	**100**

Methods of Teacher Assessment (TA): Class Tests, Assignments. Quiz, Class Attendance, etc.

Course Objectives:

1. To study the properties of steam and its behavior for different thermodynamic processes.
2. To study different types of boilers, their mountings, accessories, performance of boilers and different efficiencies.
3. To study the various fuel handling and ash handling systems in power plant.
4. To study various types of condensers and cooling towers.
5. To study various thermodynamic aspects of flow of steam through nozzle and diffuser.
6. To study flow of steam through steam turbines and concept of compounding.

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

CO	**Course Outcome**	**BT Level**
CO-1	Understand the concepts of steam, boilers, steam power plant, mounting and accessories.	L2
CO-2	Evaluate the performance of boiler	L3
CO-3	Calculate performance parameters of condenser and nozzle efficiency.	L3
CO-4	Analyze the performance of steam turbines.	L4
CO-5	Compare the various types of nuclear reactors	L2
CO-6	Understand the various renewable energy sources and conversion systems	L2

SYLLABUS

Unit I: Flow diagram for steam power plant with basic units such as steam generator, turbine, condenser and pump. Steam power plant layout, site selection. Boilers: Introduction to water tube and fire tube boilers used in thermal power plants, packaged Boilers, High pressure boilers; Loeffler, Benson, Lamont Boilers, Boiler mountings and accessories—devices for improving Boiler efficiency. Principle of fluidized bed combustion. Concept of cogeneration. (7 Hrs.)

Unit II : Boiler draught; Types of draught, expression for diameter & height of chimney, condition for maximum discharge, efficiency of chimney, reasons for draught loss. Boiler performance:- Boiler rating, boiler power, equivalent evaporation, efficiency. Effect of accessories on boiler efficiency and heat balance. (7 Hrs)

Unit III : CONDENSERS : Need, Types of condensers, quantity of cooling water required. Dalton's law of partial pressure, condenser and vacuum efficiency. Sources of air in condensers and its effect on performance. cooling towers: Natural and mechanical wet type cooling tower.

Steam nozzles : Flow of steam through nozzles & diffusers, Maximum discharge, critical pressure ratio, choking in nozzles, Effect of friction. Determination of throat & exit areas, Nozzle efficiency, no numerical on concept of super saturated flow & Wilson line. (7 Hrs.)

UNIT IV : Steam Turbines:- Principle of working, Types of steam turbines such as impulse, reaction, axial & radial flow, back pressure & condensing turbines. Compounding. Reheat, regenerative cycles, bleeding. Analysis limited to two stages only.

Analysis of steam Turbines : Flow of steam through impulse & impulse reaction turbine blades, Velocity diagrams. work & power developed, axial thrust and efficiency. Governing of steam turbines. (7Hrs)

UNIT V : NUCLEAR POWER:- Fusion, fission, Chain reaction, conversion and breeding in nuclear fission. Components of Nuclear Power Plant such as Reactor, Steam generator, turbine, Moderator, Control Rods etc., Types of nuclear reactors like BWR, PWR, CANDU and liquidized metal cooled thermal reactors. (7 Hrs.)

UNIT VI: Introduction to renewable energy, Wind Energy, solar, fuel cell, bio-gas, Geothermal, OTEC, tidal power plants, Applications of Non-conventional energy. (7 Hours)

RECOMMENDED BOOKS:

TEXTBOOKS :

1. Thermal engineering; Mahesh M Rathore; Tata McGraw-Hill
2. Thermal Engineering R.Yadav; Central publication
3. Non-conventional Energy Sources B. H. Khan Tata McGraw-Hill
4. Non-conventional Energy Sources G. D. Rai.

REFERENCE BOOKS:

1. Steam Turbine; Kearton; Oscar Publications.
2. Thermal Power Engineering; Mathur Mehta; Tata McGraw-Hill
3. Power Plant Engineering. P. K. Nag
4. Power Plant Engineering; R. K. Rajput ; Laxmi Publications
5. Thermal Engineering, P. L. Ballaney; Laxmi Publications.

MOOC LINKS:

1. https://onlinecourses.nptel.ac.in/noc20_me33/preview
2. https://archive.nptel.ac.in/courses/112/107/112107216

Sant Gadge Baba Amravati University, Amravati

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**IV**
Course:	**Fluid Mechanics and Machines (MDM -II)**	**Code:**	**4ME214M**

Lecture	Tutorial	Hours	Credit	TA	CT-I	CT-II	Th. Exam	Total
02	00	02	02	10	05	05	30	50

Methods of Teacher Assessment (TA): Class Tests, Assignments. Quiz, Class Attendance, etc.

Course Objectives:

1. To give fundamental knowledge of fluid, its properties.

2. To learn the operation, working principle & performance of hydraulic turbines.

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

CO	Course Outcome	BT Level
CO-1	To Understand the basic properties of fluid & to understand concept of buoyancy and floatation of floating/submerged bodies	L-2
CO-2	Demonstrate and understand the working of hydraulic turbines	L-2
CO-3	Demonstrate and understand the working of centrifugal pumps and reciprocating pump	L-2

SYLLABUS

Unit -I Basic characteristics of fluid -Density, Specific weight, Specific volume, Specific gravity, Viscosity of fluid, Surface Tension, Capillarity. Buoyancy & floatation: Concept of buoyancy, Centre of buoyancy

Unit -II. **Hydraulic Turbines** - Theory of impulse and reaction turbines. Pelton wheel Turbine Francis and Kaplan turbines, their construction, classification

Unit -III VI Centrifugal pumps :- Basic Theory, classification, construction, operation,
Reciprocating pump:- Basic Theory, classification, construction, operation

TEXTBOOKS:

1. Fluid Mechanics and Hydraulic Machines by R. K. Bansal
2. Engineering fluid Mechanics by R. K. Rajput
3. CSP Ojha, R. Berndtsson, Fluid mechanics and machinery; Oxford University.

REFERENCE BOOKS:

1. Hydraulic, Fluid Mechanics & Fluid Machines, S. Ramamrutham.
2. Fluid Mechanics & Machinery by Modi & Sheth
3. Dr. Modi & Seth, Hydraulics and Fluid Mechanics; Standard house book

MOOC LINKS:

1. https://onlinecourses.nptel.ac.in/noc25_me41/preview
2. https://onlinecourses.nptel.ac.in/noc25_me89/preview
3. https://onlinecourses.nptel.ac.in/noc25_me38/preview

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**IV**
Course:	**Computational Methods and Programming**	**Code:**	**4ME215VS**

Lecture	Practical	Total Hours	Credit	IE (Practical)	EXT (Practical)	Total
01	02	03	02	50	--	50

Methods of Internal Evaluation (IE): Class Tests, Assignments, Quiz, Class Attendance, etc.

Course Objectives:

This course provides an introduction to the numerical methods to solve various kinds of equations that students encounter in the field of mechanical engineering, energy and transportation. The emphasis should be more on programming techniques rather than the language itself.

1. To understand the importance of obtaining approximate solutions to various practical problems.
2. To introduce some of the key computational techniques used in modelling and simulation of engineering problems.

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

CO	Course Outcome	BT Level
CO-1	Apply fundamental programming constructs to solve numerical problems and calculate errors associated with computational methods.	L2
CO-2	Solve linear algebraic equations using numerical techniques.	L3
CO-3	Estimate solution to problems using numerical integration and differentiation.	L3
CO-4	Apply computational schemes for solving systems of ordinary differential equations.	L3

SYLLABUS:

Unit - I

Basics of scientific computing: Introduction to numerical computation and computer programming. General programming principles, Approximations and Types of errors; Taylor series and error propagation, Stability; Accuracy.

Unit - II

Numerical Methods in Linear Algebra: Direct and iterative solution techniques for simultaneous linear algebraic equations - Gauss elimination, and Gauss-Seidel iterative techniques for solving linear systems, interpolation and Lagrange polynomial, curve fitting - regression analysis, Root finding- simple methods, Engineering applications, Implementation in C++/Python/Matlab/etc.

Unit- III

Numerical differentiation & Integration: Numerical differentiation using forward-difference formula, elements of numerical integration, the trapezoidal rule, Simpson's rules.

Unit- IV

Ordinary differential equations (ODEs): Introduction to ODEs – Initial Value problems, Euler method for solving initial-value problems, Runge-Kutta method, simulating a simple pendulum.

Introduction to partial differential equations (PDEs): Finite difference method for solving PDEs, finding a root using the bisection method, fixed-point iteration, Newton's method.

List of Programs: At least **06** programs should be developed from the topics of the syllabus, as suggested below. Emphasis should be on developing own generic programmes using any programming language such as MATLAB/Python/C++ and use of available functions should be avoided. It should enhance student's ability to develop mathematical models and solve real-world problems using computational methods.

1. Program to solve a system of linear equations using Gauss elimination method.
2. Program to solve a system of linear equation using Gauss-Seidel method.
3. Program to find real root of a polynomial using Newton Raphson Method.
4. Program to find real root of a polynomial using fixed point iterative method.
5. Development of computer program for Numerical integration by Trapezoidal.
6. Development of computer program for Numerical integration by Simpson's rule.
7. Program to solve problem involving curve fitting and interpolations.
8. Program to find the value of function using Newton Forward Difference Method
9. Program to solve initial value problem using Euler Method.
10. Program to find solution of initial value problem using Runge-Kutta method.

TEXTBOOKS:

1. Shastry, S.S., Introductory Methods of Numerical Analysis, Prentice Hall Inc., India, 2012.
2. V. Rajaraman, Computer Oriented Numerical Methods, Prentice Hall of India, 4th Ed. 2019.
3. M.K. Jain, S. R. K. Iyengar, and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age Publication, 6th Ed. 2012.
4. Steven Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill, 5th Ed., 2023.
5. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 8th Ed, Tata McGraw Hill, 2021.
6. T Veerarajan, T Rama Chandran, Theory and Problems in Numerical Method, Tata McGraw Hill Co-Ltd, 2018.

REFERENCE BOOKS:

1. S. D. Conte and C. de Boor, Elementary Numerical Analysis, Third Edition, Tata McGraw-Hill Education, 2005.
2. J. D. Hoffman, Numerical Methods for Engineers and Scientists, Second Edition (Special Indian Edition), CRC Press, 2001.
3. K. E. Atkinson. An Introduction to Numerical Analysis, Second Edition, Wiley, 2008.

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B.E. Mechanical Engineering**	**Semester:**	**Fourth**
Course:	**Business Planning and Project Management**	Code:	**4ME216OE**

Lecture	Tutorial	Hours	Credit	TA	CT-I	CT-II	ESE	Total
2	**0**	**0**	**2**	**10**	**5**	**5**	**30**	**50**

Methods of Teacher Assessment (TA): Class Tests, Assignments, Quiz, Class Attendance etc.

Course Objectives:

1. To study the concept of business planning and forecasting.
2. To learn the importance of project planning and selection criteria.
3. To study the concepts of project appraisal and report writing.

Course Outcomes:

After completion of the course, the students will be able to –

CO	**Course Outcomes**	**BT Level**
CO1	Understand the concept of Business Planning and forecasting and other planning aspects in business.	L-1
CO2	Understand the importance of project planning and critically examine which project needs to be undertaken using various models.	L-2
CO3	Understand and apply the knowledge of project appraisal and project report writing.	L-3

SYLLABUS

Subject: Business Planning and Project Management **L**

UNIT I

Business Planning: Introduction, Definitions, Nature and characteristics of planning, Objectives of planning, Importance of planning, Steps in planning process, Essentials of a good planning, Advantages and limitations of planning, Elements of Business Plan 9

Planning Forecasting: Introduction to Forecasting, Scope of

	forecasting**,** Forecasting techniques/Types/ Methods, Advantages, disadvantages of forecasting	
UNIT II	**Introduction to Project Management**: Project Lifecycle, Project selection and evaluation, Selection criteria and models, Project proposals. **Project Planning:** Identifying the Project area and target group, Determining the goals and objectives of the Project, Project work plan and time frame: Preparation of action plan and time schedule (GANTT charts), Assessing the feasibility and viability of the Project, Project Appraisal techniques	8
UNIT III	**Project Appraisal:** SWOT analysis, Cash flow analysis, Payback period and Net present value, Steps in Project Appraisal Process, Types of appraisals. **Developing a Project Plan**: Developing the Project Network, Constructing a Project Network (Problems) using PERT and CPM, Resource Leveling and Resource Allocation, Project Control Process, Control Issues, Project Audit Process. **Report Writing:** Preparation and Submission of final project report, Communication and presentation of report.	9
	Total	26

TEXTBOOKS:

1. K. Ashwathappa and Siddharth Bhat, Production and Operation Management: , Himalaya Publishing House, 2010
2. Shubhangi Kulkarni, Business Planning and Project Management, Vision Publications
3. Prasanna Chandra, Projects.(2002). Planning, Analysis, Financing, Implementation and Review, Tata MC Graw Hill publishing Company Ltd, New Delhi.

REFERENCE BOOKS:

1. Arun Kanda, PROJECT MANAGEMENT, PHI, Delhi, 2011
2. Nagarajan. K. (2001). Project Management, New age international (P) Ltd. New Delhi.
3. Vasant Desai. (1997). Project Management, Himalaya publishing house, Mumbai.
4. John M. Nicholas (2005), Project Management for Business and technology: Principles and Practice, Pearson Prentice Hall, New Delhi.
5. Bhavesh M Patel. (2000). Project Management, Vikas Publishing House Pvt. Ltd., New Delhi.

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program	**B.E. Mechanical Engineering**	**Semester**	**IV**
Course	**Open Elective- II: Sustainable Energy**	**Code**	**4ME216OE**

Lecture	Tutorial	Hours	Credit	TA	CT-I	CT-II	Th. Exam	Total
2	0	0	2	10	5	5	30	50

Method of Teacher Assessment (TA): Class Tests, Assignments, Quiz, Class Attendance, etc.

Course Objectives:
To understand the basic concept of Sustainable Energy e.g. Solar Energy, P-V Cell, Geothermal Energy, Tidal Energy, Ocean Thermal Energy Conversion, Wind Energy, Biomass Energy Conversion

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

CO	**Course Outcomes**	**BT Level**
CO 1	Understand the basic concept of Sustainable energy, Sources and its importance, radiation transmission through covers and solar energy collections, the basic concept of Solar energy utilization and storage.	L2
CO 2	Understand the basic concept of Geothermal energy, energy from ocean.	L2
CO 3	Understand the basic concept of energy from Wind and biomass.	L2

SYLLABUS:

UNIT I:
Introduction: -Sustainable energy. Need of sustainable energy sources, Overview of Global and Indian Energy Scenario.
Solar Radiation: Types of Solar radiation, Measurement of solar radiation using Pyrheliometer, Pyranometer and Sunshine Recorder.
Solar Collectors: classifications of collectors, construction and working.
Solar Energy Storage & Utilization: Methods of storage, Applications of solar energy in heating, cooling, pumping, power production, distillation, drying, etc.
Solar Photo voltaic cells: Principle, Construction and Working (8Hrs)

UNIT II:
Geothermal Energy Resources: Hot Dry Rock system, Vapour dominated, liquid dominated, flash steam, binary fluid concept of power generation.
Tidal Power: Types of tidal plants such as single and two basin plants, operation of tidal power plant.
Ocean thermal energy conversion system: Construction and working of OTEC systems (8Hrs)

UNIT III:

Wind Power: Introduction, Principles of wind energy conversion, Operation, Wind speed data, Site selection, Types of windmills, Applications.

Biomass Energy Resources: Mechanism of green plant photosynthesis. Solar energy plantation,

Biogas-Types of biogas plants, factors affecting production rates. Introduction to biodiesel and ethanol as alternative fuels, properties of bio-fuel. (8 Hrs)

BOOKS RECOMMENDED:

TEXTBOOKS:

1. Solar Energy; S.P. Sukhatme; TMH.
2. Non-Conventional Energy Sources; G.D. Rai; Khanna Publications.
3. Non-Conventional Energy Sources; B. H. Khan.

REFERENCE BOOKS:

1. Treatise on Solar Energy; H.P. Garg; John Wiley & Sons.
2. Renewable Energy Conversion, Transmission and Storage; Bent Sorensen; Elsevier Publication.
3. Renewable Energy; Godfrey Boyle; Oxford University Press, Mumbai.
4. Renewable Energy Sources and Emerging Technology; D.P. Kothari, K.C. Singal, Rakesh Ranjan; PHI.

MOOC Links:

Renewable Energy Engineering: Solar, Wing, Biomass Energy Systems: https://archive.nptel.ac.in/courses/103/103/103103206/

Non-Conventional Energy Sources: https://archive.nptel.ac.in/courses/121/106/121106014/

Hydro and Renewable Energy: https://nptel.ac.in/courses/109107397

Sant Gadge Baba Amravati University, Amravati
Faculty of Science and Technology
Board of Studies in Mechanical Engineering

Program:	**B.E. Mechanical Engineering**	**Semester:**	**Fourth**
Course:	**Automotive Technology**	**Code:**	**4ME2160E**

Lecture	Tutorial	Hours	Credit	TA	CT-I	CT-II	Th. Exam	Total
2	0	2	2	10	5	5	30	50

MethodsofTeacherAssessment(TA): ClassTests,Assignments.Quiz,ClassAttendance,etc.

Course Objectives: To understand……..

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

CO	Course Outcome	BT Level
CO-1	Understand the basics of automobile engineering and its components.	L1
CO-2	Understand the basics of Control system and transmission system	L1
CO-3	Get aquatinted with the recent developments of electric and Hybrid Vehicles.	L1

Syllabus

Unit-I **: Power Unit and Fuel Supply System** :Classification of automobiles, chassis layout types, Engine parts- types, construction and functions, Multiple cylinder engines, components of fuel supply system, M.P.F.I. and C.R.D.I (8 Hrs)

Unit-II : **Control and Transmission System** : Braking system:- Mechanical, Hydraulic and Air brake system, Steering system:- Layout, steering gears, Power steering- Principle and working. Transmission system : Layout, multiplate clutches, synchromesh gear box, Automatic gear box and Differential (8-Hrs)

Unit-III: **Electric & Hybrid Vehicles :** Electric components used in hybrid and electric vehicles and their functions, Configuration and control of DC and Induction Motor drives, Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Hybridization of IC engines and electric motors. (8 Hrs)

TEXTBOOKS:

1. Automobile Engineering-Vol -I &II, Kirpal Singh, Standard Publishers Distributors
2. Automobile Engg. By K. M. Gupta.l, Vol. -I & II, Umesh Publications
3. Automobile Engineering –R. K. Rajput; Laxmi publications, New Delhi.
4. Fundamentals of Hybrid and Electric Vehicles - K. C. Jain , Dr. Amit R. Patil , Dr. Arvind J. Bhosale, Dr. S.S. Raghuvanshi
5. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.

REFERENCE BOOKS:

1.Automotive Mechanics; Crouse & Anglin, TMH.
2.Automotive Mechanics ; S. Srinivisan; TMH.
3.James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.

MOOC LINKS:

1. https://cursa.app/en/free-course/fundamentals-of-automotive-engineering-ciee
2. https://alison.com/course/mechanical-engineering-internal-combustion-engine-basics#google_vignette
3. https://www.edx.org/cour se/electric-carsintroduction-0
4. https://www.edx.org/cour se/electric-andconventional-vehicles-4
5. https://www.edx.org/cour se/hybrid-vehicles-1

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

SYLLABUS

FOR EXIT OPTIONS, AFTER

SEMESTER -III & IV

Year: 2025-26

Sant Gadge Baba Amravati University, Amravati

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**III & IV (Exit Courses)**
Course:	**Industrial Safety Engineering**	**Code:**	**L6**

Lecture	Tutorial	Hours	Credit	TA	CT-I	CT-II	Th. Exam	Total
Online Mode			3	-	-	-	-	3

Methods of Teacher Assessment (TA): Class Tests, Assignments. Quiz, Class Attendance, etc.

Course Objectives: To make students aware about various causes of accidents in industries and preventive measures to make the work environment safe.

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

CO	Course Outcome	BT Level
CO-1	Classify different safety management policies and strategies	L2
CO-2	Analyze causes of accidents and measures for prevention of accidents	L4
CO-3	Function for cause identification and prevention related of fire accidents	L4
CO-4	Explain hazards and safety issues in confined spaces	L2
CO-5	Classify occupational health and hygiene	L2
CO-6	Apply Hazard Identification and Risk Assessment (HIRA) for safety on shop floor	L3

SYLLABUS

Unit-I

Industrial Safety Management Concept: Introduction to Industrial safety Management, Safety Policy & Budgeting for Safety, Safety Committee, Job Safety Analysis (JSA), Safety Inspection & Safety Audit, Safety Survey & Safety Sampling

Unit-II

Causes of Accident and its prevention and Safety Education: Causes of Accidents and its Prevention, Henrich Domino Theory and Bird's Triangle of Accident, Accident Investigation Process, Elements of Safety Education and Training, Safety Education & Training Methods, Safety Awareness Programme, Personal Protective Equipment

Unit-III

Fire Safety: Causes and prevention: Fire triangle and various sources of Fire, Various Classes of Fire & Extinguishing, Types of Fire Extinguishers Method, Active and Passive Fire Protection, Fire Sprinkler System, Fire Detectors and Alarm System, Fire Hydrant System

Unit-IV

Confined Space Hazard and Safety: Introduction to Confined Space & Safety, Permit to Work System, Lock Out and Tag Out System

Unit-V

Occupational Health and Hygiene: Introduction to Occupational Health and Hygiene, Ergonomical Hazard, Physical and Chemical Hazard, First-Aid

Unit-VI

Hazard Identification and Risk Assessment (HIRA): Introduction to HIRA, Hierarchy of Control, HAZOP Study

Other Hazards and its Safety: Electrical Hazards and Safety, Radiation Hazard & Safety

TEXTBOOKS:

1. Industrial Safety, Health and Environment Management Systems by R. K. Jain, Sunil S. Rao, Khanna Publisher
2. Hand Book of Fire Technology by Gupta R.S., Orient Longman, Bombay
3. Industrial safety management by L.M. Deshmukh, McGraw-Hill Company

REFERENCE BOOKS:

1. Fire Prevention Hand Book by Derek and James, Butterworths and Company, London
2. Accident Prevention manual for industrial operations, N.S.C., Chicago

MOOC LINKS:

1. Industrial Safety And Fire Safety Management
https://onlinecourses.swayam2.ac.in/nou25_ge32/preview
2. Industrial Safety Engineering
https://archive.nptel.ac.in/courses/110/105/110105094/

Internship/Mini Project/ Study Project Evaluation Sheet

Year:
Semester:
Session:

Date:

Sr. No.	Name of Student	Tittle of Mini-Project/Study Project	Selection of Topic (5M)	Quality of Report & Prototype (5M)	Presentation & Communication Skill (5M)	Knowledge of Topic (5M)	Response to Queries (5M)	Total Marks (25M)

Name of Internal Examiner **Sign.**

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Name of External Examiner **Sign.**

Sant Gadge Baba Amravati University, Amravati

Faculty of Science and Technology

Board of Studies in Mechanical Engineering

Program:	**B. E. Mechanical Engineering**	**Semester:**	**III & IV (Exit Courses)**
Course:	**Quality Control and Inspection**	**Code:**	**L6**

Lecture	Tutorial	Hours	Credit	TA	CT-I	CT-II	Th. Exam	Total
Online Mode			3	-	-	-	-	3

Methods of Teacher Assessment (TA): Class Tests, Assignments. Quiz, Class Attendance, etc.

Course Objectives: To make students aware about inspection and quality control in core industry.

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

CO	Course Outcome	BT Level
CO-1	Explain the concept of Quality and Quality Control.	L2
CO-2	Make use of appropriate control charts for quality control.	L3
CO-3	Interpret the need of process capability analysis for solving quality related issues.	L2
CO-4	Choose appropriate sampling for quality control.	L3
CO-5	Solve the numerical based reliability and quality.	L3
CO-6	Demonstrate experimental design for quality function.	L3

SYLLABUS

Unit-I

History and Evolution of Quality, Quality Control and Management, Management of Quality - I, Management of Quality – II, Statistical Process Control, Control Charts for Attribute data.

Unit-II

Control Charts for Variables, Problems on control charts and Control Charts Pattern, Special purpose Control Charts, Trend Control Chart, Modified or Acceptance Control Chart, Centering of the Process

Unit-III

Process Capability Analysis, Process Spread, Specifications Spread, Process Capability Analysis – Individual Observations and Control Chart Information, Setting Tolerances, Mating Parts, Clearance Fit, Interference Fit, Transition Fit

Unit-IV

Acceptance Sampling, AQL, LQL, Producer's Risk, Consumer's Risk, Types of sampling Plan, Performance Measures of Sampling Plans: OC curve and ASN curve, AOQ, ATI Curve, Special purpose sampling Plan.

Unit-V

Design for Reliability, Concept of Reliability, General Reliability Function: MTTF, Variance, Instantaneous Failure or Hazard Rate Function, Reliability and Life Testing Plans: Measurement of Reliability using Life Testing Plans Assuming Exponential Distribution, Numerical Examples on Quality and Reliability -I.

Unit-VI

Quality by Experimental Design, Introduction - What is an Experiment, Terms Associated with Experimentation, Important Features of Experimental Design, Basic Principles of Experimental Design, Experimental Design Methods.

TEXTBOOKS:

1. Fundamentals of Quality Control and Improvement by Mitra, A., Prentice-Hall, 2nd Edn (1998), ISBN: 0-13-645086-5.

2. Product and Process Design for Quality, Economy and Reliability by Dukkipati, R V and Pradip K Ray, New Age International. 1st Edition. (2010), ISBN: 978-81-224-2661-8.

REFERENCE BOOKS:

1. The quality of measurements: a metrological reference by Fridman, A.E., Springer Science & Business Media 2011.

MOOC LINKS:

1. Quality Design and Control
https://onlinecourses.nptel.ac.in/noc21_mg24/preview