Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Revised Syllabus of Second Year (SY) Bachelor of Technology

Mechanical Engineering

(III & IV Semester)

Under Choice Based Credit System (CBCS)

Under Faculty of Science and Technology

(Effective from 2020-21 and onwards)

FACULTY OF SCIENCE AND TECHNOLOGY

Syllabus Structure w.e.f. 2020-2021 (Choice Based Credit System)

SY B. Tech. (Mechanical Engineering)

Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Practical	Tutorial	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
BSH201	Vector and Partial Differential Equation	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED202	Strength of Materials	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED203	Fluid Mechanics and Hydraulic Machines	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED204	Metrology and Quality Control	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED205	Engineering Thermodynamics	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED221	Strength of Materials	-	2	-	-	-	-	-	-	25	25	-	1	-	1
MED222	Fluid Mechanics and Hydraulic Machines	-	2	-	-	-	-	-	-	25	25	-	1	-	1
MED223	Metrology and Quality Control	-	2	-	-	-	-	-	-	25	25	-	1	-	1
MED224	Engineering Thermodynamics	-	2	-	-	-	-	-	25	-	25	-	1	-	1
MED225	Development of Skills-III	-	2	-	-	-	-	-	-	25	25	-	1	-	1
MED226	Workshop Practices II	-	2	-	-	-	-	-	25	-	25	-	1	-	1
		15	12	-	75	75	50	300	50	100	650	15	6	-	21

Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks							Credits			
		Theory	Practical	Tutorial	MSE-I	MSE-II	TA	ESE	TW	PR/OR	Total	TH	TW/PR	TUT	Total
BSH251	Probability and Random Theory	3	-	-	15	15	10	60	-	-	100	3	-	-	3

Course code	Course														
MED252	Machine Drawing	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED253	Manufacturing Processes	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED254	Applied Thermodynamics	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED291-MED293	Professional Elective Courses-I	3	-	-	15	15	10	60	-	-	100	3	-	-	3
MED271	Machine Drawing	-	2	-	-	-	-	-	-	25	25	-	1	-	1
MED272	Manufacturing Processes	-	2	-	-	-	-	-	-	25	25	-	1	-	1
MED273	Applied Thermodynamics	-	2	-	-	-	-	-	-	25	25	-	1	-	1
MED274-MED276	Professional Elective Courses-I	-	2	-	-	-	-	-	25	-	25	-	1	-	1
BSH277	Development of Skills-IV	-	2	-	-	-	-	-	-	25#	25	-	1	-	1
MED278	Advanced Manufacturing Process Laboratory	-	2	-	-	-	-	-	25	-	25	-	1	-	1
BSH803-BSH808	Mandatory non-credit audit course	2													
		17	12	-	75	75	50	300	50	100	650	15	6	-	21
	#	Online Examination													

MSE- Mid Semester Exam, ESE- End Semester Examination, TH-Theory, OR- Oral, TA-Teacher Assessment, TW- Term Work, PR- Practical, Tut- Tutorial

Professional Elective Courses-I

Group A	Group B	Group C
MED291: Total Quality Management	**MED292:** Advanced Solid Mechanics	**MED293:** Alternative Energy Sources

Mandatory non-credit audit course

Course code	Course	Offered by Department
BSH805	Energy Audit	Mechanical Engineering

Courses offered for Minor in Mechanical Engineering.

Sr.no	Semester	Course Code	Course	Remarks
1	IV		Manufacturing Engineering	**Run by Department**

Courses offered for Honor in Mechanical Engineering

Sr.no	Semester	Course Code	Course	Remarks
1	IV		Digital Manufacturing	**Run by Department**

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED202	Credits: 3-0-0
Course: Strength of Materials	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1.Knowledge of Engineering Mechanics
Objectives	1. To provide the basic concepts and principles of strength of materials. 2. To develop the theoretical basis and to derive the theories of the strength of materials and to enable students to systematically solve engineering problems and design engineering systems.
Unit-I	**Stresses & Strains** Concept, Types of Stresses and Strains, Poison's Ratio, Stresses and Strains in Simple and Compound Bars under Axial Loading, Stress-Strain Diagram, Hooks Law, Elastic Constants and Relationships, Temperature Stresses and Strains In Simple Bars under Axial Loading, Concept of Surface and Volumetric Stresses and Strains (8 Hrs)
Unit-II	**Theory of Bending** Relation between Transverse Loads, Shear and Bending Moments, Shear and Bending Moment Diagrams, Pure Bending – Beams with Symmetric Cross-Sections, Beams with Composite Cross-Section, Shear Stresses in Beams, Relationship between Bending Moment. Slope & Deflection, Mohr's Theorem, Moment Area Method, Method of Integration, Macaulay's Method, Calculations for Slope and Deflection of (i) Cantilevers And (ii) Simply Supported Beams (iii) Overhang Beams. (12 Hrs)
Unit-III	**Thin Cylindrical and Spherical Shells**

	Thin Pressure Vessels, Circumferential and Longitudinal Stresses, Cylindrical and Spherical Objects Subjected to Internal Fluid Pressure, Volumetric Strains. (4 Hrs)
Unit-IV	**Principal Stresses** Direct and Bending Stresses with Axial Loads, Core of Section, Eccentrically Loaded Short Struts & Chimneys, Concept of Stress on Oblique Plane in Two Dimensional Stress System, Planes of Maximum Shear, Mohr's Circle of Stress. (8 Hrs)
Unit-V	**Theory of Torsion** Torsion of Thin Circular Tube, Solid and Hollow Circular Shafts, Tapered Shaft, Stepped Shaft and Composite Circular Shafts, Combined Bending and Torsion, Equivalent Torque, Torsional Moment Diagrams, Effect of End Thrust. (8 Hrs)
Unit-VI	**Energy Methods** Strain Energy due Gradually Applied Loads, Suddenly Applied Loads & Impact Loads. Stored Energy In Elastic Members: Axial, Torsional & Bending, Castigliano's First & Second Theorem, Application of Castigliano's Theorem to Different Classes of Problems, Virtual Work Principles – The Basis (8 Hrs)

References

Sr. No.	Title	Author	Publication	Edition
1.	Strength of Materials	S Ramamrutham	Dhanpatrai & Sons Publications	5th edition
2.	Strength of Materials	R K Bansal	Laxmi Prakashan	6th edition
3.	Strength of Materials	R S Khurmi	S Chand & Co ltd	26th
4.	Strength of Materials	S S Ratan	TMH Publication	2nd
5.	Elements of Strength of Materials	Timoshenko	D Van Nostrand Company Inc	5th edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED203	Credits: 3-0-0
Course: Fluid Mechanics and Hydraulic Machines	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1.Concepts of Engineering mechanics, basic physics, Newton's Laws
Objectives	1. To understand properties of fluid and study different pressure measuring devices. 2. To study the behavior of fluid when fluid is in rest or in motion 3. To study the energy losses in the pipes. 4. To introduce the concepts of momentum principles. 5. To impart the knowledge on pumps and turbines 6. To give an idea about the gradually varied flow and rapidly varied flow and their equations and computations
Unit-I	**Basics of Fluid and Fluid Statics** Units and Dimensions, Properties of fluids - Density, Specific gravity, Specific weight, Viscosity; Compressibility, Vapor pressure, Capillarity and surface tension; Forces on immersed surfaces, Introduction about center of pressure and buoyancy, Piezometer, U-tube and Differential Manometers. (4 Hrs)
Unit-II	**Fluid Kinematics and Dynamics** A. Introduction, Classification of flow, continuity equation, Cartesian coordinates, types of flow line, Velocity acceleration, Velocity Potential, Stream Function, B. Forces acting on fluids in motion, Euler's equation of motion, Bernoulli's equation, Practical application of Bernoulli's equation such as Venturi meter, Orifice meter, Pitot tube. Introduction to computational fluid dynamics (12 Hrs)

Unit-III	**Flow through Pipes** Major losses, Minor Losses, Darcy's Equation, Hydraulic Gradient Line, Total Energy Line, Flow through pipes in series and parallel, Equivalent pipes, Branched pipes Losses in power transmission in pipes (8 Hrs)
Unit-IV	**Momentum Principles** Introduction, Force exerted by jet on stationary vertical, inclined & curved plate, Force exerted by jet on moving plates flat vertical, Inclined curved plate (4Hrs)
Unit-V	**Hydraulic Turbines** Introduction, Classification, Impulse Turbine, Construction & working of Pelton wheel, Work done & efficiency of a Pelton wheel, Definition of heads &efficiency, design aspects of Pelton wheel, Radial flow Reaction Turbine, Construction &working of Francis turbine, , Axial flow reaction turbine, Propeller Turbine, Kaplan Turbine, Runway speed, Draft Tube, Draft tube Theory, Types of draft tubes, Specific Speed, unit quantities Cavitation (12 Hrs)
Unit-VI	**Centrifugal Pumps** Introduction, Construction & Working of Centrifugal Pumps (C.P.) Work done by the impeller on water, Definition of Heads & efficiencies of C. P. Losses in C. P. Minimum Speed for Starting a C.P., Effect of variation of Discharge on efficiency, Effect of no. of vanes of impeller on head & efficiency, Single and Multistage C.P., Pumps in Series, Pumps in Parallel, NPSH, Cavitation and Priming. Design principles (8 Hrs)

	Sr. No.	Title	Author	Publication	Edition
References	1.	Fluid mechanics	K.Subramanya,	TATA McGraw Hill Publications	2018
	2.	Fluid mechanics and Hydraulics	Dr.R.K.Bansal	Laxmi Publications (P) LTD	9th
	3.	Fluid mechanics and Hydraulic machines	Dr. S.K.Agrawal	TATA McGraw Hill Publications	2nd
	4.	Hydraulics and Fluid Mechanics	Modi & Seth	Standard Book House	14th

	5.	Fluid Mechanics and Hydraulic Machines	S. Ramamrutham	Dhanpatrai Publications	8th
Additional Reference Books	1.	Fluid Mechanics	V.L. Streeter & E.B. Wylie	TATA McGraw Hill Publications	3rd

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED204	Credits: 3-0-0
Course: Metrology & Quality Control	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1.The student should have completed two semesters of UG Engineering or Science program.
Objectives	1. Selection of tool and techniques for determining geometry and dimensions. 2. To illustrate the use of total quality control tools. 3. Design and calibration of measuring tools and equipment's. 4. Application of Quality Control Techniques. 5. Application of Quality Control Techniques. 6. Application of Quality Management Concept.
Unit-I	**Introduction to Metrology** **Basic Concepts** Legal Metrology - Precision - Accuracy - Types of errors - Linear and Angular, Measurements, Standards of Measurements - Slip gauges - Calibration - Interchange ability and selective assembly. **Introduction to Comparators** Types of Comparators - Mechanical, Mechanical–Optical, Electrical and Electronic, pneumatic, Fluid Displacement - Automatic gauging machines. Coordinate Measuring Machine. **Introduction to Limits, Fits and Tolerances** (8 Hrs)
Unit-II	**Internal and External screw threads** Measurements of various elements of thread - Best size wire - Two and three, wire method. **Gear** Measurements of various elements - Constant chord method - Base tangent method

	(8 Hrs)
Unit-III	**Surface Finish Measurement and Interferometry** **Surface Finish** Surface topography definitions - Measurement of Surface Texture - Methods - Evaluation of Surface finish. Meaning of RMS and CLA values, Grades of roughness, specifications. **Interferometry** Principle of light wave interference - Light sources - Types of Interferometers. Measurement of straightness - Flatness - Squareness - Parallelism – and Circularity. (8 Hrs)
Unit-IV	**Statistical Quality Control** Introduction - Definition of Quality - Chance Causes and assignable Causes - SQC Benefits and Limitations. Fundamental concepts in probability – Normal curve - Measures of Dispersion - Distributions - Binomial, Poisson, Geometric, Hyper geometric, Poisson as an approximation to Binomial, Normal as an approximation to Binomial (8 Hrs)
Unit-V	**Theory of Control Charts** Control Charts for Variables - X bar and R charts, Standard deviation charts – run up - run down - Process capability studies. Control Charts for attributes - Fraction defectives - and number of defects - chart sensitivity. (8 Hrs)
Unit-VI	**Acceptance Sampling** Basic Concepts and OC curve - AQL - LTPD - AOQL - Sampling Plans – Simple - Double - Multiple and sequential sampling plans - stratified sampling plans for variables. Related problems using BIS code books. (8 Hrs)

	Sr. No.	Title	Author	Publication	Edition
References	1.	Engineering Metrology	Jain. R. K	Khanna Publishers	21st
	2.	Engineering Metrology	Hume K.J	Macdonald Publications	3rd

3.	Statistical Quality Control & Quality Management	Gupta. R. C.	Khanna Publishers	9th
4.	Statistical Quality Control	Eugene Grant, Richard Leavenworth	Tata McGraw Hill Publication	7th
5.	Quality Control	Kulkarni V. A. and Bewoor A. K	John Wiley Publication	1st
6.	Measurement Systems	Doeblin, E. O.	McGraw Hill	6th
7.	Quality Handbook	Juran J. M. Joseph A. Defeo	McGraw Hill	6th

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED205	Credits: 3-0-0
Course: Engineering Thermodynamics	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs
Prerequisite	1.Knowledge of concepts in Physic and Mathematics
Objectives	1. To understand energy conservation and essence of first law of thermodynamics. 2. To make analysis of flow and non flow processes regarding relationship between parameters, evaluation of work, heat and internal energy applied for varies thermodynamics systems. 3. To understand statements second law of thermodynamics and concept of availability and irreversibility and its analysis. 4. To study the concept of entropy, including the Clausius Inequality 5. To understand concept of pure substance and analysis of different processes including use of Mollier chart.
Unit-I	Review of fundamentals, Joules paddle-wheel experiment, energy conservations, first law of thermodynamics, first law for cyclic process, stored energy – a property of the system, non flow processes (first law and closed systems), constant volume, constant pressure, constant temperature, adiabatic, polytrophic processes, its work output and heat transfer equations, concept of internal energy (Joule's law) and free expansion. (Theoretical and Numerical treatment) (6 Hrs)
Unit-II	Flow rate and continuity equation, flow process and control volume, flow work or flow energy, steady and unsteady processes, steady flow energy equation (SFEE) time basis and mass basis, Engineering applications of steady flow energy equations such as nozzle, diffuser, boiler, steam or gas turbine, rotary compressor, reciprocating compressor, centrifugal pump, hydraulic turbine and heat exchangers (condenser and evaporator), throttling process (Theoretical and Numerical

	treatment)	(6 Hrs)
Unit-III	Limitations of first law of thermodynamics, thermal reservoir, heat engine, refrigerator and heat pump, Kelvin-Plank statement, Clausius statement, Equivalence of Kelvin Plank and Clausius statements, violations of Kelvin Plank and Clausius statements, perpetual motion machine of second kind, reversible and irreversible processes, Carnot cycle and Carnot heat engine, Carnot theorem, thermodynamic temperature scale (Theoretical and Numerical treatment) (6 Hrs)	
Unit-IV	Introduction, definition of entropy, entropy as point function, T-s plot, Clausius inequality, Entropy and Irreversibility, Entropy principle and its application, Combined I and II law, Entropy and direction, Entropy and disorder, Third Law of Thermodynamics (Theoretical treatment) (6 Hrs)	
Unit-V	Sources of energy, high grade and low-grade energy, availability of energy entering a system, availability of a system, availability of a closed system, availability in a steady flow process, second law efficiency. Second law efficiency- turbine or engine, compressor, pumps, refrigerators, heat pumps effectiveness of heat exchangers (Theoretical and Numerical treatment) (6 Hrs)	
Unit-VI	Properties and important definitions of pure substance, phases of a pure substance, phase-change processes of pure substances compressed liquid and saturated liquid saturated vapour and superheated vapour, saturation temperature and saturation pressure some consequences of saturation temperature and saturation pressure dependence, thermodynamic relations involving entropy, properties of steam, enthalpy-entropy (h-s) chart or mollier diagram, dryness fraction measurement (Theoretical and Numerical treatment) (6 Hrs)	

	Sr. No.	Title	Author	Publication	Edition
References	1.	Engineering Thermodynamics	P.K.Nag	Tata McGraw Hill Publications	5th
	2.	Fundamentals of	Claus Borgnakke	John Wiley	7th

		Thermodynamics	and Richard e. Sonntag	and Sons Publication	
	3.	Fundamentals of Engineering Thermodynamics	Michael J. Moran Howard N. Shapiro	John Wiley and Sons Publication	5th
	4.	Thermodynamics: An engineering approach	Yunus A Cengel; Michael A Boles.	Tata McGraw Hill Publications	7th
	5.	Engineering Thermodynamics	D.S.Kumar	S.K.Kataria & Sons	2015

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED221	Credits: 0-1-0
Course: Laboratory of Strength of Materials	Term Work: 0 Marks
Teaching Scheme:	Practical: 25 Marks
Practical: 2 Hrs/week	

Objectives	:	1. To test/demonstrate the basic concepts, principles and theories of the strength of materials in laboratory
List of Practical (All practical to be conducted)	:	1) Tension Test on Ductile Material Like Mild Steel or TOR Steel 2) Flexural Test on Timber Beam 3) Single shear Test on Metals 4) Double shear Test on Metals 5) Izod Impact Test on Metals 6) Charpy Impact Test on Metals 7) Torsion Test on Mild Steel 8) Rockwell Hardness Test on Metals 9) Brinell Hardness Test on Metals 10) Assignment on shear force diagram and bending moment diagram of beam.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED222	Credits: 0-1-0
Course: Laboratory of Fluid Mechanics and Hydraulics Machines	Term Work: 0 Marks
Teaching Scheme: Practical: 2 Hrs/week	Practical: 25 Marks

Objectives	:	1.To understand various concepts, theorems in fluid mechanics by performing following experiments. 2.To introduce the concepts of the working and design aspects of hydraulic machines like turbines and pumps and their applications
List of Practical (Not Less than 10)	:	1. Study of pressure measuring devices. 2. Determination of Kinematic Viscosity using Redwood Viscometer. 3. Determination of metacentric height. 4. Verification of Bernoulli's equation. 5. Determination of coefficient of discharge of Venturi meter or Orifice meter 6. Determination of coefficient of friction in pipe. 7. Determination of minor losses and Major losses 8. Trial on Pelton Turbine 9. Trial on Francis Turbine 10. Trial on Kaplan Turbine 11. Trial on Centrifugal Pump 12. Trial on Gear Pump 13. Industrial Visit to Hydraulic Power Station

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	

Course Code: MED223	Credits: 0-1-0
Course: Laboratory of Metrology & Quality Control	Term Work: 0 Marks
Teaching Scheme:	Practical: 25 Marks
Practical: 2 Hrs/week	

Objectives	:	1) Selection of tool and techniques for determining geometry and dimensions. 2) Design and calibration of measuring tools and equipment's. 3) Application of Quality Control Techniques. 4) Application of Quality Management Concept.
List of Practical	:	1. Determination of linear and angular dimensions of given composite part using precision/non precision measuring instruments. 2. Error determination with linear / angular measuring instruments. 3. Verification of dimensions & geometry of given components using Mechanical & Pneumatic comparator. 4. Identification of surfaces using optical flat/interferometers and measure surface roughness using surface roughness tester. 5. Determination of geometry & dimensions of given composite object using profile projector. 6. Measurement of various angles of single point cutting tool using tool maker's microscope. 7. Measurement of thread parameters using floating carriage diameter measuring machine. 8. Measurement of spur gear parameters using Gear Tooth Vernier, Span, Gear Rolling Tester. 9. Determination of given geometry using coordinate measuring machine (CMM) 10. Determination of process capability from given components and plot variable control chart / attribute chart.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad **(Faculty of Science & Technology)** **Syllabus of S. Y. B. Tech. (Mechanical Engineering)**		
Course Code: MED224 Course: Laboratory of Engineering Thermodynamics Teaching Scheme: Practical: 2 Hrs/week		Credits: 0-1-0 Term Work: 25 Marks Practical: 0 Marks
Objectives	:	1. To understand various concepts thermodynamics
List of Practical (Any 10)	:	1. To study Joules Experiment 2. To study measurement of dryness fraction by Separating and Throttling calorimeter 3. To study formation of steam 4. To study Non-contact type thermometer 5. Case Study on Availability of Energy 6. Assignment on Unit I 7. Assignment on Unit II 8. Assignment on Unit III 9. Assignment on Unit IV 10. Assignment on Unit V 11. Assignment on Unit VI

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED225	Credits: 0-1-0
Course: Laboratory of Development of Skills-III	Term Work: 0 Marks
Teaching Scheme:	Practical: 25 Marks
Practical: 2 Hrs/week	

Prerequisite	:	1.Basic understanding of Engineering concepts and practices
Objectives		1. To understand the importance of leadership, personality and entrepreneurship 2. To understand the importance of Report writing and Project management
List of Practical (Any 10 practical to be conducted based on the given content)	:	**1. Entrepreneurship:** Definition, need, Requirements, contribution towards society and profession, resource creation, Successful examples of renowned entrepreneurs **2. Leadership:** concept, definition, transparency, learning from failure, trust, confidence, humility, creativity, example of leadership skills 3. **Personality Development:** Positive Attitude, Will Power, Patience, Creativity. Emotional quotient, IQ, Group Discussion, handling failure, confidence. 4. **Report writing:** Introduction, Importance of report writing, contents, title page, table of content, Executive summary, Introduction, Discussion, Conclusion, Recommendations, References, Appendices 5. **Research paper writing:** Introduction, Importance of report writing, contents, Title/ cover page, Abstract, Introduction and problem statement, Literature Review, Methodology, Main body of the paper/ Argument, Limitation of the study, Conclusion, Appendices, bibliography. 6. **Engineering Project Management:** Introduction, concept, Importance, Scope statement, Critical Success Factors, Deliverables, work Breakdown structure, Schedule, Budget , Quality, Human resource plan.

	Sr. No.	Title	Author	Publication	Edition
References	1.	The art of project management	Scott Berkun	O'Rellay Media Inc	2005
	2.	Handbook of Effective Technical Communications	Taylor G. Hicks, Carl M., Valerie Sr.	Tata McGraw Hill Publications	1988
	3.	Technical Writing Process	Saron J. Gerson	Prentice Hall Publication	1996

	4.	Thesis and Assignment	Anderson, Dastan, Poole	Wiley Eastern Limited	4th

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED226	Credits: 0-1-0
Course: Laboratory of Workshop Practices II	Term Work: 25 Marks
Teaching Scheme:	Practical: 0 Marks
Practical: 2 Hrs/week	

Prerequisite	:	1. Ability to understand and visualize a component from its drawing. 2. Knowledge of basic manufacturing process like woodworking, Foundry, Welding and Plumbing.		
Objectives		1. To make the students aware and understand the basic manufacturing operations in Engineering fields. 2. To develop work culture and ability to work in a team and as an individual to acquire the skills.		
List of Practical	:	**Section**	**Contents**	**Duration**
		Plumbing	Study of plumbing tools and their uses, standards accessories used in plumbing, List of various operations and tools. Workshop diary – Sketch of job Practical: one job of thread cutting on G.I. Pipe	**20 Hrs**
		Pattern Making	Study of pattern making tools and their uses. standards accessories used in pattern making . List of various operations and tools. Workshop diary – Sketch of job Practical: one job of pattern making.	
		Foundry	Study of sand molding, Types of sands and molding equipment's. List of various operations and tools. Workshop diary – Sketch of job Practical: One job of molding (Single or multi - piece pattern)	

	Welding	Study of arc welding machines, MIG welding machine, TIG welding machine and welding equipment's. List of various operations and tools used. Workshop diary – Sketch of job. Practical: One job of welding individually or in group of students of any useful item of daily use using various welding operations.
Term Work		Term work will consist of submitting a workshop diary and minimum one job of all the above four manufacturing processes with neatly written records of the study and diagrams. A workshop diary should be maintained by students to record the progress of the jobs done.

	Sr. No.	Title	Author	Publication	Edition
References	1	A Course in Workshop Technology Vol. I & II	B.S. Raghuwanshi	Dhanpath Rai & Company Pvt. Ltd.	2017
	2	Workshop Manual	P. Kannaiah and K.L. Narayana	Scitech publications Pvt.Ltd.	3rd
	3	Mechanical Workshop Practice	K.C. John	PHI 2010	2nd
	4	Engineering Practices Lab Manual	T. Jeyapoovan and S. Gowri	Vikas publication	5th
	5	Workshop practice Lab Manual			2020

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
	(Faculty of Science & Technology)
	Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED252	Credits: 3-0-0
Course: Machine Drawing	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1.Knowledge of orthographic projection, Projection of Solids and drafting skills of Engineering drawing.
Objectives	1. The subject intends to make the students understand various curves used in machine components and their development. 2. Interpret the industrial drawings and understand various conventions of machine components. 3. Visualize and construct the assembly of given set of individual components.
Unit-I	**Development of Surfaces** Draw the development of surfaces for sections of Prisms, Cylinders, Pyramids and Cones. **(8 Hrs)**
Unit-II	**Interpenetration of solids** Draw the curves of interpenetration of the surfaces of the solids such as Cylinder, Prism, Pyramid, Cone and Sphere. **(8 Hrs)**
Unit-III	**Auxiliary views** Study of auxiliary planes, projection of objects on auxiliary planes, completing the regular views with the help of given auxiliary views. **(8 Hrs)**
Unit-IV	**Engineering curves** Draw the various curves like ellipse, Parabola, Hyperbola, Involute, Cycloid, Epicycloid, Hypocycloid and Helix. **(4 Hrs)**
Unit-V	**Conventional representations:** Representation of elements of machine drawing: Engineering Materials, Surface

	finishes, tolerances, Different types of Screw threads.
	Component Drawings: Bolts and Nuts, Locking devices, Keys and Cotter joints, welded joints, Knuckle Joint, Riveted joints, Shaft Couplings, Bearings and Pipe joints. **(10 Hrs)**
Unit-VI	**Preparing assembly from given component details:** Constructing the Assembly drawing of Foot Step Bearing, Steam Stop Valve, Screw Jack, Safety Valve, Cross Head, Piston and Connecting Rod, Lathe Tail Stock, Drill jig etc. from the given component details. **(10 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	Machine Drawing	N. D. Bhatt	Charotar Publishing House Pvt. Ltd.	50th
	2.	Machine Drawing	Dr. R.K. Dhawan	S. Chand and company Pvt. Ltd.	15th
	3.	Engineering Drawing	N. D. Bhatt	Charotar Publishing House Pvt. Ltd.	53rd
	4.	A Textbook of Machine Drawing	P.S. Gill	S.K. Kataria & Sons	2013
	5.	Machine Drawing	N. Sidheswar, P. Kannaiah and V.V.S. Sastry	McGraw Hill Education	2017

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED253	Credits: 3-0-0
Course: Manufacturing Processes	Mid Semester Examination-I: 15 Marks
Teaching Scheme**:**	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs

Prerequisite	1. Ability to understand and visualize a component from its drawing. 2. Knowledge of basic manufacturing process like Turning, Drilling, Milling, Grinding, Shaping etc.
Objectives	1. To understand the classification, advantages, disadvantages and applications of various manufacturing processes 2. To understand the working principle of different conventional and unconventional manufacturing processes 3. To understand construction, working and specifications of machinery/ machine tools required for manufacturing 4. To understand the process variables affecting the product quality in manufacturing processes 5. To choose the appropriate manufacturing processes for producing a given component
Unit-I	**Introduction to overview of manufacturing** • Manufacturing definition, manufacturing industries and products, classification of manufacturing processes, classification of material removal processes **Metal casting processes** • Introduction and classification of metal casting processes • Heating and pouring: foundry practices-cupolas, direct fuel-fired furnaces, crucible furnaces, electric-arc furnaces, induction furnaces. • Solidification and cooling: solidification of metals, shrinkage, directional solidification. • Sand casting: patterns and cores, molds and mold making, casting operation

	- Expendable mould casting processes : shell molding, vacuum molding, investment casting, plaster-mold and ceramic-mold casting - Permanent mould casting processes : basic permanent-mold process, variations of permanent-mold casting, die casting, squeeze casting and semisolid metal casting, centrifugal Casting - Casting quality : casting defects, inspection methods (8 Hrs)
Unit-II	**Metal forming processes** - Introduction and classification of metal forming operations, material behaviour in metal forming, temperature in metal forming, strain rate sensitivity, friction and lubrication in metal forming - Rolling: flat rolling and its analysis, shape rolling, rolling mills - Forging : open-die forging, impression-die forging, flash less forging, forging hammers, presses, and dies - Extrusion : types of extrusion, extrusion dies and presses, extrusion processes, defects in extruded products - Wire and bar drawing : analysis of drawing, drawing practice, tube drawing (4 Hrs)
Unit-III	**Turning and related operations** - Operations related to turning - Cutting tools and cutting conditions in turning - The engine lathe, turret, capstan, semi/automatic lathe, CNC turning center - Boring operation and machines - Machining time calculations for turning operation **Drilling and related operations** - Operations related to drilling - Cutting conditions in drilling - Geometry of twist drill - Drill machines : types, construction and operations - Machining time calculations for drilling operation (6 Hrs)
Unit-IV	**Milling operations**

	• Operations related to milling
	• Cutting tools and cutting conditions in milling
	• Milling machines : types, construction and operations
	• Machining time calculations for milling operation
	Grinding and other abrasive processes
	• Grinding operations and grinding machines : surface grinding, cylindrical grinding, centre less grinding
	• Grinding wheel: abrasive material, grain size, bonding materials, wheel structure and wheel grade, grinding wheel specification
	(8 Hrs)
Unit-V	**Non-conventional machining processes**
	• Need, benefits, classification
	• Mechanism of metal removal, parameters, advantages disadvantages and applications of EDM, ECM, LBM, USM, AJM, WJM
	• MRR calculations for the listed processes
	(4 Hrs)
Unit-VI	**Metal joining processes**
	• Welding processes : classification welding processes, types of joints, types of welds, HAZ
	• Arc welding with consumable and non-consumable electrodes
	• Resistance welding processes and power source in resistance welding
	• Oxy-fuel gas welding, alternative gases for oxy-fuel welding
	• Solid state-welding processes
	• Brazing and soldering processes
	• Weld quality: welding defects, inspection and testing methods
	(6 Hrs)

References	Sr. No.	Title	Author	Publication	Edition
	1.	Fundamentals of Modern Manufacturing	Mikell P. Groover	John Wiley & Sons	4th Edition
	2.	DeGarmo's Materials and Processes in Manufacturing	J. T. Black, Ronald A. Kohser	John Wiley & Sons	11th Edition

3.	Production Technology	Jain R.K.	Khanna Publications	17th Edition
4.	Workshop Technology	B S Raghuwanshi	Dhanpat Rai and Sons	10th Edition
5.	Workshop Technology	Hajra Chaudhary	Dhanpat Rai and Sons	10th Edition
6.	Manufacturing Science	Amitabh Ghosh	East-West press	2nd Edition
7.	Processes and Materials of Manufacture	Roy A. Lind Berg	Prentice Hall Publications	4th Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED254	Credits: 3-0-0
Course: Applied Thermodynamics	Mid Semester Examination-I: 15 Marks
Teaching Scheme**:**	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs
Prerequisite	1.Knowledge of Fundamentals of Thermodynamics
Objectives	1. To understand working principle and performance of boiler, draught, steam nozzle and reciprocating air compressor. 2. To analyse heat balance of boiler, vapour power and air standard cycles. 3. To study and understand working of steam turbines.
Unit-I	Boiler performance, equivalent evaporation, boiler efficiency, economizer efficiency, boiler trial and heat balance sheet Boiler draught, necessity and classification, natural (chimney) draught, height of chimney, chimney efficiency, artificial draught, fan draught, steam jet draught, comparison between artificial and natural draught. (theoretical and numerical treatment) (6 Hrs)
Unit-II	Carnot cycle, Rankine cycle, comparison with Carnot cycle, modified Rankine cycle, reheat cycle, regenerative cycle, binary vapour cycle (theoretical and numerical treatment) (6 Hrs)
Unit-III	Types of steam nozzles, divergent nozzle, convergent-divergent nozzle, steam flow through a nozzle, velocity of nozzle, discharge through an isentropic nozzle, condition for maximum discharge, critical velocity, critical pressure ratio, flow through actual nozzle (theoretical and numerical treatment) Steam condenser, function of a condenser, elements of condensing plant, types of condensers, jet condenser, low level counter flow jet condenser, low- level parallel flow jet condenser, high-level jet condenser, ejector condenser, surface condenser, shell-and- tube type surface condenser, evaporative condenser, condense efficiency

		(theoretical treatment)		(6 Hrs)	

Unit-IV	Steam nozzle, Hero's turbine, impulse and reaction principle, flow through nozzles, simple impulse turbine, efficiency of impulse turbine blading, steam turbine staging, reaction turbine, efficiency of reaction turbine blading, comparison of impulse and reaction turbine, losses in steam turbine (theoretical treatment) (6 Hrs)
Unit-V	Introduction to internal combustion engine and related definitions, air standard analysis, Carnot cycle, Stirling cycle, Otto cycle, Diesel cycle, duel cycle, comparison of Otto and Diesel cycle, Lenoir cycle, Atkinson cycle (theoretical treatment) (6 Hrs)
Unit-VI	Use of compressed air, classification of compressor, reciprocating compressor terminology, construction, working of single-acting air compressor, mean effective pressure, power and mechanical efficiency, minimizing compression work, adiabatic efficiency, compressor efficiency, isothermal efficiency, methods for improving isothermal efficiency, clearance volume, volumetric efficiency (theoretical treatment) (6 Hrs)

	Sr. No.	Title	Author	Publication	Edition
References	1.	Basic & Applied Thermodynamics	P.K. Nag	Tata McGraw Hill Publications	7th
	2.	Fundamentals of Thermodynamics	Claus Borgnakke and Richard e. Sonntag	Claus Borgnakke and Richard e. Sonntag	7th
	3.	Fundamentals of Engineering Thermodynamics	Michael J. Moran Howard N. Shapiro	John Wiley and Sons Publication	5th
	4.	Thermodynamics: An engineering approach	Yunus A Cengel; Michael A Boles.	Tata McGraw Hill Publications	7th
	5.	Engineering Thermodynamics	D.S. Kumar	S.K. Kataria & Sons	2015

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED291	Credits: 3-0-0
Course: Professional Elective Course - I (Total Quality Management)	Mid Semester Examination-I: 15 Marks
	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
Tutorial: 0 Hrs/week	End Semester Examination (Duration): 3 Hrs

Prerequisite	1.Knowledge of concepts of engineering metrology and quality control
Objectives	1. To know the basic philosophies of TQM
	2. To illustrate the use of total quality control tools.
	3. To understand the concept of quality circle and kaizen.
	4. To understand techniques of JIT.
	5. Concept of re-engineering, BPR.
Unit-I	**Introduction to TQM**
	Customer Orientation Continuous Improvement Quality Productivity and Flexibility, Approaches and Philosophies of TQM, Quality Awards, Strategic Quality Management, TQM and Corporate Culture.
	(8 Hrs)
Unit-II	**Total Quality Control**
	Basic analytical tools-Check sheets, Histograms, Pareto Charts, Cause and Effect diagrams, Flow Charts, Scatter diagrams, Run Charts, Cost of Quality: Quality Cost Measurement, Reliability and Failure Analysis, Bathtub Curve
	(8 Hrs)
Unit-III	**Quality Circles**
	Introduction, Implementation, formation, Intangible Impact of Quality Circle, Inhibiting Factors, Kaizen: Introduction, The Japanese style of Management & Kaizen Implementation, Modeling Kaizen Process and Benefits.
	(8 Hrs)
Unit-IV	**Just In Time Manufacturing**
	Introduction, Approach to Quality, and Importance of KANBAN in JIT.

	Introduction to ISO 9000 and 14000 Series of Quality Standard, Certification Requirements, Evolving Standards. (8 Hrs)
Unit-V	**Business Process Re-Engineering** Re-Engineering definition Strategic value-added Process, re-engineering trends, incremental improvement program, Stages of re-engineering, preparation Identification vision technical and social design transformation, Differentiation of BPR. (8 Hrs)
Unit-VI	**TQM Principles** Leadership- Strategic Quality Planning, Employee Involvement, Motivation, Empowerment, Team and Teamwork, PDCA cycle, 5S, Supplier partnership, Supplier Selection, Supplier Rating. (8Hrs)

	Sr. No.	Title	Author	Publication	Edition
References	1.	Out of Crisis	W. Edward Deming	MIT Publishing	2000
	2.	What is Total Quality Control? The Japanese way	Ishikawa & Lu	Prentice Hall	1985
	3.	Total Quality Management	D.J. Tally	ASQC Quality Press	1991
	4.	Total Quality Control	A.V. Feigenbaum	McGraw Hill International Edition, USA	2004
	5.	Quality Control Handbook	J.M. Juran	McGraw Hill Book Company, USA	1999
	6.	Kaizen: The Key to Japan's Competitive Success	Masaaki Imai	McGraw Hill International Edition, USA	1986

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED292	Credits: 3-0-0
Course: Professional Elective Course - I	Mid Semester Examination-I: 15 Marks
(Advanced solid mechanics)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
Tutorial: 0 Hrs/week	End Semester Examination (Duration): 3 Hrs

Prerequisite	1.Basic concepts of strength of material
Objectives	1. To provide the basic concepts and principle of elasticity and its applications 2. To provide the knowledge and skills in the field mechanics of solids and its application to structural analysis, machine design and material processing.
Unit-I	**Introduction to Theory of Elasticity** Stress equation of equilibrium, Compatibility equations, Stress-Strain Relations, Solution of elasticity equations stress function approach, Principal stresses, stress invariants, three-dimensional Mohr's circle, octahedral stresses, hydrostatic and deviatoric stresses. (8 Hrs)
Unit-II	**Elastic Materials** Types of Materials, Elastic Materials: Introduction, Theory of elastic constants of Isotropic material, Orthotropic material, Transversely Isotropic material, Anisotropic material, Hyper elastic material. (8 Hrs)
Unit-III	**Bending of Beams** Bending of symmetrical and unsymmetrical straight beams, Shear stresses in beams shear center and shear flow, Elastic stability - Euler's buckling load, Eigen-value problem. (6 Hrs)
Unit-IV	**Energy Methods** Principle of superposition, Elastic strain energy and Complementary energy, Reciprocal relations, Principle of virtual work, Kirchhoff's theorem. (6 Hrs)

Unit-V	**Theories of Elastic Failure** Maximum Principal stress theory (Rankine), Maximum shear stress theory (Guest - Tresca), Maximum Principal strain (Saint - Venant) Theory, Total strain energy per unit volume (Haigh) Theory, Shear strain energy per unit volume Theory (Von – Mises & Hencky). (6 Hrs)	
Unit-VI	**Experimental Measurement of Stress** Photo elasticity: Stress optic law – effect of stressed model in plane and circular polariscopes, Isoclinic & Isochromatic, Fringe order determination Fringe multiplication techniques, Calibration photo elastic model materials. Introduction to Non-destructive Test techniques, Applications of Strain gauge and Strain rosettes. (6 Hrs)	

	Sr. No.	Title	Author	Publication	Edition
References	1.	Mechanics of Materials	Timoshenko, S.P., and Gere, J.M.,	CBS Publishers	2nd 2006
	2.	Advanced Mechanics of Solids	Srinath L. S.	Tata McGraw-Hill	3rd
	3.	Strength of Materials	R. K. Bansal	Laxmi Prakashan	4th
	4.	An Introduction to the Mechanics of Solids	Crandall, S.H., Dahl, N.C., and Lardner, T.J	Tata McGraw-Hill	3rd
	5.	Elements of Strength of Materials.	Timoshenko S.P.	D. Van Nostrand Company Inc	1962
	6.	Theory of Elasticity	S.P.Timoshenko J.N.Goodier	Tata McGraw-Hill	3rd
Website	1.	https://nptel.ac.in/courses/105/105/105105177/			

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED293	Credits: 3-0-0
Course: Professional Elective Course - I	Mid Semester Examination-I: 15 Marks
(Alternative Energy Sources)	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
Tutorial: 0 Hrs/week	End Semester Examination (Duration): 3 Hrs

Prerequisite	1.Knowledge of Sources of energy and types, forms of energy
Objectives	1. To expose the students on sources of energy crisis and the alternates available 2. To get exposure on solar radiation and various applications of solar energy. 3. To know about the various collectors used for storing solar energy. 4. To learn about the wind energy and biomass and its economic aspects. 5. To know about various miscellaneous energy and its potential.
Unit-I	**Introduction:** World production and reserves of commercial energy sources, Energy Scenario in India, Energy alternatives, Environmental aspects of energy, Forms of non-conventional energy sources **(6 Hrs)**
Unit-II	**Solar Energy Systems:** Solar radiation geometry, Estimation and measurement of solar energy. Thermal systems: Water heating, Drying, Cooking, solar distillation, Solar pumping, solar furnace. Photovoltaic systems: Characteristics of Photovoltaic cells, Solar cell arrays **(9 Hrs)**
Unit-III	**Biomass Energy Systems:** Biomass conversion technologies, Biochemical route, Biogas generation, Classification of biogas plants, Bio-gas from plant wastes, Problems related to biogas plants, Utilization of biogas. Thermal gasification of biomass, classification of biomass gasifier, Applications of the gasifier, Problems in the developments of Gasifiers, Biomass energy program in India **(9Hrs)**
Unit-IV	**Wind Energy Systems:** Basic principles of wind energy conversion, Wind data and energy estimation, Wind energy conversion systems, Horizontal axis wind machines, Vertical axis wind machines, Performance of wind machines,

	Applications: Pumping, Direct heating, electric power generation, Environmental aspects, Wind Energy Program in India. **(8 Hrs)**
Unit-V	**Geothermal Energy:** Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems. **Direct Energy Conversion:** Nuclear Fusion: Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic. Thermionic & thermoelectric generation, MHD generator. **(8 Hrs)**
Unit-VI	**Hydrogen Gas as Fuel**: Production methods, Properties, I.C. Engines applications, Utilization strategy, Performances. **Other Energy Sources:** OTEC–Principle of operation, Open & Closed OTEC cycles, Wave energy: Wave energy conversion machines and recent advances, Tidal Energy: Single basin and double basin tidal systems, Small-Mini-Micro hydro system: concepts, Types of turbines. **(8 Hrs)**

	Sr. No.	Title	Author	Publication	Edition
References	1.	Solar Energy-Principles of Thermal Collection & Storage	S. P. Sukhatme	Tata McGraw Hill	1996
	2.	Non-Conventional Energy Sources	G. D. Rai	Khanna Publisher	2005
	3.	Non-Conventional Energy Resources	B.H.Khan	Tata Mcgraw Hill	2008
	4.	Solar energy Thermal Processes	John A Duffie & William A Beckman	Wiley–Inter science publication	1974
	5.	Technology and Application of Biogas	Srivastava, Shukla and Ojha	Jain Brothers	1993
	6.	Renewable Energy Resources-Basic Principles and	G.N.Tiwari and M.K.Ghosal	Alpha Science International, Limited	2005

		Applications			
Additional Reference Books	1.	Engine for biogas	Klaus Von Mitzlaff	Friedr Vielveg & Sohn Braunschweig	1988
	2.	Wind Power Plants: Theory & Design	Desire Le Gouriers	Pergamon Press	1982
	3.	Solar Energy – Fundamentals and Applications	H P Garg & J Prakash	Tata McGraw Hill	2000

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED271 Course: Laboratory of Machine Drawing Teaching Scheme: Practical: 2 Hrs/week	Credits: 0-1-0 Term Work: 0 Marks Practical: 25 Marks

Prerequisite	:	1.Knowledge of orthographic projection, Projection of Solids and drafting skills of Engineering drawing.
Objectives		1. The subject intends to make the students understand various curves used in machine components and their development. 2. Interpret the industrial drawings and understand various conventions of machine components. 3. Visualize and construct the assembly of given set of individual components.
List of Practical	:	**Term work**: Term work shall consist of Drawing work as given below. 1. Using full size sheet (A-1) draw four problems of each on unit I,II and III 2. Using full size sheet (A-1) draw four problems on different types of curve for unit no. IV 3. Using full size sheet (A-1) draw conventions of various machine components for unit no. V OR Draw various machine components using any drafting software for unit no.5 4. Using full size sheet (A-1) draw Assembly drawing of at least one assembly given in unit no.VI OR Draw Assembly drawing of at least one assembly given in unit no.6 by using any drafting software.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED272	Credits: 0-1-0
Course: Laboratory of Manufacturing Processes	Term Work: 0 Marks
Teaching Scheme:	Practical: 25 Marks
Practical: 2 Hrs/week	

Prerequisite	:	1. Ability to understand and visualize a component from its drawing. 2. Knowledge of basic manufacturing process like Turning, Drilling, Milling, Grinding, Shaping etc.		
Objectives		1. To make the students aware and understand the basic manufacturing operations in Engineering fields. 2. To develop work culture and ability to work in a team and as an individual to acquire the skills		
List of Practical	:	**Section**	**Contents**	**Duration**
		Turning Shop	Study of Different operations to be carried on lathe machine using tail stock, taper turning methods (Calculations), internal and external threading, facing, finishing cuts. **Workshop diary** – Sketch of job, List of various operations and tools **Practical**: Preparing two jobs on lathe machine performing all above operations.	**20 Hours**
		Milling	Study of vertical and horizontal milling machines, milling cutters and different operations to be carried on milling machine. **Workshop diary** – Sketch of job, List of various operations and tools **Practical**: Preparing a job individually or in a group of students i.e. Gear blank by turning,	

		External milling of gear teeth involving calculations for indexing.	
	Drilling or Boring	Study of different types of drilling machines, Drill and single point boring tool, **Workshop diary** – Sketch of job, List of various operations and tools. **Practical**: Preparing a job individually or in a group of students based on drilling, boring internal splines cuts on slotting machine and surface grinding for surface finishing.	

Practical Examination		The Practical Examination will comprise of one Job. The job should involve all the operations studied during the semester. Duration will be six hours. The job will be assessed by two examiners, one will be the internal and other will be external examiner appointed by university.		

References	Sr. No.	Title	Author	Publication	Edition
	1	A Course in Workshop Technology Vol. I & II	B.S. Raghuwanshi	Dhanpath Rai & Company Pvt. Ltd.	2017
	2	Workshop Manual	P. Kannaiah & K.L. Narayana	Scitech publications Pvt.Ltd.	3rd
	3	Mechanical Workshop Practice	K.C. John	PHI 2010	2nd
	4	Engineering Practices Lab Manual	T. Jeyapoovan and S. Gowri	Vikas publication	5th
	5	Workshop practice Lab Manual			2020

The assessment of term work shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED273		Credits: 0-1-0
Course: Laboratory of Applied Thermodynamics		Term Work: 0 Marks
Teaching Scheme:		Practical: 25 Marks
Practical: 2 Hrs/week		
Objectives	:	1.To understand different concepts in applied thermodynamics through laboratory work
List of Practical (Any 10)	:	1. To Study Principle, Construction and Working of Bomb Calorimeter 2. To Study energy balance [Heat Utilization] using any Boiler Model 3. To Study Boiler Draught 4. To study Convergent-Divergent Nozzle 5. To Study Steam Condenser 6. To Study Steam Turbine 7. Performance of Energy assessment of lighting Systems. 8. To determine isothermal and volumetric efficiency of Air Compressor 9. Case Study on 'Waste Heat Recovery' 10. Visit to Thermal Power Station and Report related to it. 11. Assignment on Unit II and Unit V

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (Faculty of Science & Technology) Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code: MED274	Credits: 0-1-0
Course: Laboratory of Professional Elective Course-I (Total Quality Management)	Term Work: 25 Marks
Teaching Scheme: Practical: 2 Hrs/week	Practical: 0 Marks
Objectives :	1.To understand various concepts in quality management
List of Practical :	1. Assignment on unit no.1 2. Assignment on unit no.2 3. Assignment on unit no.3 4. Case study on implementation of TQM 5. Case study on implantation of Kaizen 6. Assignment on unit no.4 7. Assignment on unit no.5 8. Assignment on unit no.6 9. Case study on implantation of Kanban 10.Case study on implantation of 5S

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED275	Credits: 0-1-0
Course: Laboratory of Professional Elective Course-I (Advanced Solid Mechanics)	Term Work: 25 Marks
Teaching Scheme: Practical: 2 Hrs/week	Practical: 0 Marks

Objectives	:	1. To provide the basic concepts and principle of elasticity and its applications 2. To provide the knowledge and skills in the field mechanics of solids and its application to structural analysis, machine design and material processing.
List of Practical/ Assignments	:	**Simple Problem** 1. Force and stress analysis using four link elements in trusses. **Problems on Flexure** 2. Stress and deflection analysis in cantilever beam with point load. 3. Stress and deflection analysis in simply supported beam with UDL and UVL. 4. Solve stresses and deflections of beams under symmetrical and unsymmetrical loading. 5. Shear stresses in thin-walled open section: shear centre. 6. 3D stress analysis by using Mohr's circle. 7. Problems on elastic constants of Isotropic, Orthotropic, Anisotropic, Transversely isotropic material. **Solution of Plane stress and Plane strain problem using stress function approach.** 8. Stress analysis of a rectangular plate with circular hole. 9. Stress analysis of an axis-symmetric component like pressurized cylinder.

		Solution of Thermal stresses
		10. Thermal stress analysis within the rectangular bar fixed on both end.
		11. Thermal stress analysis within the rectangular plate.
		Case studies
		12. Stress Analysis of Crankshaft.
(Any 10 problem to be solved by using Analytical Method or by using Software)		

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED276	Credits: 0-1-0
Course: Laboratory of Professional Elective Course-I (Alternative Energy Sources)	Term Work: 25 Marks
Teaching Scheme: Practical: 2 Hrs/week	Practical: 0 Marks

Objectives	:	1. To study different renewable sources of energy through assignments, field visit and case studies

List of Practical	:	**Assignment: -**
		  1. Assignment on Unit I
		  2. Assignment on Unit II
		  3. Assignment on Unit III
		  4. Assignment on Unit IV
		  5. Assignment on Unit V
		  6. Assignment on Unit VI
		Report on Industrial Visit
		  7. Report on Industrial Visit to nearby Solar Power Plant /Installation
		  8. Report on Industrial Visit to nearby Wind Power Plant /Installation
		Case Study: - Any TWO of the following
		  9. Case Study on Biomass Gasifier
		 10. Case study on Hydrogen gas as fuel
		 11. Case study on Environmental Effects of Energy
		 12. Case study on Energy Scenario of India and world

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

(Faculty of Science & Technology)

Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code: MED278	Credits: 0-1-0
Course: Advanced Manufacturing Process Laboratory	Term Work: 25 Marks
Teaching Scheme:	Practical: 0 Marks
Practical: 2 Hrs/week	

Prerequisite	:	1. Ability to understand and visualize a component from its drawing. 2. Knowledge of basic manufacturing process like Turning, Drilling, Milling and Grinding.
Objectives		1. To make the students aware and understand the modern manufacturing operations in Engineering fields. 2. To develop work culture and ability to work as an individual and in a team to acquire the skills in various modern machining processes like CNC machining tools.
List of Practical	:	1. Study the constructional details of CNC lathe 2. Study the constructional details of CNC milling machine 3. Study the constructional details and working of Automatic tool changer and tool setter, Multiple pallet, Swarf removal, Safety devices 4. Develop a part program for following lathe operations and make the job on CNC lathe by Plain turning and facing operations, Taper turning operations, Thread cutting operations, Operation along contour using circular interpolation 5. Develop a part program for the following milling operations and make the job on CNC milling machine, Plain milling - Slot milling - Pocket milling 6. Explain different processes of Additive Manufacturing and make simple part of Additive Manufacturing viz., Bracket/ Lever, Clamp, Spur Gear, threaded components etc. by extrusion (FFF Technology) and photo-polymerization (SLA).

Term work		Term work will consist of submitting a file of details of all the above experiments with neatly written records of the study and diagrams. and minimum one job of all the above two manufacturing processes			
References	Sr. No.	Title	Author	Publication	Edition
	1	CNC Machines	M. Adithan and B.S. Pabla	New Age International Publishers	3rd (2018)
	2	Computer Aided Manufacturing	P.N. Rao, T.K. Kundra and N.K.Tewari	McGraw Hill Education	2017
	3	CNC Machines	Bharaj	Satya Publications, New Delhi	2017
	4	3- D Printing and additive manufacturing Technologies	Kumar, L.Jyotish	Springer	2019
	5	Workshop practice Lab Manual			2020

The assessment of term work shall be done on the basis of the following.

- Continuous assessment

- Performing the experiments in the laboratory

- Oral examination conducted on the syllabus and term work mentioned above.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering) Semester-IV	
Course Code: BSH805	Credits: 0-0-0
Course: Mandatory Noncredit Audit Course (Energy Audit)	Mid Semester Examination-I: Nil Marks
	Mid Semester Examination-II: Nil Marks
Teaching Scheme:	Teacher Assessment: Nil Marks
Theory: 02 Hrs/week	Term Work: Nil Marks
Practical: Nil Hr/week	End Semester Examination: Nil Marks
	End Semester Examination (Duration): Nil Hrs
Prerequisite	Should have knowledge of Basic concepts of physics and thermodynamics, Electrical appliances, various types of energy utilization.
Objectives	1. Identify the demand supply gap of energy in Indian scenario. 2. Carry out energy audit of an industry/Organization. 3. Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream.
Unit-I	**Elements of energy conservation:** General energy problem, Sector wise Energy consumption, demand supply gap, Scope for energy conservation and its benefits Energy conservation Principle – Maximum energy efficiency, Maximum cost effectiveness, Mandatory provisions of Energy Conservation act 2001, Features of Energy Conservation act-Standards and labelling, designated consumers, Energy Conservation Building Codes (ECBC). **(06Hrs)**
Unit-II	**Importance of Energy Management:** Energy management concept and objectives, Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting. Energy management programmes. **(06Hrs)**
Unit-III	**Energy Conservation approach in Industries:** Energy saving opportunities in electric motors, Benefits of Power factor improvement and its techniques-Shunt capacitor, Synchronous Condenser etc., Effects of harmonics on – Motors, and remedies leading to energy conservation., Energy conservation by VSD, Methods and techniques of energy conservation in ventilation and air conditioners, compressors pumps, fans and blowers, Area Sealing, Insulating the Heating / cooling fluid pipes , automatic door closing- Air curtain, Thermostat / Control, Energy conservation in electric furnaces, ovens and boilers. **(06Hrs)**
Unit-IV	**Energy Conservation in Power generation, Transmission and Distribution:** Performance improvement of existing power plant: co-generation, small hydro, DG Set, Demand side management, Load response programmes, Types of tariff and restructuring of electric tariff, Technical measures to optimize T and D losses.

					(06Hrs)
Unit-V	**Lighting and Lighting System:** Lightings Levels, Fixtures Lighting techniques – Natural, CFL, LED lighting sources and fittings, Day lighting, Timers, Energy Efficient Windows. **(06 Hrs)**				
Unit-VI	**Energy Audit:** Energy audit and its benefits, Energy flow diagram, Preliminary, Detailed energy audit., Methodology of preliminary energy audit and Detailed energy audit – Phase I, Pre audit, Phase II- Audit and Phase III- Post audit, Energy audit report., Electrical Measuring Instruments - Power Analyser, Combustion analyzer, fuel efficiency monitor, thermometer-contact, infrared, piton tube and manometer, water flow meter, leak detector, tachometer and lux meter, IE rules and regulations for energy audit, (Numerical). **(06Hrs)**				

	Sr. No.	**Title**	**Author**	**Publication**	**Edition**
References	1.	Electric Energy Generation, Utilization and Conservation	Sivaganaraju, S	Pearson Education	First edition (2011)
	2.	Principles of Power Systems	V. K. Mehta	S Chand & Co Ltd	2005
	3.	Energy Management Handbook	Wayne C. Turner	John Wiley & Sons Inc	1982
	4.	Energy management	Paul O Callaghan	Tata McGraw Hill	Third Edition, 2003.
	5.	Fundamentals of electrical system	Bureau of Energy Efficiency	Bureau of Energy Efficiency	

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Science & Technology)
Syllabus of S. Y. B. Tech. (Mechanical Engineering)

Course Code:	Credits: 3-0-0
Course: **Minor (Manufacturing Engineering)**	Mid Semester Examination-I: 15 Marks
	Mid Semester Examination-II: 15 Marks
Teaching Scheme:	Teacher Assessment: 10 Marks
Theory: 3 Hrs/week	End Semester Examination: 60 Marks
Tutorial: 0 Hrs/week	End Semester Examination (Duration): 3 Hrs

Prerequisite	1. Ability to understand and visualize a component from its drawing. 2. Knowledge of basic manufacturing process like Turning, Drilling, Milling, Grinding, Shaping etc.
Objectives	1. To understand the classification, advantages, disadvantages and applications of various manufacturing processes 2. To understand the working principle of different conventional and unconventional manufacturing processes 3. To understand construction, working and specifications of machinery/ machine tools required for manufacturing 4. To understand the process variables affecting the product quality in manufacturing processes 5. To choose the appropriate manufacturing processes for producing a given component
Unit-I	**Introduction to overview of manufacturing**: • Manufacturing definition, manufacturing industries and products, classification of manufacturing processes, classification of material removal processes **Metal casting processes:** • Introduction and classification of metal casting processes • Heating and pouring: foundry practices-cupolas, direct fuel-fired furnaces, crucible furnaces, electric-arc furnaces, induction furnaces. • Solidification and cooling: solidification of metals, shrinkage, directional solidification.

	• Sand casting: patterns and cores, molds and mold making, casting operation
	• Expendable mould casting processes : shell molding, vacuum molding, investment casting, plaster-mold and ceramic-mold casting
	• Permanent mould casting processes : basic permanent-mold process, variations of permanent-mold casting, die casting, squeeze casting and semisolid metal casting, centrifugal Casting
	• Casting quality : casting defects, inspection methods
	(8 Hrs)
Unit-II	**Metal forming processes** • Introduction and classification of metal forming operations, material behaviour in metal forming, temperature in metal forming, strain rate sensitivity, friction and lubrication in metal forming • Rolling: flat rolling and its analysis, shape rolling, rolling mills • Forging : open-die forging, impression-die forging, flash less forging, forging hammers, presses, and dies • Extrusion : types of extrusion, extrusion dies and presses, extrusion processes, defects in extruded products • Wire and bar drawing : analysis of drawing, drawing practice, tube drawing (4 Hrs)
Unit-III	**Turning and related operations** • Operations related to turning • Cutting tools and cutting conditions in turning • The engine lathe, turret, capstan, semi/automatic lathe, CNC turning center • Boring operation and machines • Machining time calculations for turning operation **Drilling and related operations** • Operations related to drilling • Cutting conditions in drilling • Geometry of twist drill • Drill machines : types, construction and operations • Machining time calculations for drilling operation (6 Hrs)

	Milling operations
Unit-IV	- Operations related to milling - Cutting tools and cutting conditions in milling - Milling machines : types, construction and operations - Machining time calculations for milling operation **Grinding and other abrasive processes** - Grinding operations and grinding machines : surface grinding, cylindrical grinding, centre less grinding - Grinding wheel: abrasive material, grain size, bonding materials, wheel structure and wheel grade, grinding wheel specification (8 Hrs)
Unit-V	**Non-conventional machining processes** - Need, benefits, classification - Mechanism of metal removal, parameters, advantages disadvantages and applications of EDM, ECM, LBM, USM, AJM, WJM - MRR calculations for the listed processes (4 Hrs)
Unit-VI	**Metal joining processes** - Welding processes : classification welding processes, types of joints, types of welds, HAZ - Arc welding with consumable and non-consumable electrodes - Resistance welding processes and power source in resistance welding - Oxy-fuel gas welding, alternative gases for oxy-fuel welding - Solid state-welding processes - Brazing and soldering processes - Weld quality: welding defects, inspection and testing methods (6 Hrs)

	Sr. No.	Title	Author	Publication	Edition
References	1.	Fundamentals of Modern Manufacturing	Mikell P. Groover	John Wiley & Sons	4th Edition
	2.	DeGarmo's	J. T. Black,	John Wiley &	11th

		Materials and Processes in Manufacturing	Ronald A. Kohser	Sons	Edition
	3.	Production Technology	Jain R.K.	Khanna Publications	17th Edition
	4.	Workshop Technology	B S Raghuwanshi	Dhanpat Rai and Sons	10th Edition
	5.	Workshop Technology	Hajra Chaudhary	Dhanpat Rai and Sons	10th Edition
	6.	Manufacturing Science	Amitabh Ghosh	East-West press	2nd Edition
	7.	Processes and Materials of Manufacture	Roy A. Lind Berg	Prentice Hall Publications	4th Edition

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	
(Faculty of Science & Technology)	
Syllabus of S. Y. B. Tech. (Mechanical Engineering)	
Course Code:	Credits: 3-0-0
Course: **Honor (Digital Manufacturing)**	Mid Semester Examination-I: 15 Marks
Teaching Scheme:	Mid Semester Examination-II: 15 Marks
Theory: 3 Hrs/week	Teacher Assessment: 10 Marks
Tutorial: 0 Hrs/week	End Semester Examination: 60 Marks
	End Semester Examination (Duration): 3 Hrs
Prerequisite	1.knowledge of basic concepts of manufacturing engineering and computer fundamental
Objectives	1. Understand the concept of digital manufacturing. 2. Identify various key factors comprising digital manufacturing. 3. Understand framework of digital manufacturing in current industries.
Unit-I	**Introduction** Concept of manufacturing process and product cycle, Introduction to digital manufacturing concept, Major components of digital manufacturing: CAD (Product design and simulation), CAM (computerized production and quality control), Marketing and market analysis, customer service, Benefits of digital manufacturing. (6 Hrs)
Unit-II	**Computer Aided Design** The design process and use of computers in it (CAD),**Design simulation technology**: 3D modelling, Finite element analysis, etc. **Manufacturing simulation technology**: Assembly line balancing simulation, etc. (6 Hrs)
Unit-III	**Computer Aided Manufacturing** Manufacturing process and use of computers in it (CAM), Computer numerical control machines (CNC), CAM technology, Production planning and inventory control, Computer aided quality control. (6Hrs)

Unit-IV	**Automation of machining processes** Introduction to industrial automation, Components of industrial automation: Sensors, Actuators, Programmable logic controllers (PLC), Industrial hydraulics and pneumatics**.** (6 Hrs)
Unit-V	**Recent technologies in digital manufacturing** Additive manufacturing, Rapid prototyping Processes, **RP types**: Selective laser sintering, Fused deposition modeling, Laser powder forming **Micro electro-mechanical systems (MEMS):** Introduction, Types of MEMS, Applications of MEMS – Accelerometers, Inkjet printers, Building management systems etc**.** (6 Hrs)
Unit-VI	**Industry 4.0 / IIoT** History of industrial revolutions, **Components of I4.0:** IoT, Smart sensors, Cyber physical systems, Cloud computing, Additive manufacturing, Big data analytics etc. (6 Hrs)

	Sr. No.	Title	Author	Publication	Edition
References	1.	CAD/CAM	M. P. Grower and E. W. Zimmer,	Prentice hall of India.	2008
	2.	CAD/CAM	Zeid Ibrahim, R. Sivasubramanian	Tata McGraw Hill	2nd 2009
	3.	The Internet of Things: Applications and Protocols	Oliver Hersent, David Boswarthick, Omar Elloumi,	Wiley publications	2012
	4.	Programmable Logic Controller	W. Bolton	Newnes	4th
	5.	Mechatronics	Robert H. Bishop	Tailor and Francis.	2005