

(Established under Gujarat Private Universities Act, 2009)

## Shroff S.R. Rotary Institute of Chemical Technology

Ref: UPL University /SRICT/BOS/ME/2021-22/01

Date: 12-03-2022

### Proposed Teaching Scheme for Second Year Diploma in Mechanical Engineering

#### Semester-III (Mechanical Engineering) Proposed Structure

Sl. No	Category	Code No.	Course Title	Hours per week			Total contact hrs/ week	Credits	E	M	I	V	Total
				L	T	P							
1	Program core course	ME1201	Fluid mechanics & hydraulic machinery	3	0	2	5	4	70	30	20	30	150
2	Program core course	ME1202	Material science & engineering	2	0	2	4	3	70	30	0	0	100
3	Program core course	ME1203	Thermal engineering -I	3	0	2	5	4	70	30	20	30	150
4	Program core course	ME1204	Engineering Mechanics	2	0	2	4	3	70	30	20	30	150
5	Program core course	ME1205	Manufacturing engineering	3	0	2	5	4	70	30	20	30	150
6	Humanities and Social Science course	MH1201	Communication Skills in English	3	0	2	5	4	70	30	20	30	150
7	Audited course -	MH1202	Essence of Indian Traditional Knowledge	2	0	0	2	0	0	0	20	30	50
8	Project/Seminar/Ind. Training/Mandatory Course	MH1203	In plant Training	0	0	0	0	1	0	0	50	0	50
<b>Total</b>				<b>18</b>	<b>0</b>	<b>12</b>	<b>30</b>	<b>23</b>	<b>420</b>	<b>180</b>	<b>170</b>	<b>180</b>	<b>950</b>

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**Semester-IV (Mechanical Engineering) Proposed Structure**

Sl. No	Category	Code No.	Course Title	Hours per week			Total contact hrs/ week	Credits	E	M	I	V	Total
				L	T	P							
1	Program core course	ME1206	Thermal engineering-II	3	0	2	5	4	70	30	20	30	150
2	Program core course	ME1207	Strength of materials	3	0	2	5	4	70	30	20	30	150
3	Program core course	ME1208	Measurements & Metrology	2	0	2	4	3	70	30	20	30	150
4	Program core course	ME1209	Heat Transfer	3	0	2	5	4	70	30	20	30	150
5	Programme Elective-I	ME1210 ME1211	*Any one programme elective-I	3	0	2	5	4	70	30	20	30	150
6	Open Elective	ME1212 ME1213	**Any one open elective-I	3	0	0	3	3	70	30	0	0	100
<b>Total</b>				<b>17</b>	<b>0</b>	<b>10</b>	<b>27</b>	<b>22</b>	<b>420</b>	<b>180</b>	<b>100</b>	<b>150</b>	<b>850</b>

5	*Programme Elective-I	ME1210	Tool Engineering	3	0	2	5	4	70	30	20	30	150
	*Programme Elective-I	ME1211	Material Handling Systems	3	0	2	5	4	70	30	20	30	150

6	**Open Elective-I	ME1212	Renewable Energy Technologies	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	70	30	0	0	100
	**Open Elective-I	ME1213	Energy Conservation & Audit	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	70	30	0	0	100

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**A. Course code and definition:**

<b>Course code</b>	<b>Definitions</b>
L	Lecture
T	Tutorial
P	Practical
E	Theory External Examination Marks
M	Theory Internal Examination Marks
I	Practical Internal Examination Marks
V	Practical External Examination Marks

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Diploma of Engineering

Subject Code: ME1201

Subject Name: Fluid Mechanics and Hydraulic Machinery

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - III

Type of course: Core subject

Prerequisite: Nil

**Rationale:** This course imparts fundamental knowledge regarding fluid, types, properties, basic governing equations in static and moving conditions and various fluid machines used in the practice.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Fluid statics:</b> Dimensions and units: physical properties of fluids- specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure, Atmospheric gauge and vacuum pressure – measurement of pressure, Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal’s law, hydrostatic law, Buoyancy and floatation: Meta center, stability of floating body, Submerged bodies, Stability analysis and applications.	6
2	<b>Fluid kinematics:</b> Introduction, flow types. Equation of continuity for one dimensional flow, Stream line, path line and streak lines and stream tube. Fluid dynamics: surface and body forces –Euler’s and Bernoulli’s equations for flow along a stream line, momentum equation and its applications, force on pipe bend. Closed conduit flow: Reynold’s experiment, Darcy Weisbach equation- Minor losses in pipes, pipes in series and pipes in parallel	6
3	<b>Dimensional Analysis and Similarities:</b> Dimension reasoning, dimensional homogeneity, dimensional analysis using Rayleigh’s method, Buckingham $\pi$ -theorem, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity,	6

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**Diploma of Engineering**

**Subject Code: ME1201**

**Subject Name: Fluid Mechanics and Hydraulic Machinery**

	kinematic similarity, model testing, model laws, undistorted and distorted models	
<b>SECTION-B</b>		
<b>4</b>	<b>Hydraulic Turbines:</b> Introduction, classification of hydraulic turbines, impulse and reaction turbines, construction, working and analysis of Pelton, Francis and Kaplan turbines, draft tube, governing of turbine	<b>8</b>
<b>5</b>	<b>Centrifugal Pumps:</b> Pump classification and selection criterion, velocity vector diagrams, pump losses and efficiencies, net positive suction head, pressure rise in impeller, characteristic curves, priming	<b>5</b>
<b>6</b>	<b>Hydraulic Machines:</b> Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings, fluid torque converter and air lift pump	<b>5</b>

**Text Books:**

1. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan
2. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.

**Reference Books:**

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons
2. Theory and Applications of Fluid Mechanics by K. Subramanya, McGraw Education
3. Fluid Mechanics by Frank .M. White, McGraw Hill Education
4. Mechanics of Fluids by Shames, McGraw Hill Education

**List of Experiments:**

1. To measure the velocity of flow using Orifice meter and Venturimeter.
2. To determine the coefficient of discharge through open channel flow over a notch.
3. To determine the different types of flow patterns by Reynolds' experiment.
4. To determine the friction factor for the different pipes.
5. To determine the loss coefficients for different pipe fittings.
6. Performance test on Pelton turbine.
7. Performance test on Kaplan turbine.
8. Performance test on Francis turbine.
9. Performance test on centrifugal pump.

**Course Outcomes:**

Sr. No.	CO statement
CO-1	Understand various fluid properties and behavior of fluid in static mode
CO-2	Explain behavior of fluid in dynamic mode

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**Diploma of Engineering**

**Subject Code: ME1201**

**Subject Name: Fluid Mechanics and Hydraulic Machinery**

CO-3	Make use of dimensional analysis and interpret types of fluid flow
CO-4	Analyze performance of hydraulic turbine
CO-5	Evaluate performance of centrifugal pumps
CO-6	Understand working of various hydraulic machines

**List of Open Source Software/learning website:**

- [nptel.ac.in](http://nptel.ac.in)

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Diploma Engineering

Subject Code: ME1202

Subject Name: Material Science & Engineering

## Shroff S.R. Rotary Institute of Chemical Technology

### Semester: III

**Type of course: Professional Core Course**

**Prerequisite:** Zeal to learn the subject

**Rationale:** Study of basic science related to the molecules, atoms, structures, properties of materials. Study of different types of ferrous and non-ferrous metals and alloys, in terms of their composition, structure, properties and applications; nondestructive testing are included in this course to understand the basic concept of selection and processing of metals and materials for their applications.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
2	0	2	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	Introduction to Material Science and Metallurgy: Basics of Engineering Materials, their Classifications and Application, Engineering requirements of materials, Properties of engineering materials, Criteria for selection of materials for engineering Applications.  Concept of Macroscopic & Microscopic examinations., Macro-etching,	2
2	Crystal Geometry and Crystal Imperfection: Concept of crystalline structure. Structure of metal-unit cell, BCC, FCC and HCP. Examples and properties of metallic structures.	3
3	Solidification of metals & alloys: Concept, grain, grain boundaries and dendritic solidification. Effect of cooling rate on material properties.	5

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**Diploma Engineering**

**Subject Code: ME1202**

**Subject Name: Material Science & Engineering**

	Phase and Phase equilibrium, Allotropy of Iron, Iron-Iron Carbide equilibrium system: Allotropy of iron; Iron-iron carbide equilibrium diagram, Phases present and their properties.	
<b>SECTION-B</b>		
<b>4</b>	TTT diagram, need & their applications. Study of heat treatment processes such as annealing, normalizing, spheroidizing, hardening, tempering, carburizing, nitriding, cyaniding, induction hardening, flame hardening and hardenability of steel. Types of quenching mediums, their properties and applications.	<b>6</b>
<b>5</b>	Metals and Its Alloys: Classification of metals, Ferrous metals: Classification, composition, properties, applications. (for Plain carbon steel, alloy steel including stainless steel and cast iron.), Non-ferrous metals: Classification, composition, properties and applications. (for Copper, copper alloys, Aluminum and Aluminum alloys.)	<b>6</b>
<b>6</b>	Powder metallurgy: Basic concept of powder metallurgy and its applications, merits and demerits. Non-Destructive Testing: Non Destructive testing of materials such as Radiography Testing, Dye Penetration Testing, Magnetic Particle Testing, Ultrasonic Testing. Eddy current testing with their principle of non-destructive testing, the test methods, relative merits, demerits and applications	<b>6</b>

**Text Books:**

1. O. P. Khanna, "A Textbook of Material Science and Metallurgy", Edition, 5, Dhanpat Rai, 1987.

**Reference Books:**

1. Donald R. Askeland and Pradeep P. Phule, "The Science and Engineering of Materials", Edition, 5, Cengage Learning, 2005.
2. William F. Smith, "Principles of Materials Science and Engineering", Edition, 4, McGraw Hill, 2020.
3. Lawrence H. Van Vlack, "Elements of Material Science and Engineering", Pearson Education.
4. Ed. George F. Vander Voort, "Metallography and Microstructure", ASM International 2004.
5. Baldev Raj, T. Jayakumar and M. Thavasimuthu, "Practical Non-Destructive Testing", Narosa Pub. House. ASM Handbook Vol.
6. K. I. Parashivamurthy, "Materials Science and Metallurgy", Pearson Education.

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**Diploma Engineering**

**Subject Code: ME1202**

**Subject Name: Material Science & Engineering**

**List of Practical/ tutorials:**

1. To get acquainted with the operation, construction, use and capabilities of a metallographic microscope.
2. To study procedure of specimen preparation for microscopic examination and to carry out a specimen preparation.
3. To understand what is micro examination, importance of micro examination and to study various ferrous, non-ferrous microstructures.
4. To understand the Iron-Iron Carbide Equilibrium Diagram.
5. Study of different heat treatment processes- annealing, normalizing, hardening and tempering, surface and casehardening to improve properties of steel during processes and applications.
6. To understand the concept of hardenability and its relevance to heat treatment procedure to be adopted in practice.
7. To understand the principle & working of the liquid penetrant test and the magnetic particle test.

**Course Outcomes:**

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Understand the basic concept of Material Science and engineering.
CO-2	Know about the ferrous and non-ferrous metals and alloys and their Applications.
CO-3	Describe various heat treatment processes for the different metals.
CO-4	Understand different non-destructive testing methods.
CO-5	Understand the processes of the powder metallurgy.
CO-6	Judge the Scope and limitations of different materials.

**List of Open Source Software/learning website:**

- [nptel.ac.in](http://nptel.ac.in)
- [www.learnerstv.com](http://www.learnerstv.com)
- [Cosmolearning.org](http://Cosmolearning.org)
- <https://www.vlab.co.in/>

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**Diploma Engineering**  
**Subject Code: ME1203**  
**Subject Name: Thermal Engineering-I**

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### Semester: - III

**Type of course:** Program Core Course

**Prerequisite:** Zeal to learn the subject

**Rationale:** In industry, the mechanical engineers are supposed to operate and maintain thermal equipment. This course will provide the basic knowledge of thermal engineering which will function as foundation in applications in major fields of mechanical engineering and technology notably in steam and nuclear power plants. This course would develop knowledge and skills related to compressors, steam turbines, condensers, cooling tower etc. This course is important for mechanical engineers. Apply basic concepts, laws and principles of thermal engineering to operate and maintain the I.C.engines.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

#### Content:

Sr .No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Two phase system:</b> Concept of two phase system, Formation of steam, its various phases, definition and representation of wet steam, dry steam, saturated steam and superheated steam on P-V, T-s and H-s diagram, Concept and determination of dryness fraction and degree of superheat, Concept and determination of latent heat, sensible heat, enthalpy, entropy and specific volume of steam, Use of Steam tables and Mollier chart.	04
2	<b>Steam Nozzle:</b> Flow through the nozzle at the exit of nozzle in terms of heat drop using analytical method and Mollier chart, Discharge of steam through nozzles, Critical pressure ratio, Methods of calculation of cross sectional areas at throat and exit for maximum discharge, Effect of friction in nozzles and Super saturated flow in nozzles, Working steam Jet Injector, Simple Numerical Problems.	06

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**Diploma Engineering**

**Subject Code: ME1203**

**Subject Name: Thermal Engineering-I**

<b>3</b>	<b>Steam Turbines:</b> Concept and classification of steam turbines with examples, Impulse and reaction turbines working and differences, Principle of De-Laval turbine with line diagrams, Velocity diagrams, Expression of work done, axial thrust, tangential thrust, blade and diagram efficiency, stage efficiency, Nozzle efficiency, methods of reducing rotor speed, Compounding of steam turbine, Need, Pressure compounding, Velocity compounding, Pressure velocity compounding, Working Principle of De-Laval turbine with line diagrams, Velocity diagrams, Simple problems on single stage impulse turbines (without blade friction) and reaction turbine including data on blade height, Bleeding, Governing of steam turbines, Throttle, By-pass and Nozzle control governing.	<b>08</b>
<b>SECTION-B</b>		
<b>4</b>	<b>Steam condensers:</b> Elements of a steam condensing plant, concept, function and classification of condensers, Jet condensers and surface condensers- constructional sketch, working and differences. Vacuum efficiency and condenser efficiency of condensers- simple numerical example.	<b>06</b>
<b>5</b>	<b>Cooling towers:</b> Mass of cooling water required, Edward air pump, Necessity of cooling ponds and cooling towers, Condenser water cooling systems, Types of cooling towers and cooling ponds, Classification, function and working of cooling towers.	<b>04</b>
<b>6</b>	<b>Air compressors:</b> Air compressor-concepts, functions, classification and applications, Working of reciprocating air compressor and rotary air compressors, Single stage air compressor and multistage air compressor, Working, .Inter-cooling & after cooling, Power required and efficiency of reciprocating air compressors-single and two stages, simple numerical examples, Concept of screw compressors for oil free air.	<b>08</b>

**Text book:**

1. Thermal Engineering – I by K.K. Patel, Atul Prakashan.

**Reference Books:**

1. Thermal Engineering by R K Rajput, Laxmi Publications.
2. A Text book of Thermal Engineering by R S Khurmi & J K Gupta, S. Chand & Co. New Delhi.
3. Power Plant Engineering by P.K. Nag, McGraw-Hill Education
4. Engineering Thermodynamics by P.K. Nag; Tata McGraw Hill, Delhi.
5. Steam Turbine Theory and Practice by William J. Kearton, CBS Publication.

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**Diploma Engineering**  
**Subject Code: ME1203**  
**Subject Name: Thermal Engineering-I**

**List of Practical:**

1. Study of different types of Steam Nozzle with working.
2. Understand construction and working of different Steam turbines.
3. Study different methods of Compounding for Steam turbine.
4. Study different methods for Governing of Steam turbine.
5. Study of different types of Steam condenser.
6. Study of different types of cooling tower.
7. Demonstrate the working of Reciprocating air compressor.
8. Study performance of Centrifugal air compressor.

**Course Outcomes:**

Sr. No.	CO statement
CO-1	<b>Determine</b> and <b>indicate</b> steam properties and dryness fractions.
CO-2	<b>Identify</b> and <b>compare</b> different types of steam nozzle.
CO-3	<b>Identify</b> the elements and different processes of steam turbine.
CO-4	<b>Understand</b> the working of Steam condensers.
CO-5	<b>Identify</b> the elements and processes of cooling towers.
CO-6	<b>Illustrate</b> the operation of air compressors and observe the parameters affecting the performance.

**List of Open Source Software/learning website:**

- <https://nptel.ac.in>

**Prepared By:**  
**Mr. Chetan R. Patel**

**HOD:-**  
**Dr. Hemant Gupta**

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**Diploma of Engineering**  
**Subject Code: ME1204**  
**Subject Name: Engineering Mechanics**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: 3<sup>rd</sup>**

**Type of course:** Engineering Science Course

**Prerequisite:** Zeal to learn the subject

**Rationale:** Engineering Mechanics is a branch of Applied Science where laws of physics are applied to solve engineering problems. Broadly speaking Engineering Mechanics can be classified in two categories-Static and Dynamics

### Teaching and Examination Scheme:

Teaching Scheme			C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)		
2	0	2	3	70	30	30	20	150

### Content:

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Basics of mechanics:</b> Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units). Principle of transmissibility of force, Principle of Superposition. Force system and its classification.	<b>03</b>
2	<b>Coplanar Concurrent Forces:</b> Resolution,, Free body and Free body diagram, conditions of equilibrium, Resultant of forces using analytical and graphical methods for the forces acting at Law of Parallelogram, Law of triangle, Law of Polygon. Lami's Theorem – statement and explanation, Application for various engineering problems.	<b>04</b>
3	<b>Moment of Force and Parallel Forces:</b> Moment of a force, Varignon's Theorem, Couple, application, properties of couple, conditions of equilibrium. Resultant of force, System of forces. Types of beam, supports and loads acting on beam. Beam reaction for cantilever, simply supported beam with or without overhang	<b>05</b>
<b>SECTION-B</b>		
4	<b>Centroid &amp; Centre Of Gravity:</b> Concept of Centroid, Centre of Gravity. Centroid of One Dimensional geometrical figures using principle of moment. Centroid of Two Dimensional geometrical Plane figures (Square, Rectangle, Triangle, Circle, Semicircle, and Quarter-circle).	<b>04</b>

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**Diploma of Engineering**  
**Subject Code: ME1204**  
**Subject Name: Engineering Mechanics**

<b>5</b>	<b>Friction: Friction:</b> Law of friction, coefficient of friction, angle of friction, angle of repose, Types of friction, Application of Lami's theorem and theory of resolution of forces, Problems on Friction for a block resting on horizontal plane & inclined plane.	<b>04</b>
<b>6</b>	<b>Simple Lifting Machine:</b> Mechanical Advantage, V.R., Efficiency, line sketch of different systems of pulley blocks, simple and compound levers, simple machines, problems. Laws of Machines, Reversible, Non-reversible machines.	<b>04</b>

**Text Books:**

1. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
2. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.

**Reference Books:**

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
2. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
3. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune Vidhyarthi Gruh.
4. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
5. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

**List of Practical:**

1. Law of parallelogram of forces.
2. Law of Triangle of forces.
3. Law of polygon of forces.
4. Law of parallel Forces. (Reactions of Beam-couple)
5. Verify Lami's theorem.
6. Centroid of given lamina.
7. Determine support reactions for simply supported beam.
8. Determine M.A. and efficiency for double purchase crab.
9. Efficiency of Machine & Law of Machine.
10. Determine coefficient of friction for motion on horizontal and inclined plane.

**Course Outcomes:**

Sr. No.	CO statement
CO-1	Calculation of the force systems for given conditions by applying the basics of mechanics.
CO-2	Find the unknown forces of different engineering systems.
CO-3	Define concept of moment of force and beam reaction.
CO-4	Find the centroid and Centre of gravity of various components in engineering systems.
CO-5	Apply the principles of friction in various conditions for useful purposes.
CO-6	Select the relevant simple lifting machines for given purposes.

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**Diploma of Engineering**  
**Subject Code: ME1204**  
**Subject Name: Engineering Mechanics**

**List of Open Source Software/learning website:**

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**Diploma of Engineering**

**Subject Code: ME1205**

**Subject Name: Manufacturing Engineering**

**Shroff S.R. Rotary Institute of Chemical Technology**

**Semester: - III**

**Type of course:** Programme Core course

**Prerequisite:** Knowledge of Basic mechanical workshop and various tools associated with manufacturing and fabrication work.

**Rationale:** Manufacturing, the major and the most important aspect in industries needs utmost care and attention. Knowledge about various processes and allied areas will be of great use to the personnel involved in production. This will provide the students an opportunity to skill themselves for the industrial scenario. This subject of Manufacturing Engineering provides knowledge regarding different types of manufacturing processes used to produce variety of metal products used in automobile and other machines and equipment. It also develops understanding that can be used to suggest and manipulate vital process parameters related to different manufacturing processes so that the high quality component may be produced at low cost and in minimum time.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	5	70	30	20	30	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction to manufacturing processes :</b> Nature, role and scope of manufacturing processes. Role of various fabrication processes like machining, forming, casting and joining processes in manufacturing of industrial components. Mechanics of cutting action, orthogonal and oblique cutting. Importance of mechanical properties of material.	<b>04</b>

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**Diploma of Engineering**

**Subject Code: ME1205**

**Subject Name: Manufacturing Engineering**

<b>2</b>	<p><b>Cutting Fluids &amp; Lubricants:</b> Introduction; Types of cutting fluids, Fluids and coolants required in turning, drilling, shaping, sawing &amp; broaching; Selection of cutting fluids, methods of application of cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applications of lubricants.</p> <p><b>Lathe Operations:</b> Types of lathes – light duty, Medium duty and heavy duty geared lathe, CNC lathe; Specifications; Basic parts and their functions; Operations and tools – Turning, parting off, Knurling, facing, Boring, drilling, threading, step turning, taper turning.</p>	<b>08</b>
<b>3</b>	<p><b>Broaching Machines:</b> Introduction to broaching; Types of broaching machines – Horizontal type (Single ram &amp; duplex ram), Vertical type, Pull up, pull down, and push down; Elements of broach tool; broach teeth details; Nomenclature; Tool materials.</p> <p><b>Drilling:</b> Classification; Basic parts and their functions; Radial drilling machine; Types of operations; Specifications of drilling machine; Types of drills and reamers.</p>	<b>08</b>
<b>SECTION-B</b>		
<b>4</b>	<p><b>Welding:</b> Classification; Gas welding techniques; Types of welding flames; Arc Welding –Principle, Equipment, Applications; Shielded metal arc welding; Submerged arc welding; TIG / MIG welding; Resistance welding - Spot welding, Seam welding, Projection welding; Welding defects; Brazing and soldering: Types, Principles, Applications</p> <p><b>Milling:</b> Introduction; Types of milling machines: plain, Universal, vertical; constructional details – specifications; Milling operations: simple, compound and differential indexing; Milling cutters–types; Nomenclature of teeth; Teeth materials; Tool signature of milling cutter; Tool &amp; work holding devices.</p>	<b>08</b>
<b>5</b>	<p><b>Gear Making:</b> Manufacture of gears – by Casting, Moulding, Stamping, Coining Extruding, Rolling, Machining; Gear generating methods: Gear Shaping with pinion cutter &amp; rack cutter; Gear hobbing; Description of gear hob; Operation of gear hobbing machine; Gear finishing processes; Gear materials and specification; Heat treatment processes applied to gears.</p>	<b>08</b>

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**Diploma of Engineering**

**Subject Code: ME1205**

**Subject Name: Manufacturing Engineering**

	<p><b>Press working:</b> Types of presses and Specifications, Press working operations - Cutting, ending, drawing, punching, blanking, notching, lancing; Die set components- punch and die shoe, guide pin, bolster plate, stripper, stock guide, feed stock, pilot; Punch and die clearances for blanking and piercing, effect of clearance.</p>	
<p align="center"><b>6</b></p>	<p><b>Grinding and finishing processes:</b> Principles of metal removal by Grinding; Abrasives –Natural &amp; Artificial; Bonds and binding processes: Vitrified, silicate, shellac, rubber, bakelite; Factors affecting the selection of grind wheels: size and shape of wheel, kind of abrasive, grain size, grade and strength of bond, structure of grain, spacing, kinds of bind material; Standard marking systems: Meaning of letters &amp; numbers sequence of marking, Grades of letters; Grinding machines classification: Cylindrical, Surface, Tool &amp; Cutter grinding machines; Construction details; Principle of centerless grinding; Advantages &amp; limitations of centre less grinding; Finishing by grinding: Honing, Lapping, Super finishing; Electroplating: Basic principles, Plating metals, applications; Hot dipping: Galvanizing, Tin coating, Parkerising, Anodizing; Metal spraying: wire process, powder process and applications;</p>	<p align="center"><b>06</b></p>

**Text Books:**

1. Elements of workshop Technology (Volume I & II) – S. K. Hajra Chaudary, Bose & Roy, Media Promoters and Publishers Limited.
2. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.

**Reference Books:**

3. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications.
4. Workshop Technology \_ B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
5. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications.
6. Workshop Technology I & II - J. A. Schey, Tata McGraw-Hill Publications.

**List of Practical/ tutorials:**

1. Study of various Machine Tools (Lathe, Shaper, Slotter, Planner).
2. Study of various cutting angles on Single point cutting tool.

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**Diploma of Engineering**

**Subject Code: ME1205**

**Subject Name: Manufacturing Engineering**

3. Study of various turning operations like plain turning, facing, taper turning, knurling, threading, grooving, etc. performed on lathe machine
4. Turning Job: Prepare a job on centre lathe as per the given drawing.
5. Milling Job: Prepare a job on milling machine as per the given drawing using various milling operations.
6. Shaping and Drilling Job: Prepare a job having plain and inclined surfaces on shaping machine with minimum two holes as per given drawing.
7. Prepare a job using arc welding. This includes cutting of raw material and preparation of pre-weld parts and continuous welding in job.(Any of Lap joint, Lap Tee joint, Edge joint, Butt joint)
8. Study of various sheet metal operations which can be performed on Press
9. Demonstration of Gear making process using Indexing mechanism on milling machine.
10. Study of various surface finishing processes like grinding, honing, lapping, super finishing

**Course Outcomes:**

At the end of the course, the student will be able to:

Sr. No.	CO statement
CO-1	<b>Know and identify</b> basic manufacturing processes for manufacturing different components.
CO-2	<b>Operate and control</b> different machines and equipments.
CO-3	<b>Observe and conclude</b> the effect of varying tool materials, cutting parameters and work piece materials.
CO-4	<b>Produce</b> jobs as per specified dimensions and <b>inspect</b> the job for specified dimensions.
CO-5	<b>Select</b> the specific manufacturing process for getting the desired type of output.
CO-6	<b>Adopt</b> safety practices while working on various machines.

**List of Open Source Software/learning website:**

- <http://nptel.iitm.ac.in/video.php?subjectId=112105126>
- <http://nptel.iitm.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Manuf%20Proc%20II/pdf/LM-01.pdf>

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**Diploma of Engineering**

**Subject Code: MH1201**

**Subject Name: Communication Skills in English**

**Shroff S.R. Rotary Institute of Chemical Technology**

**Semester: III**

**Type of course:** Language and Communication

**Prerequisite:** Zeal to learn the Language

**Rationale:** The rationale of the curriculum is to help students to express their original ideas in English and also develop interest in language and literature with a focus on comprehension, and reading, speaking and writing skills.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Prose:</b> 1) An Astrologer's Day by R. K. Narayan 2) The Portrait of a Lady by Khushwant Singh, 3) Sparrows by K.A. Abbas 4) The Night Train at Deoli by Ruskin Bond	6
2	<b>Poetry:</b> 1) My Grandmother by Elizabeth Jennings, 2) My Papa's Waltz by Theodore Roethke, 3) The Road Not Taken by Robert Frost 4) The Tyger by William Blake.	7
3	<b>Fiction:</b> Robinson Crusoe by Daniel Defoe	7
<b>SECTION-B</b>		
4	Listening Ability: Hearing & Listening, Types of Listening, Traits of an Effective Listener	6

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**Diploma of Engineering**

**Subject Code: MH1201**

**Subject Name: Communication Skills in English**

<b>5</b>	Speaking Skills: Group Discussion, Interview, Presentation Strategies , Public Speaking	<b>6</b>
<b>6</b>	Writing :Mastering the final Skill: Paragraph Writing, Comprehension Passage Business Letters-(Complaint, Enquiry, Sales, Order, Apology) Email Etiquettes	<b>7</b>

**Text books:**

1. Prism: Spoken and Written Communication, Prose & Poetry' published by Orient Longman
2. Communication Skills by Sanjay Kumar& Pushp Lata, OUP.

**Reference Books:**

1. Robinson Crusoe, Daniel Defoe, Harper Collins, UK
2. The Most Anthologized Poems of the Last 25 Years - Literary .

**List of Practicals /Tutorials:**

**Language Laboratory Activities:**

1. Conversation at a Clinic
2. Seeking Information about various Engineering Programs at an Institute
3. At the cinema Hall
4. Letter Writing
5. Conversing with your colleagues/Co-workers
6. Comprehension Passage
7. Picture Description & Completion of a Story
8. Presentation.
9. Group Discussion
10. Interview

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**Diploma of Engineering**  
**Subject Code: MH1201**  
**Subject Name: Communication Skills in English**

**Course Outcomes:**

After Learning this course, students will be able to:

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Use English in day-to-day communication
CO-2	Use various forms of vocabulary in varied situations in oral and written communication.
CO-3	Comprehend the dynamics of various rules of grammar and check its validation while they speak and write language correctly
CO-4	Use grammar effectively to make themselves competent Listener, Speaker, Reader and Writer by exposing to various set of situations
CO-5	Write various formal and informal documents of day to day life
CO-6	Prepare for lifelong learning and enjoyment of English Language and literature.

**List of Open Source Software/learning website:**

- <http://www.free-english-study.com/>
- <http://www.english-online.org.uk/course.htm>

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## Shroff S.R. Rotary Institute of Chemical Technology

**Diploma Engineering**

**Subject Code: MH1202**

**Subject Name: Essence of Indian Know Tradition**

**Semester: 3**

**Type of course:** Audit Course

**Prerequisite:** Zeal to learn the subject.

**Rationale:** At the end of the course, students will become aware of certain knowledge traditions and practices of India that are being followed in their families and society around them.

**Teaching and Examination Scheme:**

Teaching Scheme			C	Examination Marks				Total Marks
L	T	P		Theory Marks				
				ESE (E)	PA (M)	ESE (V)	PA (I)	
1	-	-	1	-	-	30	20	50

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Introduction to Traditional Knowledge:</b> Definition of traditional knowledge, scope and importance, kinds of traditional knowledge, traditional knowledge Vs western knowledge.	<b>03</b>
2	<b>Protection of Traditional Knowledge:</b> Significance of protection of traditional knowledge, Role of Government to harness traditional knowledge.	<b>02</b>
<b>SECTION-B</b>		
3	<b>Education System in India:</b> Education in ancient, medieval and modern India, Aims of education, Different subjects of traditional education in India.	<b>03</b>

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<b>4</b>	<b>Civilization and Culture:</b> Culture and Civilization, Cultural Heritage, Essence of Indian Culture.	<b>02</b>
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**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>10</b>	<b>10</b>

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

**Reference Books:**

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino.

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

Sr. No.	CO statement	rks % weight
CO-1	Understanding the concept of traditional knowledge and its importance	15%
CO-2	Analyzing the need and importance of protecting traditional knowledge	10%
CO-3	Understanding the traditional educational system in India	15%
CO-4	Analyzing the Indian civilization and culture	10%

**List of Open Source Software/learning website:**

- [https://en.wikipedia.org/wiki/Traditional\\_knowledge](https://en.wikipedia.org/wiki/Traditional_knowledge)
- <https://oufastupdates.com/essence-of-indian-traditional-knowledgeit/>

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**Diploma Engineering**

**Subject Code: ME1206**

**Subject Name: Thermal Engineering-II**

## Shroff S.R. Rotary Institute of Chemical Technology

### Semester: - IV

**Type of course:** Program Core Course

**Prerequisite:** Thermal Engineering-I

**Rationale:** In industry, the mechanical engineers are supposed to operate and maintain thermal equipment. This course would develop knowledge and skills related to heat exchangers, gas turbines etc. This course is very important for mechanical engineers to operate and maintain equipment, devices and machines working in Refrigeration and Air conditioning systems.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

#### Content:

Sr .No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Internal Combustion (I. C.) Engines:</b> Concepts and classification, I.C. engines parts and their functions, Working of two stroke and four stroke cycle Spark Ignition (SI) and Compression Ignition (CI) engines, Valve timing of I.C. engine and its explanation on PV diagram, Various systems of I.C. engines, Carburetion, fuel pump and fuel injectors including Multi Point Fuel Injectors(MPFI), Scavenging and Turbocharger, Performance testing on I.C. engine and its heat balance sheet. Familiarization with IS testing, Concept of Octane and Cetane numbers.	06
2	<b>Alternate fuels:</b> Types, properties, compositions, advantages, disadvantages and implementation issues- includes mainly Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LPG) and Biodiesel, Effect of these fuels from pollution point of view. Supply system requirement for CNG and LPG as alternate fuel in vehicle, Conversion devices/ kits for SI Engines- vaporizer/ PRV for fuel compatibility, piping and allied needs.	03
3	<b>Gas Turbines:</b> Introduction to Gas turbine as a prime mover, applications, classification, fuels for gas turbine, comparison of gas turbine with steam turbines and I.C. engines, concept of Brayton cycle, ideal and actual cycle,	09

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**Diploma Engineering**

**Subject Code: ME1206**

**Subject Name: Thermal Engineering-II**

	compressor and turbine efficiency, efficiency of ideal Brayton cycle-derivation, simple Numerical, methods to improve efficiency of gas turbine, open cycle and closed cycle gas turbine comparison, types of compressors and combustion chambers for gas turbine.	
<b>SECTION-B</b>		
<b>4</b>	<b>Refrigeration:</b> Introduction, Reversed Carnot cycle & Bell column cycle (No numerical), Unit of refrigeration & basic terminologies, working on p-v and T-s diagrams and applications of Vapour Compression Refrigeration System (VCRS) and Vapour Absorption Refrigeration System (VARs), Working of components of vapour compression refrigeration system. Calculation of Coefficient of Performance and Refrigeration Effect, Effect of change in operating conditions (condenser pressure, evaporator pressure, sub cooling, superheating) on performance of VCRS & its representation on P-h diagram (with suitable numerical examples)	<b>08</b>
<b>5</b>	<b>Air-Conditioning:</b> Introduction to air conditioning, Air conditioning- types and its applications, Psychrometry- properties of air. Representation of Psychrometry properties on chart (simple numerical using chart), Various air conditioning processes on psychrometric charts, Dessert cooler, window and split air conditioners-components and working, Ducts- need, types with applications, Air conditioning fans-types, constructional features and applications. Concept of human comfort conditions.	<b>06</b>
<b>6</b>	<b>Jet Propulsion:</b> Principle of operation of ram-jet engine and turbo jet engine application of jet engines, thrust, thrust power, propulsive efficiency, thermal efficiency, Principle of Rocket propulsion, working principle of a rocket engine, application of rocket propulsion, comparison of jet and rocket propulsions.	<b>04</b>

**Text book:**

1. Thermal Engineering – II by K.K. Patel, Atul Prakashan.

**Reference Books:**

1. Thermal Engineering by R K Rajput, Laxmi Publications.
2. A Text book of Thermal Engineering by R S Khurmi & J K Gupta, S. Chand & Co. New Delhi.
3. Thermal Science and Engineering by Dr. D.S.Kumar, S.K.Kataria & Sons.
4. A Text Book of Refrigeration and Air Conditioning by R S Khurmi, Eurasia Publishing House.
5. Refrigeration and Air Conditioning by R.K.Rajput, S.K.Kataria & Sons.
6. Internal Commercial Engine by V. Ganeshan; Tata McGraw Hill, Education.

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**Diploma Engineering**  
**Subject Code: ME1206**  
**Subject Name: Thermal Engineering-II**

**List of Practical:**

1. Study Valve timing diagram of 2 Stroke Engine.
2. Study Valve timing diagram of 4 Stroke Engine.
3. Perform a test and prepare heat balance sheet of petrol/diesel engine.
4. To study gas turbines.
5. To study different types of Refrigerant.
6. To study refrigeration tubing operations.
7. To perform a test on given VCR system.
8. To perform a test on given VAR system.
9. To study the properties of air.
10. To study jet propulsion.

**Course Outcomes:**

Sr. No.	CO statement
CO-1	<b>Understand</b> the different components and analyze the systems of I.C. Engine.
CO-2	<b>Identify</b> different alternative fuels for I.C. engines.
CO-3	<b>Explain</b> the layout, construction and working of Gas turbine system.
CO-4	<b>Understand</b> the basic concepts of refrigeration and air conditioning systems.
CO-5	<b>Make</b> basic calculation of psychometric properties and process.
CO-6	<b>Understand</b> the basics of jet propulsion system.

**List of Open Source Software/learning website:**

- <https://nptel.ac.in>

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**Diploma Engineering**  
**Subject Code: ME1207**  
**Subject Name: Strength of Materials**

## Shroff S.R. Rotary Institute of Chemical Technology

### Semester: IV

**Type of course:** Professional Core Course

**Prerequisite:** System of units, Laws of motion, Basic idea of force, Concept of centroid & Moment of Inertia, Fundamentals of stress, strain and their relationships.

**Rationale:** This subject is intended to understand the applications of principles of mechanics of rigid and deformable bodies in Engineering.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

#### Content:

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	Direct Stress & Strain: Different types of Structures and Loads, Direct Stress, linear Strain, Hook's Law, Calculate Numerical on Direct Stress & Linear Strain, Stress Strain curve of Mild Steel, Modulus of Elasticity, Yield, Breaking & Ultimate Stress and factor of Safety, Lateral Strain and Poisson's ratio, Temperature Stresses & Strain with & without yielding, Shear Stress, Shear Strain & Shear Modulus, Bulk Modulus & Volumetric Strain.	6
2	Analysis of support reactions of Beams, Moment, Couple, Statically Determinate Beams Like Simply Supported & Uniformly Distributed, Relation between Shear Force and Bending Moment, Sagging & Hogging Bending Moment and its importance, Point of Contra flexure & its importance, S.F & B.M Diagram for Simply Supported & U.D.L.	8
3	Torsion: Torsion, Angle of Twist, Polar Moment of Inertia, Torsional Rigidity, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, Power Transmitted by shaft.	8

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**Diploma Engineering**  
**Subject Code: ME1207**  
**Subject Name: Strength of Materials**

<b>SECTION-B</b>		
<b>4</b>	Moment of Inertia & its Importance, Parallel & Perpendicular Axis Theorem, Moment of Inertia about C.G for I section, H section.	<b>7</b>
<b>5</b>	Principal Stresses: Formulae for Normal, Tangential & Resultant Stresses due to Direct Orthogonal Stresses & Shear Stress. Numericals on Principal Plane & Principal Stress.	<b>8</b>
<b>6</b>	Physical & Mechanical properties of materials: Elastic, homogeneous, isotropic materials; stress-strain relationships for ductile and brittle materials, Properties: Toughness, hardness, Ductility, Brittleness.	<b>5</b>

**Text Books:**

1. Dr. R.K.Bansal, "A Textbook of Strength of Materials", Sixth edition, Laxmi Publications, 2018.

**Reference Books:**

1. Dr. R.P. Rethaliya, Dr. V.R. Panchal, Dr. Y.D. Patil, "Mechanics of Solids", Edition, 1, Atul Prakashan, 2014-15.
2. Dr. B C Punamia, "Strength of Material & Mechanics of Structures, E-Book, 2019.
3. S. RAMAMURTHAN, R. Narayan, "Strength of Material", E-Book, 2005.
4. R.S.Khurmi, "Theory of Structures", S. Chand Publishing, New Delhi, 2000.
5. Indrajeet M. Jain, "Mechanics of Solids", Tech-Max Publications, 2012.

**List of Practical/ tutorials:**

1. Determination of the Beam reactions.
2. Determination of Shear Force & Bending Moment Diagram of the beam.
3. Determination of impact of metals: Izod/Charpy impact test.
4. Determination of Compression strength for Metals/Timber.
5. Draw Stress Strain Curve for Tension Test on Ductile Materials like Mild Steel, Aluminium.
6. Determination of Principle stresses of a system.

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**Diploma Engineering**  
**Subject Code: ME1207**  
**Subject Name: Strength of Materials**

**Course Outcomes:**

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering.
CO-2	Use principles of statics to determine reactions & internal forces in statically determinate beams.
CO-3	Know basics of friction and its importance through simple applications.
CO-4	Explain the different types of stresses and strains developed in the member subjected to axial, bending, shear & torsional effects.
CO-5	Discuss the importance of moment of inertia of different sections.
CO-6	Know behaviour & properties of engineering materials.

**List of Open Source Software/learning website:**

- [www.nptel.iitm.ac.in/courses](http://www.nptel.iitm.ac.in/courses)
- <http://sm-nitk.vlabs.ac.in/>

**(Established under Gujarat Private Universities Act, 2009)**

**Diploma Engineering**

**Subject Code: ME1208**

**Subject Name: Measurement & Metrology**

**Shroff S.R. Rotary Institute of Chemical Technology**

**Semester: IV**

**Type of course:** Programme Core Course

**Prerequisite:** Nil

**Rationale:** Measurement and Metrology deals with the application of science in Mechanical Engineering. It provides a means of assessing the suitability of measuring instruments, their calibration, and the quality control of manufactured products.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Linear and Angular Measurement:</b> Concept of linear measurement and its instruments: surface plate, V-block, calipers, combination set, depth gauge, vernier instruments, micrometer instruments, slip gauges; Concept of angular measurement; Instruments for angular Measurements; Use and working of universal bevel protractor, sine bar, spirit level; Principle of Working of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges), Angle dekkor as an angular comparator.	<b>06</b>

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**Diploma Engineering**

**Subject Code: ME1208**

**Subject Name: Measurement & Metrology**

<b>2</b>	<p><b>Standards and Comparators:</b> Definition and introduction to line Standard, end standard, Wavelength standard and their comparison; Slip gauge and its accessories; Definition and Requirement of good comparator, Classification, use of comparators; Construction and Working principle of comparators- Dial indicator, Sigma Comparator, Pneumatic comparator- high pressure differential type; Relative advantages and disadvantages.</p>	<b>10</b>
<b>3</b>	<p><b>Limits, Fits, Tolerances and Gauges</b> Concept of Limits and Fits, deviation and Tolerances; Basic Terminology, Selective Assembly, Interchangeability; Indian standard (IS 919-1993) Fits, types of fits, Hole and Shaft Basis System, guide for selection of fit; ISO system of limit and fit, (Numerical on finding the limit and tolerances of hole and shaft assembly); Gauges: Limit gauges. Taylors principle of gauge design Plug, Ring Gauges, snap gauge adjustable snap gauge.</p>	<b>08</b>
<b>SECTION-B</b>		
<b>4</b>	<p><b>Introduction to Metrology:</b> Definition of metrology, objectives of metrology; Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology; Need of inspection, Precision, Accuracy, Sensitivity, Readability, Calibration, Traceability and Reproducibility. Sources of errors, Factors affecting accuracy; Selection of instrument, Precautions while using an instrument for getting higher precision and accuracy; Concept of least count of measuring Instrument.</p>	<b>06</b>
<b>5</b>	<p><b>Screw Thread Measurements:</b> Screw thread terminology, Errors in threads and Pitch; Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch diameter, best size of wire Two wire method, Thread gauge micrometer; working principle of floating carriage micrometer; Introduction to Tool Makers Microscope, applications and working principle.</p> <p><b>Gear Measurement:</b> Analytical and functional inspection of Gear, Measurement of tooth thickness by constant chord method and base tangent Method by Gear Rolling tester / Parkinsons Gear Tester; Measurement of tooth thickness by Gear tooth Vernier and Profile projector Errors in gears such as backlash, run out.</p>	<b>08</b>
<b>6</b>	<p><b>Other Measurements:</b> Primary and secondary texture, terminology of surface texture as per IS 3073-1967, CLA, Ra, RMS, Rz values and their interpretation, Symbol for</p>	<b>08</b>

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**Diploma Engineering**

**Subject Code: ME1208**

**Subject Name: Measurement & Metrology**

designating surface finish on drawing; Various techniques of qualitative analysis, working principle of stylus probe type instruments, Surface Roughness Tester, Interferometry; Parallelism, Straightness, Squareness, roundness, run out, alignment tests of Lathe and Drilling, machine tools as per IS standard; Flatness testing using Monochromatic light source with optical flat, Introduction to CMM.
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**Text Books:**

1. Mechanical Measurements and Instrumentations, Er. R. K. Rajput, Kataria Publication (KATSON).
2. Engineering Metrology”, Gupta S.C, Dhanpat Rai Publications.

**Reference Books:**

1. Engineering Metrology and Measurements, Bentley, Pearson Education.
2. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill.
3. Mechanical Measurement and Metrology by R. K. Jain, Khanna Publisher.
4. Mechanical Measurement & Control by D.S. Kumar, Metroplitan Book Co. Pvt. Ltd.
5. Industrial Instrumentation & Control by S. K. Singh, McGraw-Hill.
6. Engineering Metrology and Measurement, N. V. Raghavendra and Krishnamurthy, Oxford University Press.

**List of Practical/ Tutorials:**

1. Measure various dimensions of a given components using radius gauge, Vernier caliper, Vernier height gauge, Micrometer.
2. Measure bores of a give sample using internal micrometers and dial bore indicators.
3. Use slip gauges combination to set the adjustable snap gauge Go end and No-Go end for a given dimension.
4. Measure gear tooth elements using gear tooth Vernier caliper.
5. Measure the effective diameter of the screw thread using profile projector / Tool maker Microscope.
6. Measure unknown angle of a given tapered component using sine centre in combination with slip gauges.
7. Use Bevel Protractor to measure an angle and taper of the given component.
8. Measure run out of cylindrical component using dial indicator.

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**Diploma Engineering**  
**Subject Code: ME1208**  
**Subject Name: Measurement & Metrology**

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>Sr. No.</b>	<b>CO Statement</b>
CO-1	Use linear and angular measuring instruments.
CO-2	Use different types of comparators.
CO-3	Select gauges, fits and tolerances for machine components.
CO-4	Select the relevant instrument for measurement.
CO-5	Use relevant instruments to measure different parameters of screw thread and gear.
CO-6	Select relevant surface testing methods.

**List of Open-Source Software/Learning Website:**

- <https://archive.nptel.ac.in/courses/112/106/112106138/>
- <https://archive.nptel.ac.in/courses/112/106/112106139/>

(Established under Gujarat Private Universities Act, 2009)

Diploma of Engineering

Subject Code: ME1209

Subject Name: Heat Transfer

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - IV

Type of course: Core subject

Prerequisite: Nil

**Rationale:** The course is prepared to provide the detailed understating of various modes of heat transfer and its applications in Mechanical Engineering. The course also provides the basic technical knowledge related to heat exchangers.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Introduction:</b> Overview of applications of heat transfer in different fields of engineering, modes of heat transfer- conduction, convection and radiation, heat transfer with and without change of phase, various laws of heat transfer	3
2	<b>Conduction:</b> Mechanism of heat conduction, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity, General heat conduction equation in Cartesian coordinates, Boundary conditions, formulation of heat transfer problems without generation of heat, Conduction through systems of constant thermal conductivity, conduction through plane, cylindrical and spherical wall, conduction through composite slab, cylindrical and spherical shells. Electrical analogy to heat flow, Critical and Optimum thickness of Insulation, Unsteady State heat Conduction	8
3	<b>Convection:</b> Mechanism, thermal and velocity boundary layers, boundary layer thickness, relationship between hydrodynamic and thermal boundary layer thickness for flow over flat plates, the convective heat transfer coefficient, reference temperatures, thermal boundary layers for the cases of flow over a flat plate and flow through pipe, dimensionless numbers in	7

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**Diploma of Engineering**

**Subject Code: ME1209**

**Subject Name: Heat Transfer**

	<p>heat transfer and their significance.</p> <p><b>Forced Convection:</b> General methods for estimation of convection heat transfer coefficient, Correlation equations for heat transfer in laminar and turbulent flow for external and internal flows for constant heat flux and wall temperature conditions- flow in a circular tube Analogy between momentum and heat transfer: Development of Reynold’s and Prandtl analogy</p> <p><b>Natural Convection:</b> Dimensional analysis, natural convection from vertical and horizontal surfaces under laminar and turbulent conditions for plates, cylinders, physical significance of Grashoff and Rayleigh numbers.</p>	
<b>SECTION-B</b>		
<b>4</b>	<p><b>Heat transfer by radiation:</b> Introduction- theories of radiation, electromagnetic spectrum, thermal radiation, spectral emissive power, surface emission- total emissive power, emissivity. Radiative properties, Emission, irradiation, absorptivity, reflectivity and transmissivity. Concept of black and grey body, radiation intensity, Laws of black body radiation, non-black surfaces- Grey, white and real surface, radiation between black surfaces and gray surfaces</p>	<b>6</b>
<b>5</b>	<p><b>Heat exchanger:</b> Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness-NTU method for parallel and counter flow heat exchanger</p>	<b>6</b>
<b>6</b>	<p><b>Boiling and Condensation:</b> Pool boiling - Boiling curve, hysteresis in the boiling curve, mechanism of nucleate boiling, Forced convection boiling - Brief over view of internal forced convection boiling. Condensation: Physical mechanisms, types of condensation, factors affecting condensation.</p>	<b>6</b>

**Text Books:**

- Heat and Mass Transfer by R K Rajput, S.Chand Publication
- Rao Y.V.C, “Heat Transfer”, University Press, India

**Reference Books:**

- Kern D Q, Process Heat Transfer, McGraw Hill Book Co. (1997).
- Binay. K. Dutta, “Heat Transfer Principles and applications” Prentice Hall of India
- Holman J. P, “Heat Transfer”, McGrawHill.
- Incropera F. P. and DeWitt D. P, “Introduction to Heat Transfer”. John Wiley & Sons.
- Cengel A. Yunnus. “Heat Transfer – A Practical Approach”, McGraw Hill

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**Diploma of Engineering**

**Subject Code: ME1209**

**Subject Name: Heat Transfer**

**List of Experiments:**

1. To Determination of thermal conductivity of given metal rod
2. Determination of heat transfer coefficient by natural convection and forced convection
3. To determine the thermal conductivity of the given composite walls.
4. To determine Stephan Boltzmann constant experimentally.
5. To determine the overall heat transfer co-efficient of shell and tube type heat exchangers.
6. To determine the emissivity of gray body.
7. To study film and drop wise condensation and to determine the film co-efficient

**Course Outcomes:**

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Understand basic concept of different modes of heat transfer
CO-2	Understand basic mechanism of conduction
CO-3	Explain heat transfer under different convective regimes
CO-4	Analyse extent of heat flow by radiation through grey, white and real surfaces.
CO-5	Analyze heat transfer through different types of heat exchangers used for various applications
CO-6	Describe industrial applications and regimes involved in boiling and condensation

**List of Open Source Software/learning website:**

- [nptel.ac.in](http://nptel.ac.in)

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**Diploma of Engineering**  
**Subject Code: ME1210**  
**Subject Name: Tool Engineering**

## Shroff S.R. Rotary Institute of Chemical Technology

### Semester: IV

**Type of course:** Engineering Science Course

**Prerequisite:** Zeal to learn the subject

**Rationale:** This course attempts to develop abilities in students to select a tool of proper size and shape for required machining operation. The design of cutting tools, jigs and fixtures are also dealt with in this course. This course is therefore a core course for mechanical engineers.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA(I)	
3	0	2	4	70	30	30	20	150

#### Content:

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Introduction:</b> Concept, meaning and definitions of tool, tool design and tool engineering. Tools-types, classification, features & applications. Tool engineering-functions and importance to enhance productivity and quality. Importance of process planning in tool engineering. Economy-concept, meaning, importance and principles in tool engineering.	04
2	<b>Cutting tools and tool holders:</b> Cutting tool materials-types, composition, properties and applications. Carbide inserts-types, ISO-designation and applications. Re-sharpening methods of following cutting tools Drill, Side and face milling cutter, End mill, Centre drill etc. Tool holders for turning and milling carbide inserts-types. Tool holding and tool mounting systems for conventional milling and drilling machine tools.	07
3	<b>Locating and clamping devices:</b> Concept, meaning and definitions of location and clamping. Use of locating and clamping principles in day-to-day supervision on shop floor. Degree of freedom-concept and importance, 3-2-1 principle of location, type of locators, Fool proofing and ejecting & Clamping devices.	07
<b>SECTION-B</b>		
4	<b>Jigs and fixtures:</b> Concept, meaning, differences and benefits of jigs and fixtures. Types, sketches with nomenclature, working and applications of jigs, Types, sketches with nomenclature, working and applications of	07

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**Diploma of Engineering**  
**Subject Code: ME1210**  
**Subject Name: Tool Engineering**

	fixtures. Steps to design jigs and fixture.	
5	<p><b>Press tools:</b> Press tools: types, working, components and their functions. Concept, meaning, definitions and calculations of press tonnage and shut height of press tool.</p> <p>Shear action in die cutting operation Centre of pressure: Concept, meaning, definition, methods of finding and importance.</p> <p>Cutting force: Methods to calculate and methods of reducing, Shear angle-concept, need and method to give shear angle on punch and die.</p> <p>Scrap strip layout: - Concept, importance, method to prepare, and determining percentage stock utilization. Types, working, and applications of stock stop, pilots, strippers and knockouts.</p>	07
6	<p><b>Dies and moulds:</b></p> <p>Bending: Types, Parts and functions of bending die, Method to compute bending pressure, Types, sketch, working and applications of bending dies. Types, sketch, working and applications of drawing dies (embossing, curling, bulging, coining, swaging and hole flanging).</p> <p>Forging dies- Terminology, types, sketch, working and applications.</p> <p>Applications of following dies/mould: Extrusion, Plastic injection, Blow moulding.</p>	04

**Text Books:**

1. Jigs and fixture by P. H. Joshi, publication TMGH
2. Tool design by Donaldson & Lecain, publication TME

**Reference Books:**

1. Tool engineering by Doyal.
2. Principles of tool & jig design by M. H. A. Kempster
3. Design Of Jigs Fixtures And Press Tools by C. Elanchezhian, T. Sunder Selwyn, B. Vijaya Ramnath Eswar Press,2007,

**List of Practical:**

1. Study of various tools and tool geometry.
2. Study of importance of process planning in tool engineering
3. Study of various type of cutting tool holders,
4. Study of locating device with its application.
5. Study of clamping device with its application
6. Study of Jig and its application.
7. Study of Fixture and its application.
8. Study of Press tool.
9. Study of Die and Mould.
10. Study of Extrusion, Plastic injection, Blow moulding.

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**Diploma of Engineering**  
**Subject Code: ME1210**  
**Subject Name: Tool Engineering**

**Course Outcomes:**

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Selection of tool for economic manufacturing operation
CO-2	Determine the system of cutting tool and tool holder
CO-3	Find out the proper locating and clamping devices for component.
CO-4	Select and design jig and fixture for given simple component
CO-5	Explanation of various type press tools and press tools operations.
CO-6	Understand the concept of die & Mould

**List of Open Source Software/learning website:**

- <https://nptel.ac.in>

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**Diploma Engineering**  
**Subject Code: ME1211**  
**Subject Name: Material Handling Systems**

Shroff S.R. Rotary Institute of Chemical Technology

**Semester: IV**

**Type of course:** Programme Elective-I

**Prerequisite:** Nil

**Rationale:** The course aims to provide fundamental knowledge of Material Handling Equipment. Design and analysis of Hoisting Equipment's Like, Rope, Drum, Hook, Chain, Pulley and Girder etc. and design of arresting gear, Conveyors and Elevators.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction:</b> Principles of material handling, Objective and benefits of better material handling, material handling and plant layout, concepts of unit load containerization and palletisation.	<b>06</b>
<b>2</b>	<b>Material handling Equipment's and Systems for Various Materials:</b> Storing equipment's like pallets, bins, racks, decking, order picking, positioning equipment's. Hoisting equipment's like jacks, pulleys, hand trolleys, hoists, power hoist, various types of cranes and elevators. Conveying equipment's like belt, chain, roller, wheel, trolley, tray conveyors, gravity and vibratory type conveyors, screw conveyors. Mobile equipment's like hand trucks, fork lift trucks, powered industrial trucks and tractors, powered stackers, reach trucks, order pickers.	<b>10</b>
<b>3</b>	<b>Material Handling in CIMS:</b> Need, Comparison with conventional systems, Equipment like industrial robots and automatically guided vehicles etc.	<b>08</b>

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**Diploma Engineering**

**Subject Code: ME1211**

**Subject Name: Material Handling Systems**

<b>SECTION-B</b>		
<b>4</b>	<b>Material Flow:</b> Operation sequence, material flow pattern, stages of material flow at receiving, in process and at shipping, flow planning criteria & design of flow pattern.	<b>06</b>
<b>5</b>	<b>Selection of Material Handling Equipment:</b> Factors affecting selection of material handling equipment, Material handling equation, Choices of Material Handling Equipment, General Procedure for Selection, Basic Analytical techniques, Selection of suitable types of material handling systems, Functions and Parameters, affecting service, packing and storage material, Selection of Material Handling Equipment in Green Sand Moulding Foundry, Sugar Manufacturing Industry	<b>08</b>
<b>6</b>	<b>Safety and Training:</b> Need, Environmental and human factors in material handling, Safety Regulations	<b>08</b>

**Text Books:**

1. Introduction to Materials Handling, Siddhartha Ray, New Age International Publishers.
2. Material Handling, Immer J. R., Tata McGraw Hill Publication.

**Reference Books:**

1. Material Handling System Design, James Apple, John Wiley.
2. Material Handling Principles & Practice, Theodore H., Allegre Sr., CBS Publishers & Distributors.
3. Material Handling Equipments by Rudenko, MIR Publishers.
4. Plant layout & material Handling, James Apple, John Wiley.
5. Material Handling Handbook, Raymond A Kulwiec, John Wiley & Sons

**List of Practical/ Tutorials:**

1. Basic type of material handling equipments and their applications.
2. Selection criteria for material handling.
3. Principles of Material Handling.
4. Analysis of Material Handling Problems.
5. Cost analysis for material handling.
6. Capacity calculation for belt conveyer.
7. Capacity calculation for screw conveyer.
8. Capacity calculation for bucket elevator.

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**Diploma Engineering**  
**Subject Code: ME1211**  
**Subject Name: Material Handling Systems**

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>Sr. No.</b>	<b>CO Statement</b>
CO-1	Understand the basic Fundamentals of Material Handling Equipment.
CO-2	Understand the design requirement of material handling systems like storing, hoisting, and conveying equipment's
CO-3	Implement CIMS (Computer Integrated Manufacturing Systems) in material handling systems.
CO-4	Understand the flow and type of movement of industrial goods.
CO-5	Select material handling systems in various industries.
CO-6	Implement safety regulations in material handling systems.

**List of Open-Source Software/Learning Website:**

- <https://nptel.ac.in/courses/113105104>

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**Diploma of Mechanical Engineering**

**Subject Code: ME1212**

**Subject Name: Renewable Energy Technologies**

**Shroff S.R. Rotary Institute of Chemical Technology**

**Semester: IV**

**Type of course:** Open Elective – I

**Prerequisite:** Zeal to learn the subject

**Rationale:** Energy is an important input in all sectors of country's economy. Standards of living of a country can be directly judged by per capita consumption of energy. Students will develop awareness about the technologies involved in tapping such energy resources and then putting them in use effectively for the service of mankind. They may also be apprised of the problem of the limited availability of energy and so to take effective measures to save energy.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
1.	<b>RENEWABLE SOURCES OF ENERGY:</b> - Renewable Sources of Energy such as Hydro, Solar, Wind, Bio-mass, Tidal and Geothermal - their availability and limitations. Energy crisis and energy demand projection.	5
2.	<b>SOLAR ENERGY:</b> - Solar radiation. Solar constant, Pyranometer, Solar Thermal Collectors, Solar air heaters, Solar Cell, Materials of Solar Cell, Applications of solar energy	10
3.	<b>WIND ENERGY:</b> Wind map of India, mean wind speed, and wind density during different months in specific areas. Types of wind mills, their assembly and applications as electric converters, pumping Motors, Concept of wind farms, its applications.	6
4.	<b>BIO-MASS ENERGY:</b> Bio-mass as a source of energy, Energy plantation. Pyrolysis, Classification and Anaerobic fermentation, Types of Biogas plants.	10

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**Diploma of Mechanical Engineering**

**Subject Code: ME1212**

**Subject Name: Renewable Energy Technologies**

<b>5.</b>	<b>OTHER ALTERNATE SOURCES OF ENERGY:</b> Tidal power, sites for tidal power plants in India, Micro hydel power station, Geothermal energy, Limitations and applications of such power plants.	<b>6</b>
<b>6.</b>	<b>ENERGY CONSERVATION AND AUDITING :</b> Conservation of energy in - Domestic appliances and industries, Use of fuel efficiently in vehicles, Waste recycling, Fuel gases and heat recovery, Energy demand management, Energy accounting and auditing.	<b>5</b>

**Text Books:**

1. Solar Energy Utilization - G.D. Rai, Khanna Publishers, Delhi.
2. Power Plant Engg. - G.R. Nagpal, Khanna Publishers, Delhi.

**Reference Books:**

1. Principles of thermal collection and storage - by S.P. Sukhatame, Tata McGraw Hills.
2. Biogas Technology - K.C. Khandelwal, S.S.Mahdi, Tata MGH.
3. Principles of energy conservation - A.W. Culp, Tata MGH.

**Course Outcomes:**

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	To Identify non-conventional (renewable) sources of energy
CO-2	To Understand the concept of solar radiation and operations of various solar systems
CO-3	To Understand the concept of wind energy and its applications like wind mill wind farm etc.
CO-4	To Identify different types of biomass energy plants and its working.
CO-5	To Identify newer and newer renewable sources of energy.
CO-6	To Understand the concept of energy auditing, energy saving etc.

**List of Open Source Software/learning website:**

- <http://nptel.ac.in>, [www.vlab.co.in](http://www.vlab.co.in)

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**Diploma Engineering**  
**Subject Code: ME1213**  
**Subject Name: Energy Conservation & Audit**

Shroff S.R. Rotary Institute of Chemical Technology

**Semester: IV**

**Type of course:** Open Elective-I

**Prerequisite:** Fundamentals of Thermal engineering and Electrical engineering.

**Rationale:** The course provides basic understanding of energy conservation and energy audit. Energy conservation can be achieved through energy audit and management Energy audit is a process to determine when, where, why and how energy is used in a plant or building. Collection of these information helps to identify the situation where there is need to improve energy efficiency and decrease production cost.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Basics of Energy and conservation:</b> Thermal Basics-fuels, thermal energy contents of fuel, temperature and pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity and heat transfer. Electricity basics - Direct Current and Alternative Currents, electricity tariff.	7
2	<b>Energy Scenario :</b> Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, Indian energy scenario, long term energy scenario, energy pricing, Energy security, energy conservation and its importance.	5

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**Diploma Engineering**

**Subject Code: ME1213**

**Subject Name: Energy Conservation & Audit**

<b>3</b>	<b>Elements of Energy Conservation and Management:</b> General energy problem, Scope for energy conservation and its benefits Mandatory provisions of EC act, Features of EC act-Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC).	<b>6</b>
<b>SECTION-B</b>		
<b>4</b>	<b>Introduction to Energy Audit:</b> Energy audit and its benefits, Types of energy audit, 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.	<b>6</b>
<b>5</b>	<b>Measuring instruments:</b> Thermal and electrical parameter measuring Instruments - Power Analyser, Combustion analyzer, fuel efficiency monitor, thermometer-contact, infrared, pitot tube and manometer, water flowmeter, leak detector, tachometer and luxmeter.	<b>5</b>
<b>6</b>	<b>Energy Audit Methodology:</b> General Philosophy, need of Energy Audit and Management, Definition and Objective of Energy Management, General Principles of Energy Management. Energy Management Skills, Energy Management Strategy, energy saving opportunities and recommendation, Financial Analysis: Simple Payback, IRR, NPV.	<b>7</b>

**Text Books:**

1. Energy Conservation and Audit, M.A.Chaudhari, S.M.Chaudhari and S.A Asarkar
2. Energy Conservation and Audit, B.L.Singhal and P.G.Jamdade

**Reference Books:**

1. Energy Audit and Management, Volume-I, IECC Press
2. Energy Efficiency in Electrical Systems, Volume-II, IECC Press
3. Energy Management: W.R.Murphy, G.Mckay, Butterworths Scientific
4. Energy Management Principles, C.B.Smith, Pergamon Press

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**Diploma Engineering**

**Subject Code: ME1213**

**Subject Name: Energy Conservation & Audit**

5. Industrial Energy Conservation, D.A. Reay, Pergammon Press
  6. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience
  7. Industrial Energy Management and Utilization, L.C. Witte, P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988
  8. Hand Book of Energy Audits, Albert Thumann, P.E., C.E.M. William J. Younger, C.E.M., CRC Press
- Course Outcomes:

Sr. No.	CO statement
CO-1	Understand the importance of energy conservation and energy audit.
CO-2	Know the Indian and long term energy scenario.
CO-3	Inculcate the skills required for energy audit and management.
CO-4	Identify and assess energy conservation opportunities in thermal system.
CO-5	Recognize the instruments used to measure performance parameters
CO-6	Apply the concept of energy audit methodology to find energy saving measures.

**List of Open Source Software/learning website:**

- <https://beeindia.gov.in/>
- <http://nptel.ac.in/>
- [https://lbre.stanford.edu/sem/energy\\_conservation](https://lbre.stanford.edu/sem/energy_conservation)