 <b>MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI</b> <b>TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES</b>																	
<b>COURSE NAME : MECHANICAL ENGINEERING GROUP</b>																	
<b>COURSE CODE : ME / MI / MH</b>																	
<b>DURATION OF COURSE : 6 SEMESTERS for ME ( 8 SEMESTERS for MH/MI)</b>											<b>WITH EFFECT FROM 2012-13</b>						
<b>SEMESTER : FOURTH</b>											<b>DURATION : 16 WEEKS</b>						
<b>PATTERN : FULL TIME - SEMESTER</b>											<b>SCHEME : G</b>						
SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17400)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Environmental Studies	\$		01	--	02	01	50#*	20	--	--	--	--	25@	10	<b>50</b>	
2	Fluid Mechanics & Machinery	β		04	--	02	03	100	40	25#	10	--	--	25@	10		
3	Thermal Engineering			04	--	02	03	100	40	--	--	25#	10	25@	10		
4	Electrical Engineering	ELE		03	--	02	03	100	40	--	--	--	--	25@	10		
5	Theory of Machines	β		03	--	02	03	100	40	--	--	--	--	25@	10		
6	Manufacturing Processes	β		03	--	02	03	100	40	25#	10	--	--	50@	20		
7	Professional Practices-II	β		--	--	03	--	--	--	--	--	--	--	50@	20		
<b>TOTAL</b>				<b>18</b>	<b>--</b>	<b>15</b>	<b>--</b>	<b>550</b>	<b>--</b>	<b>50</b>	<b>--</b>	<b>25</b>	<b>--</b>	<b>225</b>	<b>--</b>	<b>50</b>	

Student Contact Hours Per Week: **33 Hrs.**  
**THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.**  
Total Marks : **900**  
@ - Internal Assessment, # - External Assessment,  No Theory Examination, \$ - Common to all branches, #\* - Online Examination, β - Common to AE, PG, PT

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

**Course Name : All Branches of Diploma in Engineering & Technology**

**Course Code : AE/CE/CH/CM/CO/CR/CS/CW/DE/EE/EP/IF/EJ/EN/ET/EV/EX/IC/IE/IS/  
ME/MU/PG/PT/PS/CD/CV/ED/EI/FE/IU/MH/MI**

**Semester : Fourth**

**Subject Title : Environmental Studies**

**Subject Code :**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	01	50#*	--	--	25	75

**#\* - Online Theory Examination**

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Environment essentially comprises of our living ambience, which gives us the zest and verve in all our activities. The turn of the twentieth century saw the gradual onset of its degradation by our callous deeds without any concern for the well being of our surrounding we are today facing a grave environmental crisis. The unceasing industrial growth and economic development of the last 300 years or so have resulted in huge ecological problems such as overexploitation of natural resources, degraded land, disappearing forests, endangered species, dangerous toxins, global warming etc.

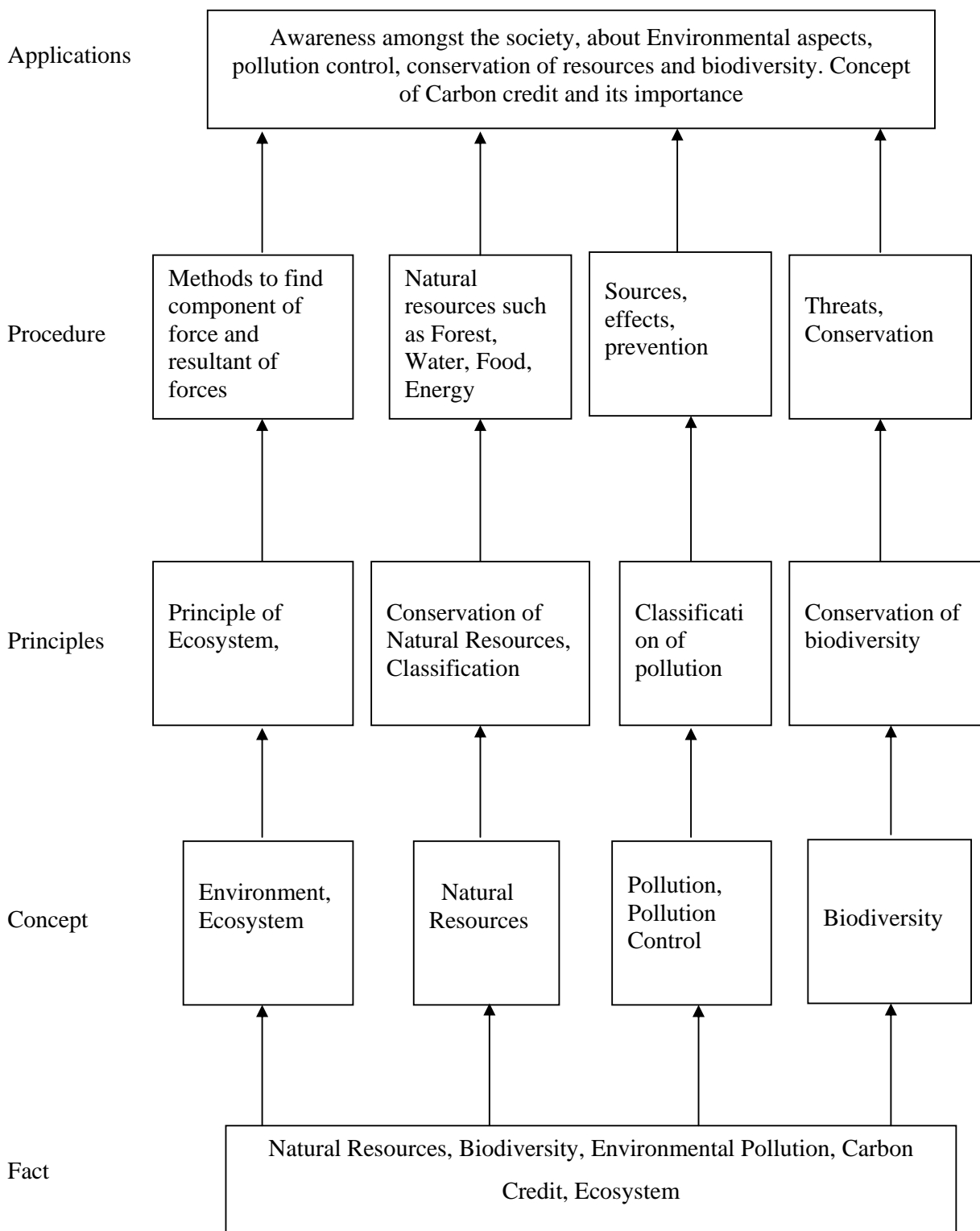
It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could be possible remedies or precautions which need to be taken to protect the environment.

The curriculum covers the aspects about environment such as Environment and Ecology, Environmental impacts on human activities, Water resources and water quality, Mineral resources and mining, Forests, etc.

**General Objectives:** The student will be able to,

1. Understand importance of environment
2. Know key issues about environment
3. Understands the reasons for environment degradation
4. Know aspects about improvement methods
5. Know initiatives taken by the world bodies to restrict and reduce degradation

**Learning Structure:**



**Theory:**

<b>Topic and Contents</b>	<b>Hours</b>	<b>Marks</b>
<p><b>Topic 1: Nature of Environmental Studies</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Define the terms related to Environmental Studies</li> <li>➤ State importance of awareness about environment in general public</li> </ul> <p><b>Contents:</b></p> <ul style="list-style-type: none"> <li>• Definition, Scope and Importance of the environmental studies</li> <li>• Importance of the studies irrespective of course</li> <li>• Need for creating public awareness about environmental issues</li> </ul>	01	04
<p><b>Topic 2: Natural Resources and Associated Problems</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Define natural resources and identify problems associated with them</li> <li>➤ Identify uses and their overexploitation</li> <li>➤ Identify alternate resources and their importance for environment</li> </ul> <p><b>Contents:</b></p> <p>2.1 Renewable and Non renewable resources</p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Associated problems</li> </ul> <p>2.2 Forest Resources</p> <ul style="list-style-type: none"> <li>• General description of forest resources</li> <li>• Functions and benefits of forest resources</li> <li>• Effects on environment due to deforestation, Timber extraction, Building of dams, waterways etc.</li> </ul> <p>2.3 Water Resources</p> <ul style="list-style-type: none"> <li>• Hydrosphere: Different sources of water</li> <li>• Use and overexploitation of surface and ground water</li> <li>• Effect of floods, draught, dams etc. on water resources and community</li> </ul> <p>2.4 Mineral Resources:</p> <ul style="list-style-type: none"> <li>• Categories of mineral resources</li> <li>• Basics of mining activities</li> <li>• Mine safety</li> <li>• Effect of mining on environment</li> </ul> <p>2.5 Food Resources:</p> <ul style="list-style-type: none"> <li>• Food for all</li> <li>• Effects of modern agriculture</li> <li>• World food problem</li> </ul>	04	10
<p><b>Topic 3. Ecosystems</b></p> <ul style="list-style-type: none"> <li>• Concept of Ecosystem</li> <li>• Structure and functions of ecosystem</li> <li>• Energy flow in ecosystem</li> <li>• Major ecosystems in the world</li> </ul>	01	04
<p><b>Topic 4. Biodiversity and Its Conservation</b></p> <ul style="list-style-type: none"> <li>• Definition of Biodiversity</li> <li>• Levels of biodiversity</li> </ul>	02	06

<ul style="list-style-type: none"> <li>• Value of biodiversity</li> <li>• Threats to biodiversity</li> <li>• Conservation of biodiversity</li> </ul>		
<b>Topic 5. Environmental Pollution</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Air pollution: Definition, Classification, sources, effects, prevention</li> <li>• Water Pollution: Definition, Classification, sources, effects, prevention</li> <li>• Soil Pollution: Definition, sources, effects, prevention</li> <li>• Noise Pollution: Definition, sources, effects, prevention</li> </ul>	03	08
<b>Topic 6. Social Issues and Environment</b> <ul style="list-style-type: none"> <li>• Concept of development, sustainable development</li> <li>• Water conservation, Watershed management, Rain water harvesting: Definition, Methods and Benefits</li> <li>• Climate Change, Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust: Basic concepts and their effect on climate</li> <li>• Concept of Carbon Credits and its advantages</li> </ul>	03	10
<b>Topic 7. Environmental Protection</b> Brief description of the following acts and their provisions: <ul style="list-style-type: none"> <li>• Environmental Protection Act</li> <li>• Air (Prevention and Control of Pollution) Act</li> <li>• Water (Prevention and Control of Pollution) Act</li> <li>• Wildlife Protection Act</li> <li>• Forest Conservation Act</li> </ul> Population Growth: Aspects, importance and effect on environment <ul style="list-style-type: none"> <li>• Human Health and Human Rights</li> </ul>	02	08
<b>Total</b>	<b>16</b>	<b>50</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. Collection of information, data
2. Analysis of data
3. Report writing

**Motor Skills:**

1. Presentation Skills
2. Use of multi media

**List of Projects:**

**Note:** Any one project of the following:

1. Visit to a local area to document environmental assets such as river / forest / grassland / hill / mountain
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
3. Study of common plants, insects, birds

4. Study of simple ecosystems of ponds, river, hill slopes etc

**Prepare a project report on the findings of the visit illustrating environment related facts, analysis and conclusion. Also suggest remedies to improve environment.**

**Learning Resources:**

**Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
01	Anindita Basak	Environmental Studies	Pearson Education
02	R. Rajgopalan	Environmental Studies from Crises to Cure	Oxford University Press
03	Dr. R. J. Ranjit Daniels, Dr. Jagdish Krishnaswamy	Environmental Studies	Wiley India

**Course Name : Mechanical Engineering Group**

**Course Code : ME/MH/MI/PG/PT**

**Semester : Fourth**

**Subject Title : Fluid Mechanics Machinery**

**Subject Code :**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	25#	--	25@	150

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

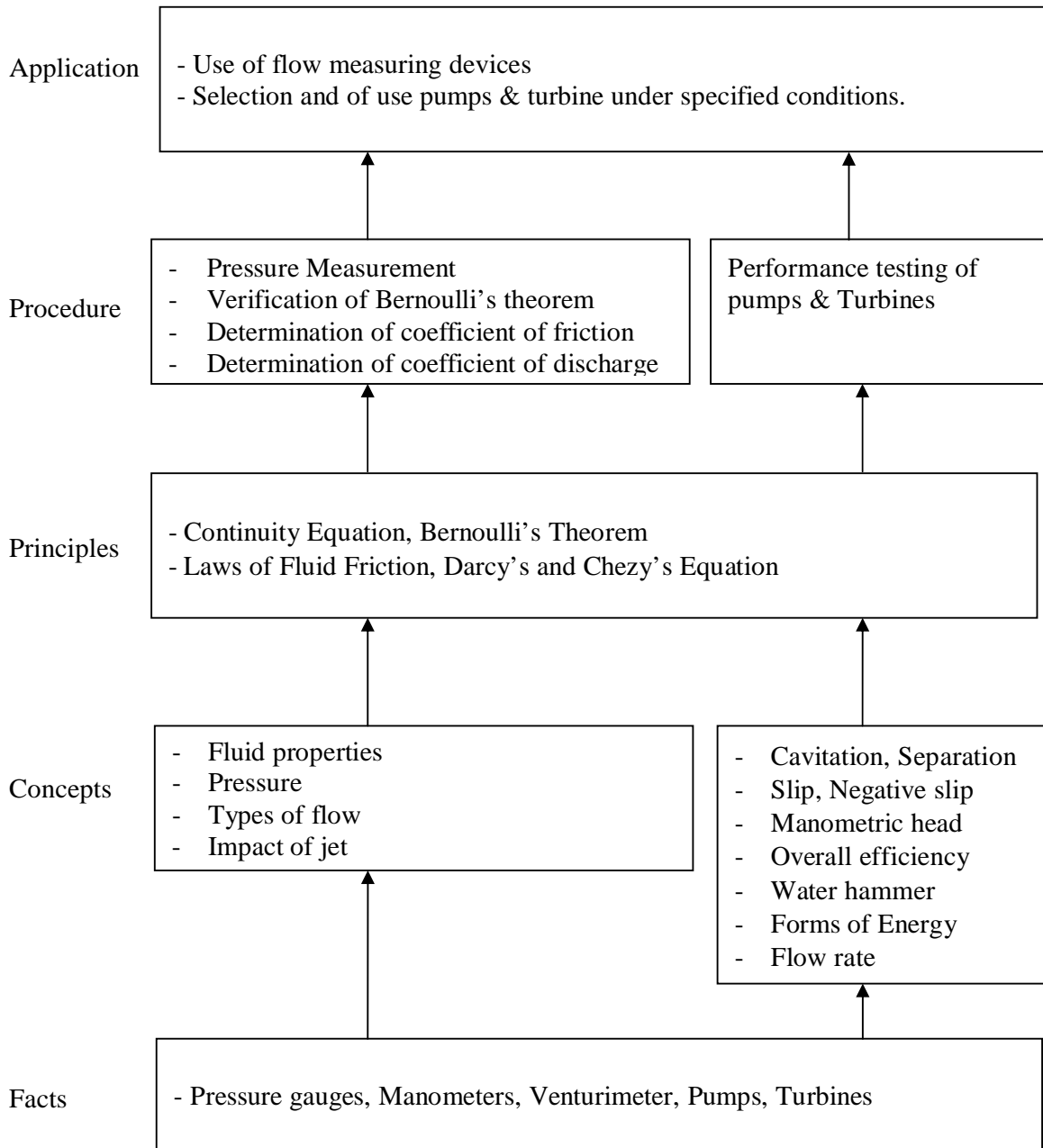
**Rationale:**

Knowledge of fluid properties, fluid flow & fluid machinery is essential in all fields of engineering. Hydraulic machines have important role in water supply, irrigation, power generation and also in most of the engineering segments. This subject requires knowledge of basic engineering sciences, applied mechanics, mathematics etc. The fundamentals of this subject are essential for the subject "Industrial Fluid Power" in sixth semester.

**General Objectives:** The student will be able to

- 1) Understand various properties of fluids
- 2) Measure pressure, velocity and flow rate using various instruments.
- 3) Understand continuity equation, bernoulli's equation and its applications.
- 4) Estimate various losses in flow through pipes.
- 5) Understand concept of impact of jet on various types of vanes.
- 6) Describe the construction, working of hydraulic pumps and turbines.
- 7) Evaluate performance of turbines and pumps.

**Learning Structure:**





**Theory:**

Topics and Contents	Hours	Marks
<p><b>1. Properties of fluid and Fluid Pressure</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Define fluid properties.</li> <li>➤ Differentiate between fluid pressure intensity and pressure head.</li> <li>➤ Solve numericals related to properties of fluid, fluid pressure and manometers.</li> </ul> <p>Contents:</p> <p><b>1.1 Properties of Fluid <span style="float: right;">06 Marks</span></b> Density, Specific gravity, Specific volume, Specific Weight, Dynamic viscosity, Kinematic viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility</p> <p><b>1.2: Fluid Pressure &amp; Pressure Measurement <span style="float: right;">14 Marks</span></b></p> <ul style="list-style-type: none"> <li>• Fluid pressure, Pressure head, Pressure intensity</li> <li>• Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure.</li> <li>• Simple and differential manometers, Bourden pressure gauge.</li> <li>• Total pressure, center of pressure- regular surface forces on immersed bodies in liquid in horizontal, vertical and inclined position</li> </ul>	12	20
<p><b>2. Fluid Flow</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ State Bernoulli's theorem and apply it to venturimeter, orifice and pitot tube.</li> </ul> <p>Contents:</p> <ul style="list-style-type: none"> <li>• Types of fluid flows-Laminar, turbulent, steady, unsteady, uniform, non uniform, rotational, irrotational.</li> <li>• Continuity equation, Bernoulli's theorem</li> <li>• Venturimeter – Construction, principle of working, coefficient of discharge, Derivation for discharge through venturimeter.</li> <li>• Orifice meter – Construction, Principle of working, hydraulic coefficients. Derivation for discharge through Orifice meter</li> <li>• Pitot tube – Construction, Principle of Working</li> </ul>	10	14
<p><b>3. Flow Through Pipes</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ State laws of friction and list various losses in flow through pipes.</li> <li>➤ Solve numericals on laws of friction and list various losses in flow through pipes.</li> </ul> <p>Contents:</p> <ul style="list-style-type: none"> <li>• Laws of fluid friction ( Laminar and turbulent)</li> <li>• Darcy's equation and Chezy's equation for frictional losses</li> <li>• Minor losses in fittings and valves</li> <li>• Hydraulic gradient line and total energy line</li> <li>• Hydraulic power transmission through pipe</li> </ul>	10	14
<p><b>4. Impact of Jets</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Analyze impact of jet on vanes in various conditions.</li> </ul>	06	10

<p>➤ Solve numericals on impact of jet on vanes in various conditions.</p> <p>Contents:</p> <ul style="list-style-type: none"> <li>• Impact of jet on fixed vertical, moving vertical flat plates.</li> <li>• Impact of jet on curved vanes with special reference to turbines and pumps</li> </ul>		
<p><b>5. Hydraulic Turbines</b></p> <p>Specific Objectives:</p> <p>➤ Explain working principle of various hydraulic turbines.</p> <p>➤ Calculate work done, power generated and various efficiencies of hydraulic turbines.</p> <p>Contents:</p> <ul style="list-style-type: none"> <li>• Layout and features of hydroelectric power plant, surge tanks and its need.</li> <li>• Classification of hydraulic turbines and their applications.</li> <li>• Construction and working principle of Pelton wheel, Francis and Kaplan turbine.</li> <li>• Draft tubes – types and construction, Concept of cavitation in turbines,</li> <li>• Calculation of Work done, Power, efficiency of turbine</li> </ul>	12	18
<p><b>6. Pumps</b></p> <p>Specific Objectives:</p> <p>➤ Explain working of centrifugal, reciprocating and multistage pumps.</p> <p>➤ Explain the concept of cavitation in pumps.</p> <p>➤ Calculate manometric head, work done and various efficiencies related to the pumps.</p> <p>➤ Select the pump for a given application.</p> <p><b>6.1 Centrifugal Pumps</b> <span style="float: right;"><b>14 Marks</b></span></p> <p>Contents:</p> <ul style="list-style-type: none"> <li>• Construction, principle of working, priming methods and Cavitation</li> <li>• Types of casings and impellers.</li> <li>• Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH.</li> <li>• Performance Characteristics of Centrifugal pumps.</li> <li>• Trouble Shooting.</li> <li>• Construction, working and applications multistage pumps</li> <li>• Submersible pumps and jet pump</li> </ul> <p><b>6.2 Reciprocating Pump</b> <span style="float: right;"><b>10 Marks</b></span></p> <ul style="list-style-type: none"> <li>• Construction, working principle and applications of single and double acting reciprocating pumps.</li> <li>• Slip, Negative slip, Cavitation and separation.</li> <li>• Use of Air Vessels.</li> <li>• Indicator diagram with effect of acceleration head &amp; frictional head.</li> </ul> <p><b>(No numerical reciprocating pumps)</b></p>	14	24
<b>Total</b>	<b>64</b>	<b>100</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

- 1) Select appropriate flow and pressure measuring devices for a given situation.
- 2) Analyze the performance of pumps and turbines.

**Motor Skills:**

- 1) Use flow and pressure measuring devices.
- 2) Operate pumps and turbines.

**List of Practicals:**

01. Measurement of water pressure by using bourden pressure gauge and U - tube manometer and measurement of discharge using measuring tank and stop watch.
02. Calibration of Bourden pressure gauge with the help of Dead Weight Pressure gauge.
03. Verification of Bernoulli's Theorem.
04. Determination of Coefficient of Discharge of Venturimeter.
05. Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of sharp edged circular orifice.
06. Determination of friction factor for given pipes.
07. Determination minor losses in pipe fittings.
08. Trial on Pelton wheel to determine overall efficiency.
09. Trial on centrifugal pump to determine its overall efficiency and plot operating characteristics.
10. Trial on reciprocating pump to determine its overall efficiency.

**Assignments**

1. Information collection of Centrifugal, reciprocating, multistage pumps and submersible pumps from local market and from internet. Comparison of various models manufactured by different manufacturers. [The market survey is to be completed in a group of (max.) three to four students and the report of the same is to be included as part of term work.]

**Learning Resources:****1. Books:**

Sr. No	Author	Title	Publication
01	Ojha, Berndtsson, Chnadramouli	Fluid Mechanics and Machinery	Oxford University Press
02	Som S K , Biswas G.	Introduction to Fluid Mechanics and Fluid Machines 3 <sup>rd</sup> Edition	Tata McGraw-Hill Co. Ltd.
03	Modi P.N. Seth S M	Hydraulics and Fluid Mechanics including Hydraulic Machines	Standard Book House New Delhi
04	Subramanya K.	Fluid Mechanics and Hydraulic Machines: problems and solution	Tata McGraw-Hill Co. Ltd.
05	Product catalogues of various pump manufacturers		

**Course Name : Diploma in Mechanical Engineering**

**Course Code : ME/MH/MI**

**Semester : Fourth**

**Subject Title : Thermal Engineering**

**Subject Code :**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	25#	25@	150

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

**Rationale:**

Mechanical Engineers have to work with various power producing & power absorbing devices like Boilers, Turbines, Compressor, I.C. Engines, and Pumps etc. In order to understand the principles, construction and working of the devices, it is essential to understand the concept of energy, work, heat and conversion between them.

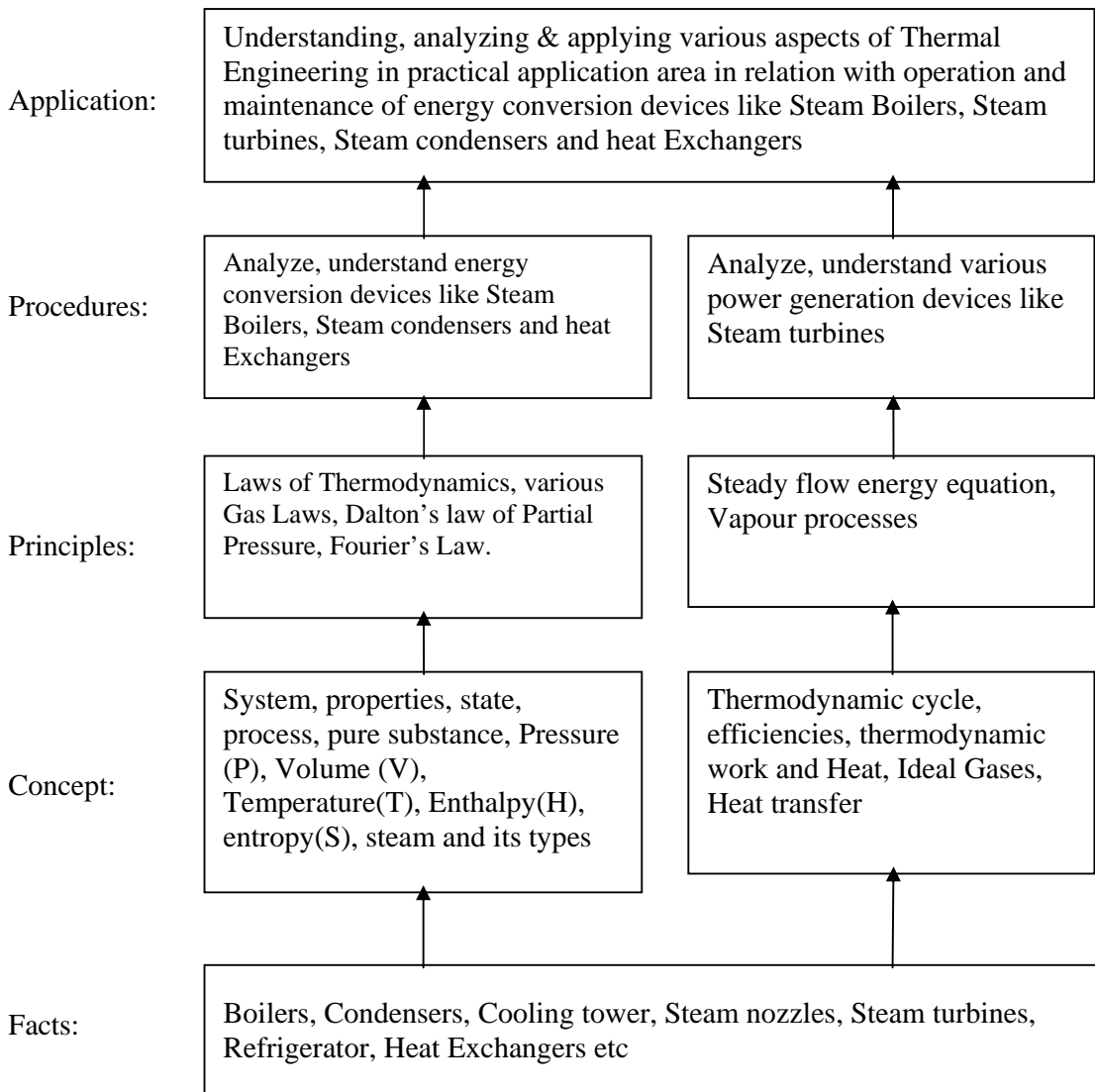
The subject is a related to Power Engineering and other related subjects in which the application of fundamental concepts of Thermal Engineering are included.

**General Objectives:**

The Student will be able to:

1. Understand fundamental concepts of thermodynamics to thermodynamic systems.
2. Use various laws of thermodynamics.
3. Apply various gas laws and ideal gas processes to various thermodynamic systems.
4. Understand construction and working of boilers, turbines & condensers.
5. Find properties of two phase system from steam table / mollier charts
6. Know various modes of heat transfer.

**Learning Structure:**



**Theory Content:**

Topic and Contents	Hours	Marks
<p><b>1. Fundamentals of Thermodynamics -----20 Marks</b>  <b>Specific objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Define fundamental concepts of Thermodynamics</li> <li>➤ Apply first law of thermodynamics to various thermodynamic devices.</li> <li>➤ Apply second law of thermodynamic.</li> </ul> <p>Contents</p> <p>1.1 Concepts of pure substance, types of systems , properties of systems- Extensive and Intensive properties, processes and cycles, Quasi-static process, flow and non flow process, Thermodynamic equilibrium, Point and path function.</p> <p>1.2 Work, Heat Transfer and Energy. Thermodynamic definition of work &amp; heat, Difference between heat and work. Energy –Potential Energy, Kinetic Energy, Internal Energy, Flow Work, concepts of enthalpy &amp; entropy.</p> <p>1.3 Laws of Thermodynamics- Zeroth Law, principle of law of conservation of energy First law of Thermodynamics, Second Law of Thermodynamics- Kelvin Planks, Clausius statements and their equivalence, Clausius inequality, Concept of perpetual motion machine of first and second kind.</p> <p>1.4 Application of Laws of Thermodynamic – Steady Flow Energy equation and its application to boilers, engine, nozzle, turbine, compressor &amp; condenser. Application of Second law of Thermodynamics to Heat Engine, Heat Pump and Refrigerator.</p>	12	20
<p><b>2. Ideal Gases -----12 Marks</b>  <b>Specific objectives:</b></p> <ul style="list-style-type: none"> <li>➤ State ideal gas laws</li> <li>➤ Represent various ideal gas processes on P-V and T-S diagrams</li> </ul> <p>Contents</p> <p>2.1 Concept of Ideal gas- Charle's law, Boyle's law, Avogadro's law, equation of state, characteristic gas constant and universal gas constant.</p> <p>2.2 Ideal gas processes: - Isobaric, Isochoric, Isothermal, Isentropic, Polytropic, and their representation on P-V and T-S diagram (only simple numerical based on above)</p>	08	12
<p><b>3. Steam and Steam Boiler -----20 Marks</b>  <b>Specific objectives:</b></p> <ul style="list-style-type: none"> <li>➤ State the concept of Steam generation.</li> <li>➤ Use of steam tables and Mollier chart.</li> <li>➤ Explain construction and working of different types of boilers and function of mountings &amp; accessories</li> </ul> <p>Contents</p> <p>3.1 Generation of steam at constant pressure with representation on various charts such as T-S, H-S. Properties of steam and use of steam table, Dryness fraction, Degree of superheat</p> <p>3.2 Vapour processes : -</p>	12	20

<p>Constant pressure, constant volume, constant enthalpy, constant entropy process (numerical using Mollier chart), Rankine Cycle.</p> <p>3.3 Steam Boilers: - Classification, Construction and working of - Cochran, Babcock and Wilcox, La-mont and Loeffler boiler. Boiler draught. Indian Boiler Regulation (IBR)</p> <p>3.4 Boiler mountings and accessories (to be covered in practical periods).</p>		
<p><b>4. Steam Nozzles and Turbines -----16 Marks</b></p> <p><b>Specific objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Define Mach number &amp; critical pressure.</li> <li>➤ State the application of steam nozzles.</li> <li>➤ Explain the principle of working of steam turbine</li> </ul> <p>Contents</p> <p>4.1 Steam nozzle: - Continuity equation, types of nozzles, concept of Mach number, critical pressure, application of steam nozzles.</p> <p>4.2 Steam turbine: - Classification of turbines, Construction and working of Impulse and Reaction turbine.</p> <p>4.3 Compounding of turbines and its types, Regenerative feed heating, bleeding of steam, governing &amp; its types, losses in steam turbines (no velocity diagrams and numerical).</p>	10	16
<p><b>5. Steam Condensers and Cooling Towers -----16 Marks</b></p> <p><b>Specific objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Apply Dalton's law to condenser.</li> <li>➤ Explain construction and working of condensers and cooling towers.</li> <li>➤ Analyze effect of air leakages in condenser</li> </ul> <p>Contents</p> <p>5.1 Dalton's law of partial pressure, function and classification of condensers, construction and working of surface condensers.</p> <p>5.2 Sources of air leakage and its effect, concept of condenser efficiency, vacuum efficiency (Simple numerical).</p> <p>5.3 Cooling Towers.-Construction and working of forced, natural and induced draught cooling tower.</p>	12	16
<p><b>6. Heat Transfer -----16 Marks</b></p> <p><b>Specific objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Describe various modes of heat transfer.</li> <li>➤ Describe construction and working of different types of Heat exchangers.</li> </ul> <p>Contents</p> <p>6.1 Modes of heat transfer: - Conduction, convection and radiation.</p> <p>6.2 Conduction :- Fourier's law, thermal conductivity, conduction through cylinder, thermal resistance, composite walls(Simple numerical)</p> <p>6.3 Radiation: - Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emissivity, black and gray bodies, Stefan-Boltzman law.</p> <p>6.4 Heat Exchangers: - Classification, Construction and working of Shell and tube, shell and coil and pipe in pipe type, plate type heat exchanger and its applications.</p>	10	16
<b>Total</b>	<b>64</b>	<b>100</b>

**Practical:**

Skills to be developed:

**Intellectual Skills:**

1. Understand various concepts and fundamentals of thermodynamics.
2. Understand vapour processes, principle of working of steam boilers and function of different mountings and accessories.
3. Understand construction and working of steam turbines and condensers.
4. Understand modes of heat transfer and concept of heat exchanges.
5. Interpret steam tables, Mollier chart and relationship between different thermodynamic properties.
6. Understand different sources of energy and their applications

**Motor Skills:**

1. Trace path of flue gases and water steam circuit in a boiler.
2. Collect information and write report on boiler and its mounting and accessories.
3. Conduct trial on the setup for calculation of thermal conductivity of metal rod
4. Collect information and write technical specifications of photovoltaic cells and identify different components on panels of photovoltaic cells.
5. Report writing on presentation given on Renewable sources of energy.

**List of Practicals:**

1. Trace and draw the path of flue gases and water-steam circuit with the help of boiler model.
2. Study and draw various types of Boiler mountings and Accessories.
3. Prepare a report on a visit to sugar factory / Dairy / steam power plant, with specifications of boiler and list of mountings and accessories.
4. Draw the sketches of impulse and reaction turbine ,describe their working
5. Study and draw jet condensers.
6. Calculation of thermal conductivity of a solid metallic rod.
7. Enlist the heat exchangers available in the laboratory. Classify them.
8. Mini project: - Student will prepare individually a report on Renewable Sources of Energy and make power point presentation

Collect information on following -

- a) Photovoltaic cells
- b) Solar water heating system
- c) Wind, Tidal and Geothermal energy
- d) Biogas, Biomass and Bio-diesel
- e) Hydraulic and Nuclear energy.



9. A power point presentation on above topics.

[Assignments to be completed in a group of (max.) four students. The topics should be distributed in the groups.]

**Learning resources:**

**Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
1	Domkundwar V. M.	A Course in Thermal Engineering	Dhanpat Rai & Co.
2	R. S. Khurmi	A text book of Thermal Engineering.	S. Chand & co. Ltd.
3	P. Chattopadhyay	Engineering Thermodynamics	Oxford university press
4	P. K. Nag	Engineering Thermodynamics	Tata McGraw –Hill, New Delhi
5	B. K. Sarkar	Thermal Engineering	Tata McGraw –Hill, New Delhi
6	P. L. Ballaney	A Course in Thermal Engineering	Khanna Publishers
7	R. K. Rajput	A Course in Thermal Engineering	Laxmi Publication, Delhi

**Course Name : Mechanical Engineering Group**

**Course code : ME/MH/MI/PG/PT**

**Semester : Third**

**Subject Title : Electrical Engineering**

**Subject Code : 174**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	---	25@	125

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

**Rationale:**

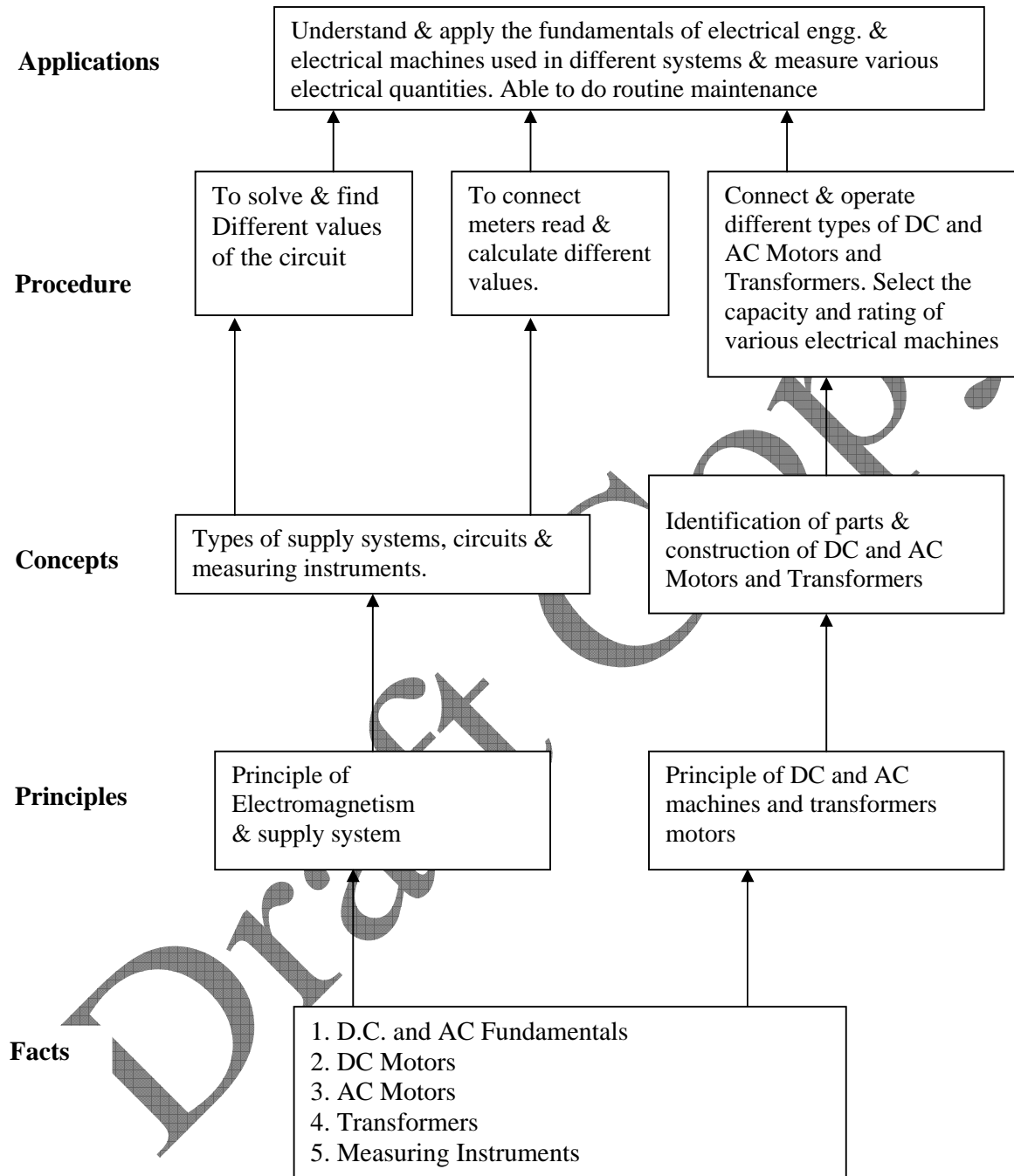
This subject is introduced with intention to teach students of mechanical branch facts, concepts, principles and procedure of operating electrical machines, circuits and systems and their applications. This subject is most important in regards to selection of electrical drives for various applications and will provide sufficient knowledge about electrical machines, equipments used in industry/field. This subjects deals with measurements of electrical quantities to judge the performance of electrical machines

**General Objectives:**

Student will be able to:

1. Differentiate between a.c. and d.c. supply.
2. Identify different type's motors, transformers and drives.
3. Select suitable drive as per the requirements.
4. Understand various types of electric heating and welding operations in manufacturing processes.
5. Supervise routine maintenance of electrical machines and supply systems.
6. Use the tariff system.
7. Calculate energy requirements and cost of energy.

**Learning Structure:**



**Theory:**

Topic and Content	Hours	Marks
<p><b>1. Introduction to Electric Power System and A. C. Supply</b> <b>20 Marks</b></p> <p><b>Specific Objectives:</b>  <b>Student will be able to :</b></p> <ul style="list-style-type: none"> <li>➤ Understand various components of power system.</li> <li>➤ Distinguish between a.c. and d.c. supply.</li> <li>➤ Calculate electrical quantities of a.c. supply and circuit parameters of R-L and R-C circuits.</li> <li>➤ Calculate line and phase quantities and various powers in three phase circuit</li> </ul> <p><b>Contents: Introduction</b> <b>04 Marks</b></p> <p>1.1 Electrical power supply system generation, transmission, distribution. AC supply &amp; DC Supply. <b>10</b></p> <p><b>AC Fundamentals:</b> <b>08 Marks</b></p> <p>1.2 Definitions; cycle, frequency, phase, period, maximum value, average value, r.m.s. value. <b>(Simple Numericals)</b></p> <p>1.3 Concept of current, voltage, power &amp; energy in series R-L and R-C circuits. <b>(Simple Numericals)</b></p> <p><b>Three phase supply:</b> <b>08 Marks</b></p> <p>1.4 Star and Delta circuit,  1.5 Line and Phase relationship, power equation. <b>(No Derivation, Simple Numericals)</b></p>	10	20
<p><b>2.Measuring Instruments:</b> <b>06 Marks</b></p> <p><b>Specific Objectives:</b>  <b>Student will be able to :</b></p> <ul style="list-style-type: none"> <li>➤ Understand ac and dc meters.</li> <li>➤ Use multimeter for measurements of current, voltage and passive parameter.</li> </ul> <p><b>Contents:</b></p> <p>2.1 Introduction to construction, operation and use of AC and DC ammeter, voltmeter (PMMC and MI meters only).</p> <p>2.2 Electro-dynamic wattmeter, energy meter and digital multimeter, Clip on meter.</p>	04	06
<p><b>3. DC Motor</b> <b>04 Marks</b></p> <p><b>Specific Objectives:</b>  <b>Student will be able to :</b></p> <ul style="list-style-type: none"> <li>➤ Understand working principle of d.c. motor.</li> <li>➤ Select type of d.c. motor as per requirement.</li> </ul> <p><b>Contents:</b></p> <p>3.1 Construction and principle of operation.</p> <p>3.2 Speed-torque characteristics. D.C. shunt, series and compound motors. Their specifications and applications.</p>	02	04
<p><b>4. Transformer:</b> <b>14 Marks</b></p> <p><b>Specific Objectives:</b>  <b>Student will be able to :</b></p> <ul style="list-style-type: none"> <li>➤ Understand working principle of transformer.</li> <li>➤ Calculate transformation ratio, efficiency and regulation from direct load test.</li> </ul> <p><b>Contents:</b></p>	06	14

<p>4.1 Construction and principle of operation.  4.2 EMF equation and transformation ratio.  4.3 Load test for efficiency and regulation. Specifications and rating.  4.4 Auto transformer &amp; 3 phase transformer concept only.  4.5 Applications of transformers.</p>		
<p><b>5. AC Motor: 24 Marks</b>  <b>Specific Objectives:</b>  <b>Student will be able to :</b></p> <ul style="list-style-type: none"> <li>➤ Describe working principle of three phase induction motor.</li> <li>➤ Calculate slip and rotor frequency and draw speed-torque curves.</li> <li>➤ Use starter for three phase induction motor.</li> <li>➤ Understand working principle of single phase induction motor and its types.</li> <li>➤ Select proper type of single phase induction motor.</li> </ul> <p><b>Contents:</b>  <b>5.1 Three Phase Induction Motor: 10 Marks</b></p> <ul style="list-style-type: none"> <li>➤ Construction and principle of operation of 3 phase induction motor.</li> <li>➤ Speed torque characteristics, slip, speed control of Induction Motor by variable frequency drive( VFD)-working principle and block diagram only, Reversal of rotation (Simple Numerical on speed and slip calculations)</li> <li>➤ Starters-Direct ON Line Starters and Star-Delta Starters-Working principle, circuit diagram and applications.</li> </ul> <p><b>5.2 Single Phase Induction Motors 04 Marks</b>  a) Capacitor start, b) Capacitor start and run, c) Shaded pole</p> <p><b>5.3 Other Motors: 06 Marks</b>  Study the following motors with respect to specifications and rating, construction and applications.</p> <ul style="list-style-type: none"> <li>➤ Universal motor</li> <li>➤ Servo motor</li> <li>➤ Stepper motor</li> </ul> <p><b>5.4 Alternator: 04 Marks</b>  Construction, principle of operation &amp; applications. Self and separate excitation.</p>	10	24
<p><b>6.Utilization of Electrical Energy: 18 Marks</b>  <b>Specific Objectives:</b>  <b>Student will be able to :</b></p> <ul style="list-style-type: none"> <li>➤ Classify and select electric drives on the basis of speed-torque characteristics and enclosures.</li> <li>➤ Understand working principle of electric heating, welding and electroplating.</li> <li>➤ Use electric motor for electro-agro system.</li> </ul> <p><b>Contents:</b>  <b>6.1 Industrial Applications: 04 Marks</b></p> <ul style="list-style-type: none"> <li>➤ Classification of drives</li> <li>➤ Factors for selection of motor for different drives.</li> <li>➤ Types of enclosures.</li> </ul> <p><b>6.2 Electric Heating &amp; Welding: 10 Marks</b>  Working principle &amp; types of heating and welding and their applications.</p> <p><b>6.3 Electrometallurgical &amp; Electro Agro Systems: 04 Marks</b>  Concept and principle used in electroplating.</p> <ul style="list-style-type: none"> <li>➤ Electrical machines used in electro-agro systems.</li> </ul>	08	18
<p><b>7.Electric Wiring, Illumination, Electric Safety, Tariff &amp; Power</b></p>	08	14

<p><b>Conservation :</b> <span style="float: right;"><b>14 Marks</b></span></p> <p><b>Specific Objectives:</b>  <b>Student will be able to :</b></p> <ul style="list-style-type: none"> <li>➤ Do wiring of switchboards.</li> <li>➤ Select type of lamp as per requirement.</li> <li>➤ Understand importance of MCB and ELCB and electric safety.</li> <li>➤ Understand need of earthing and importance of pf. improvement.</li> </ul> <p><b>Contents:</b></p> <p>7.1 Introduction to switches used in mechanical machines. Simple Electric Installations with 2 sockets, 2 fans, 2 lamps, with switches and fuses</p> <p>7.2 Introduction to different accessories like MCB, ELCB, wires &amp; cables.</p> <p>7.3 Fluorescent, CFL and LED lamps with their ratings and applications.</p> <p>7.4 Concept of energy conservation and energy audit</p> <p>7.5 Necessity of earthing, type, safety tools, first aid.</p> <p>7.6 Types of tariff, pf improvement only methods.</p> <p>7.7 Fire extinguishing methods adopted in electrical engineering</p> <p>7.8 Trouble shooting electrical installations and machines.</p>		
<b>Total</b>	<b>48</b>	<b>100</b>

**Skills to be developed for practical:**

**Intellectual skills**

**Student will be able to:**

1. Identify and give specifications of electrical motors and transformers.
2. Interpret wiring diagrams for various applications.
3. Identify safety equipments required.
4. Decide the procedure for setting experiments.

**Motor skills:**

**Student will be able to:**

1. Draw wiring diagram
2. Make wiring connections to connect electrical equipments and instruments.
3. Measure electrical power, earthing resistance and other electrical quantities.
4. Calibrate electrical instruments.
5. Use of safety devices while working.
6. Prepare energy consumption bill with present tariff structure.

**List of Practical:**

1. Know your electrical laboratory.
2. Understand the performance of R-L series circuit with single phase A.C. supply and determine the current, power and power factor.
3. Understand the performance of R-C series circuit with single phase A.C. supply and determine the current, power and power factor.
4. Verify the relationship between line and phase values of voltages and currents in three phase balanced star and delta connected load.
5. Determine efficiency and single phase transformer at no load, half load and full load by conducting load test.
6. Determination of slip of three phase induction motor by use of tachometer at no load and full load.
7. Observe the change in direction of rotation of three phase induction motor by changing the phase sequence R-Y-B
8. Prepare switch board for two lamps, one fan, one fan regulator and one 5 ampere socket.
9. Connect single phase energy meter in simple lamp circuit for measurement of energy consumption for one hour.
10. Search fault in faulty machines or installation.
11. Demonstration of servo motor and stepper motor.

**[Note: Practicals 1 to 9 shall be performed by 2 students and practical 10 in a group of 4 students]**

**Assignment:**

1. **Industrial visit:** Visit to show various motors, electrical devices, accessories used in mechanical industrial applications like dairy, crushers, dall mill, oil mill or small scale unit. [The group size is as suggested by industry]
2. Detail study of electrical motors manufacture's catalogues to study mounting installation, frame work, coupling, rotor inertia etc. [To be performed individually]

**NOTE: All Practicals and assignment are compulsory and should be considered in assessment formats A1, A2 And So On.**

**Learning Resources:****1. Books:**

Sr.No.	Author	Title Of Book	Edition	Publisher
01	B.L. Theraja	Electrical Technology (Vol. I and IV)	Multicolour Edition 2005 And Subsequent Reprint	S.Chand & Co. Ramnagar New Delhi
02	E. Hughes	Electrical Technology	Second Edition	ELBS/Pearson
03	R.S. Ananda Murthy	Basic Electrical Engineering	Second Edition	Pearson
04	Theodore Wildi	Electrical Machines, Drives and Power Systems	Sixth Edition	Pearson
05	Sunil T. Gaikwad	Basic Electrical Engineering	First Edition	WILEY India

**2. Websites:**

www.wikipedia.com  
 www.youtube.com  
 www.narosa.com  
 www.dreamtechpress.com

**List of Equipments**

Sr No.	List of Equipments	Qty.
1	Portable MI type A.C. ammeter range (0-5A)	05
2	Portable MI type A.C. voltmeter range (0-150/300V)	05
3	Portable MI type A.C. voltmeter range (0-15/30/75 V)	05
4	Portable electro-dynamometer type wattmeter (10/20 A and 250/500V)	05
5	Portable electro-dynamometer type power factor meter (10/20 A and 250/500V)	05
6	Rheostat (0-250 Ohm,2A)	05
7	Rheostat (0-90 Ohm,5A)	05
8	3 phase load bank of 10A capacity/phase suitable for 415V	02
9	Single phase 230/115V,50Hz,1kVA natural air cooled transformer	02
10	Analog type (0-5000 r.p.m.) tachometer	02
11	A three phase 415 V, 50Hz , 4h.p. squirrel cage induction motor	02
12	A simple model of servometer for demo	01
13	A small model of stepper motor for demo	01
14	A single Phase 230 V, 5A electrical/electronic energy meter	02



**Course Name : Mechanical Engineering Group**

**Course code : AE/ME/MH/MI/PG/PT**

**Semester : Fourth**

**Subject Title : Theory of Machines**

**Subject Code :**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					TOTAL
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	
03	--	02	03	100	--	---	25@	125

**NOTE:**

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)

**Rationale:**

It is a core technology subject in Mechanical Engineering Discipline. Mechanical Engineers often come across various machines in practice. They should be able to identify and interpret various elements of machines in day to day life. In maintaining various machines, a diploma engineer should have sound knowledge of fundamentals of machine and mechanism. It will be helpful for them to understand the mechanisms from operational point of view in a better way. This subject imparts the kinematics involved in different machine elements and mechanisms like gear, cam-follower, follower, belt-pulley, flywheel, brake, dynamometer, clutch, etc.

Detailed knowledge of these aspects with deep insight into the practical applications develops a professional confidence in them to become successful Engineer.

This subject serves as a prerequisite for subjects like Machine Design to be learned in higher semester.

**Objectives:**

**The student will be able to:**

1. Understand different machine elements and mechanisms.
2. Understand Kinematics and Dynamics of different machines and mechanisms.
3. Draw cam profile suitable to various displacement diagram.
4. Select Suitable Drives and Mechanisms for a particular application
5. Understand the function, operation and application of flywheel and governor.
6. Understand the function, operation and application of brake, dynamometer, clutch and bearing
7. Find magnitude and plane of unbalanced forces.

**Theory:**

Topic and Content	Hours	Marks
<p><b>1. Fundamentals and type of Mechanisms</b></p> <p>Specific objectives:</p> <ul style="list-style-type: none"> <li>➤ Define various terms related to mechanisms.</li> <li>➤ Explain construction and working of various mechanisms</li> </ul> <p>1.1 Kinematics of Machines:- Definition of Kinematics, Dynamics, statics, Kinetics, Kinematics link, Kinematics pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. ----- 8 Marks</p> <p>1.2 Inversion of Kinematic Chain</p> <ul style="list-style-type: none"> <li>• Inversion of four bar chain, coupled wheels of Locomotive, Beam engine, Pantograph.</li> <li>• Inversion of single slider Crank chain –Pendulum pump, Rotary I.C. Engines mechanism, Oscillating cylinder engine, Whitworth quick return mechanism. Quick return mechanism of shaper.</li> <li>• Inversion of Double Slider Crank Chain- Scotch Yoke Mechanism, Elliptical trammel, Oldham's Coupling ----- 8 Marks</li> </ul>	07	16
<p><b>2. Velocity and Acceleration in Mechanisms</b></p> <p>Specific objectives</p> <ul style="list-style-type: none"> <li>➤ Draw velocity and acceleration diagram for given mechanism</li> </ul> <p>2.1 Concept of relative velocity and relative acceleration of a point on a link, angular acceleration, inter-relation between linear and angular velocity and acceleration.</p> <p>2.2 Analytical method (No derivation) and Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism. -----8 Marks</p> <p>2.3 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple Mechanism. Determination of velocity and acceleration of point on link by relative velocity method(Excluding Coriolis component of acceleration) ----- 8 Mark</p>	08	16
<p><b>3. Cams and Followers</b></p> <p>Specific objectives</p> <ul style="list-style-type: none"> <li>➤ Define the terms related to Cam</li> <li>➤ Classify Cams and Followers</li> <li>➤ Draw cam profile as per the given applications</li> </ul> <p>3.1 Concept, definition and applications of Cams and Followers. Cam terminology</p> <p>3.2 Classification of Cams and Followers.</p> <p>3.3 Different follower motions and their displacement diagrams - Uniform velocity, Simple harmonic motion, uniform acceleration and Retardation. ---- 4 Marks</p> <p>3.4 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method) -----8 Marks</p>	06	12
<p><b>4. Power Transmission</b></p> <p>Specific objectives</p> <ul style="list-style-type: none"> <li>➤ Give broad classification of Drives.</li> </ul>	10	20

<ul style="list-style-type: none"> <li>➤ Select Suitable Drives and Mechanisms for a particular application</li> <li>➤ Calculate various quantities like velocity ratio, belt tensions, slip, angle of contact, power transmitted in belt drives</li> </ul> <p>4.1 Belt Drives- flat belt, V-belt &amp; its applications, material for flat and V-belt. Selection of belts, angle of lap, length of belt, Slip and creep. Determination of velocity ratio, of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Simple numerical) ----- 8 Marks</p> <p>4.2 Chain Drives- Types of chains and sprockets, velocity ratio. Advantages &amp; Disadvantages of chain drive over other drives, Selection of Chain &amp; Sprocket wheels, methods of lubrication. ----- 4 Marks</p> <p>4.3 Gear Drives – Classification of gears, Law of gearing, gear terminology. Types of gear trains, their selection for different applications. Train value &amp; velocity ratio for simple, compound, reverted and epicyclic gear trains. 8 Marks</p>		
<p><b>5. Flywheel and Governors</b></p> <p>Specific objectives</p> <ul style="list-style-type: none"> <li>➤ Differentiate between flywheel and governor</li> <li>➤ Explain with neat sketch the construction and working of various governors</li> </ul> <p>5.1 Flywheel –Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C Engine (no Numericals) Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance.</p> <p>5.2 Governors- Types, concept, function and application &amp; Terminology of Governors.</p> <p>5.3 Comparison between Flywheel and Governor.</p>	04	08
<p><b>6. Brakes and Dynamometers.</b></p> <p>Specific objectives</p> <ul style="list-style-type: none"> <li>➤ List the differences between brakes and dynamometers</li> <li>➤ Explain with neat sketch the construction and working of various brakes and dynamometers</li> <li>➤ Calculate braking force, braking torque and power lost in friction in shoe and band brake</li> </ul> <p>6.1 Function of brakes and Dynamometers, Type of brakes &amp; Dynamometers, comparison between brakes &amp; Dynamometer.</p> <p>6.2 Construction and working i) shoe brake, ii) Band brake iii) Internal expanding shoe brake iv) Disc Brake</p> <p>6.3 Numerical problems to find braking force and braking torque and power for shoe and band brake.</p> <p>6.4 Construction and working of i) Rope brake Dynamometer ii) Hydraulic Dynamometer iii) Eddy current Dynamometer.</p>	05	10
<p><b>7. Clutches and Bearings.</b></p> <p>Specific objectives</p> <ul style="list-style-type: none"> <li>➤ Explain the difference between uniform pressure and uniform wear theories</li> <li>➤ Explain with neat sketch, the construction and working of various clutches</li> <li>➤ Calculate torque required to overcome friction and power lost in friction in clutches and footstep bearings</li> </ul> <p>7.1 Clutches- Uniform pressure and Uniform Wear theories. Function of Clutch</p>	06	12

and its application, Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch v) Diaphragm clutch, (Simple numerical on single and Multiplate clutch). 7.2 Bearings- i) Simple Pivot, ii) Collar Bearing iii) conical pivot. Torque and power lost in friction. (Simple numerical)		
<b>8. Balancing</b> Specific objectives ➤ Explain the concept of balancing ➤ Find balancing mass and position of plane, analytically and graphically. 8.1 Concept of balancing. Balancing of single rotating mass. Analytical/Graphical method for balancing of several masses revolving in same plane.	02	06
<b>Total</b>	<b>48</b>	<b>100</b>

**Practicals:****Skills to be developed:****Intellectual Skills:**

1. Determine velocity and acceleration of links in a given mechanism.
2. Analyse balancing of rotating masses in a single plane.
3. Interpret interrelationship between components of various braking mechanisms.
4. Compare various power transmission devices.

**Motor Skills:**

1. Drawing of velocity and acceleration diagrams.
2. Dismantle and assemble given brakes and clutches.
3. Draw cam profiles for a given application
4. Draw velocity and acceleration diagram of the given mechanisms
5. Draw force polygon for unbalanced masses revolving in same plane

**Note-** The Term work shall consist of Journal / lab manual and A-3 size sketch book.

**List of Practical:**

- 1) Sketch and describe Working of quick return mechanism for a shaper. Find the ratio of time of cutting stroke to the time of return stroke for the same
- 2) Sketch and explain the working of the following mechanisms
  - a) Bicycle free wheel sprocket mechanism
  - b) Geneva mechanism
  - c) Ackermans steering gear mechanism
  - d) Foot operated air pump mechanism (Evaluate the effort at pedal for a given pump pressure)
- 3) Determine velocity and acceleration of various links of the given two mechanisms, by relative velocity method.(Any two mechanism)
- 4) Determine velocity and acceleration of piston of an I. C. engine's Slider Crank mechanism by Klein's construction
- 5) Describe the working and function of flywheel. Determine the coefficient of fluctuation of speed for a given turning moment diagram.
- 6) Draw a schematic diagram of Hartnell governor (or any other governor) and describe its working. Draw a graph between radius of rotation versus speed of the governor.
- 7) Sketch the two wheeler braking system and identify the functions of various components. Dismantle and assemble mechanically operated braking mechanism of two wheelers.
- 8) Dismantle and assemble multi-plate clutch of two-wheeler. Draw neat sketch and state the functions of various components

- 9) Determine graphically counterbalance mass and its direction for completely balancing a system of several masses rotating in a single plane.

**Learning Resources:**

**Books:**

Sr. No.	Title	Author	Edition	Publication
01	Theory of Machines	Khurmi Gupta	--	Eurasia publishing House Pvt. Ltd. 2006 edition
02	Theory of Machines	S.S. Rattan	Third	McGraw Hill companies, II Edition
03	Theory of Machines	P.L. Ballaney	--	Khanna Publication
04	Theory of Machines	Jagdishlal	--	Bombay metro-politan book limited
05	Theory of Machines	Sadhu Singh	Second	Pearson
06	Theory of Machines	Ghosh – Mallik	--	Affiliated East west press
07	Theory of Machines	Thomas Bevan	Third	Pearson
08	Theory of Machines	J.E. Shigley	Third	Oxford

**Course Name : Mechanical Engineering Group**

**Course Code : ME/PG/PT/MH/MI**

**Semester : Fourth**

**Subject Title : Manufacturing Process**

**Subject Code :**

**Teaching and Examination Scheme**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	25#	--	50@	175

**Rationale:**

Diploma technician often comes across various types of basic manufacturing processes. He/she is required to select, operate and control the appropriate processes for specific applications. He/she is also required to know about various cutting tools, latest improvements in manufacturing processes. This is a core technology subject. The diploma technician should know how the raw material gets processed through various processes and ultimately results into finished goods.

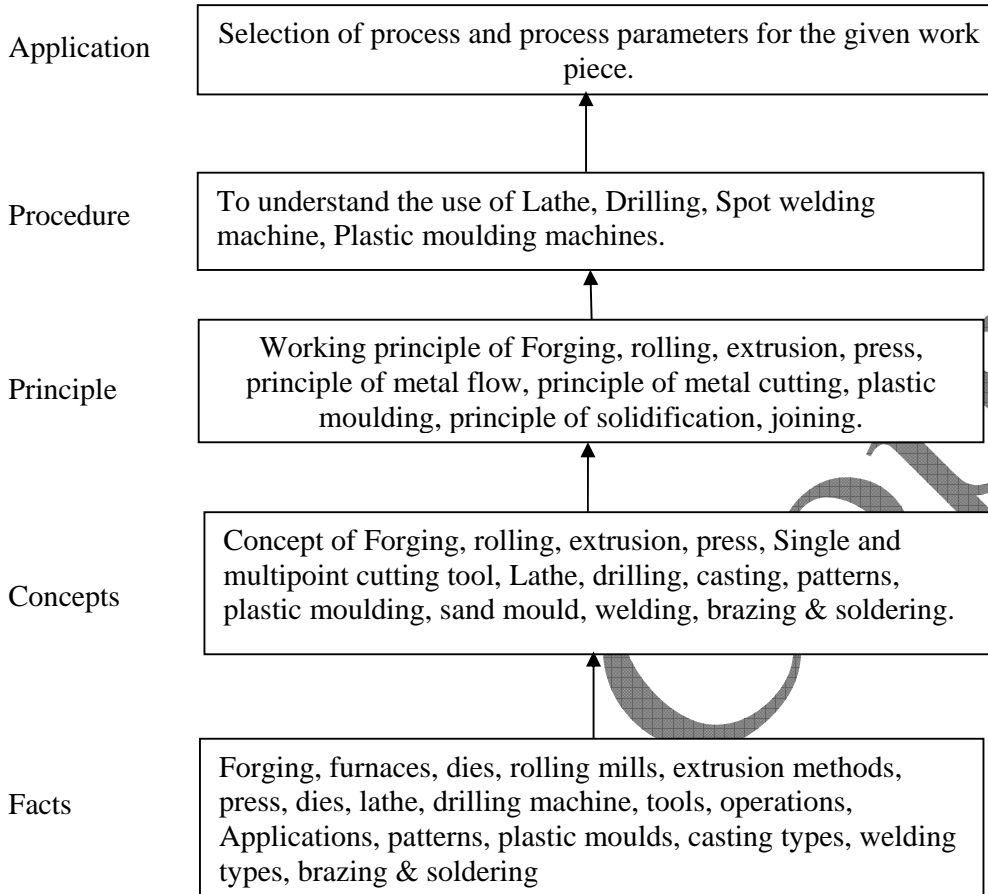
Hence it is essential that, he has understanding of basic manufacturing processes, machines, tools and equipments. With sound knowledge of this subject, the diploma technician will be able to handle and control practical situations more effectively and confidently.

**Objectives:**

The student will be able to:

- 1) Use the basic machine tools like lathe and drilling .
- 2) Produce and inspect the job as per specified dimensions.
- 3) Select the specific manufacturing processes for the desired output.
- 4) Adopt safety practices while working on various machines.
- 5) Understand and select plastic moulding processes.
- 6) Know and identify basic manufacturing process for different components to be machined.

**Learning Structure:**



**Theory:**

Topic and Content	Hours	Marks
<b>1:Forming Processes</b> <b>18 Marks</b> <b>Specific Objectives:</b> <ul style="list-style-type: none"> <li>➤ To know and identify basic manufacturing process for different components to be machined.</li> </ul> <b>Content</b> <b>1.1 Drop forging:</b> <b>06 Marks</b> Upset forging, press forging(die forging),open die & closed die forging, forging operations <b>1.2 Rolling:</b> <b>06 Marks</b> Principle of rolling, hot & cold rolling, Types of rolling mill, application of rolling <b>1.3 Extrusion:</b> <b>06 Marks</b> Direct & indirect extrusion, Advantages, disadvantages and Applications.	08	18
<b>2. Press working:</b> <b>16Marks</b> <b>Specific Objectives:</b> <ul style="list-style-type: none"> <li>➤ Know and identify basic press operations and tools.</li> </ul> <b>Content</b> 2.1 Press classification, press operations like punching/piercing, blanking, notching, lancing <b>06 Marks</b> 2.2 Die set components and types of dies <b>06 Marks</b> 2.3 Forming Operations: Bending, drawing <b>04 Marks</b>	08	16
<b>3. Casting Processes:</b> <b>22 Marks</b> <b>Specific Objectives:</b> <ul style="list-style-type: none"> <li>➤ To study and understand the use of casting as a basic manufacturing process.</li> </ul> <b>Content</b> <b>3.1 Pattern making:</b> <b>06 Marks</b> Basic steps in making casting, Pattern : types, materials and allowances, tools, colour coding of patterns <b>3.2 Moulding:</b> <b>06 Marks</b> Types of moulding sands, properties of sand, moulding methods, cores and core prints, elements of gating system, bench moulding, floor moulding, pit moulding, machine moulding. <b>3.3 Casting:</b> <b>06 Marks</b> Furnaces: Construction and working of cupola furnace, electric arc furnace. - Methods & applications of - Centrifugal casting, shell moulding, investment casting, Casting defects - Causes & remedies. <b>3.4 Hot chamber and cold chamber die casting, Die casting defects - Causes &amp; remedies.</b> <b>04 Marks</b>	10	22
<b>4. Welding</b> <b>14 Marks</b> <b>Specific Objectives:</b> <ul style="list-style-type: none"> <li>➤ To study and observe the use of welding as a manufacturing process.</li> </ul> <b>Content</b> <b>4.1 Introduction &amp; classification of welding processes -</b> Gas welding, carbon arc welding, shielded metal arc welding, TIG welding, MIG welding, plasma arc welding, resistance welding types-spot, seam projection. Electron beam welding, laser beam welding, welding defects. <b>10 Marks</b> <b>4.2 Introduction to soldering and brazing –</b>	07	14



Process, fillers, heating methods & applications.	<b>04 Marks</b>		
<b>5. Machining Operations</b>	<b>20 Marks</b>		
<b>Specific Objectives:</b>			
➤ To observe & understand the use of basic machine tools like lathe, drilling milling and broaching.			
<b>Content</b>			
<b>5.1 Lathe Machine:</b>	<b>12 Marks</b>		
Introduction, classification and basic parts of center lathe & their functions, Lathe operations like facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling. Cutting tool nomenclature & tool signature, cutting parameters.		10	20
<b>5.2 Drilling Machine:</b>	<b>08 Marks</b>		
Introduction, classification, basic parts of radial drilling machine and their functions, twist drill nomenclature, drilling machine operations like drilling, reaming, boring, counter sinking, counter boring, spot facing. cutting parameters.			
<b>6. Plastic Moulding:</b>	<b>10 Marks</b>		
<b>Specific Objectives:</b>			
➤ To understand and select the plastic moulding processes.			
<b>Content</b>			
Introduction, Properties of plastics, types of plastics, plastic moulding methods - compression moulding, injection moulding, blow moulding, extrusion, vacuum forming and calendaring.		05	10
	<b>Total</b>	<b>48</b>	<b>100</b>

**Practical:**

Skills to be developed:

**Intellectual skills:**

- 1) Identify basic manufacturing processes like forging, rolling and extrusion, for required component.
- 2) Specify need of pattern allowances.
- 3) Decide process parameters for different operations.
- 4) Decide tools required for a manufacturing process.
- 5) Identify a joining method for fabrication.

**Motor Skills:**

- 1) Operate lathe, drilling machine.
- 2) Set the tool and select the cutting parameters for machining operations.
- 3) Set the tools, job and decide cutting parameters.
- 4) Inspect various dimensions of jobs by using measuring instruments.
- 5) Make simple wooden / thermocole pattern.

**List of Practical:**

- 1) One turning job on lathe containing the operations like plain turning, step turning, taper turning, grooving, knurling and chamfering.
- 2) One job using Spot welding machine. (Min. 4 spots on 0.5-1mm thick metal strip.)
- 3) One simple job on TIG / MIG welding setup or visit to TIG / MIG welding shop.

- 4) Moulding practice for any one pattern.
- 5) Industrial visit to observe plastic processing shop and report on the visit.
- 6) One composite job containing the operations like lathe with axial & across drilling (like Nut- Bolt assembly or any other equivalent job).
- 7) Demonstration of eccentric turning using four jaw chuck.

**Notes:**

- 1] The workshop instructors should prepare specimen job in each shop as demonstration practice before the student (as per the drawing given by subject teacher/ workshop superintendent).
- 2] Theory behind practical is to be covered by the concerned subject teacher/ workshop superintendent.
- 3] Workshop diary should be maintained by each student duly signed by respective shop instructors.
- 4] Assignments are to be assessed by the concerned subject teacher/ workshop superintendent.

**Guidelines for conducting Practical Examination for MANUFACTURING PROCESSES**

1. The job drawing must be jointly decided by the External and Internal examiner prior to one day in advance from the commencement of practical examination. Every student should be supplied the copy of job drawing before examination.
2. Time for practical examination should be **THREE HOURS**.
3. Practical examination of the students shall consists of Turning job containing different operations like Facing, straight Turning, Taper turning, Chamfering, Knurling , Threading, Grooving. (Minimum 5 operations) Students will perform the job as per the drawing provided to them.
4. Raw material size – Bar dia. 40 to 50 mm, length 80 to 100 mm.

**Learning Resources:****Books:**

Sr. No.	Author	Title	Publisher
01	S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology-Volume I & II	Media Promoters and Publishers Limited
02	O. P. Khanna & Lal	Production Technology Volume- I & II	Production Technology Volume- I & II Dhanpat Rai Publications.
03	W. A. J. Chapman, S. J. Martin	W. A. J. Chapman, S. J. Volume –I,II	Viva Books (p) Ltd.
04	O.P. Khanna	A text book of Foundry Tech.	Dhanpat Rai Publications.
05	H.S. Bawa	Workshop Technology Volume- I & II	Tata McGraw-Hill
06	P.C. Sharma	Production Engg.	S. Chand Publications.

**Course Name : Mechanical Engineering Group**

**Course Code : AE/ME/PG/PT/MH/MI**

**Semester : Fourth**

**Subject Title : Professional Practices-IV**

**Subject Code :**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	03	--	--	--	--	50@	50

**Rational:**

The purpose of introducing Professional practices is to fulfill the need of students to stand in today's global market with knowledge and confidence. This can be achieved by arranging industrial visits, expert lectures attitude to present them-selves, get alternative solutions and validation of the selected alternatives, socially relevant activities, and modular courses. Professional Practices is helpful in broadening technology base of students beyond curriculum. Model making exercises allow students to think more creatively and innovatively and inculcating habit of working with their own hands. Modular courses are introduced with a view of learning and acquiring higher technology skills through industry experts and consultants from the respective fields.

**Objectives:**

The student will be able to:

- 1) Acquire information from different sources.
- 2) Prepare notes for given topics
- 3) Present seminar using power projection system.
- 4) Interact with peers to share thoughts.
- 5) Work in a team and develop team spirit.

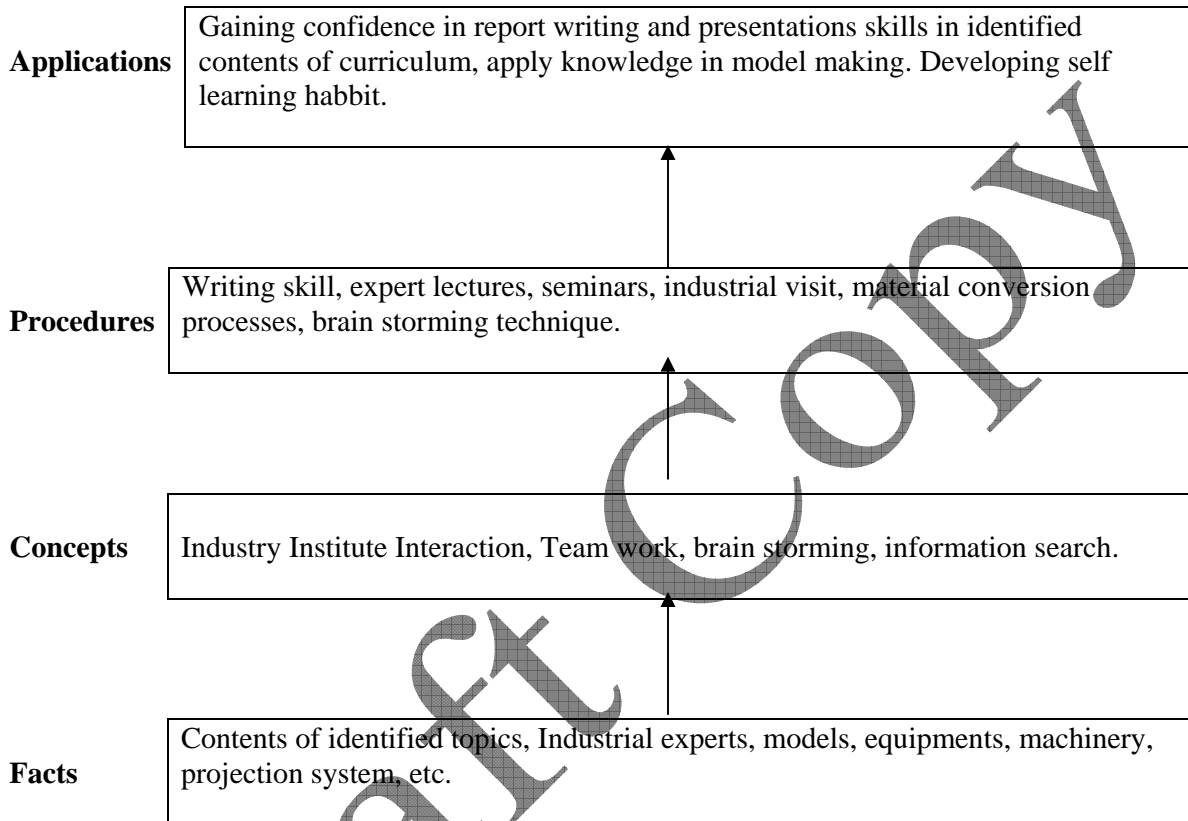
**Intellectual Skill:**

Student will be able to-

- 1) Search information from various resources.
- 2) Prepare notes on selected topics.
- 3) Participate in group discussions.

**Motor Skills:**

- 1) Observe industrial practices during visits.
- 2) Prepare slides / charts for presentation in seminar.
- 3) Develop a model

**Learning Structure:**

**Content:**

Topic & Content	Hours
<p><b>1: Information Search –</b> Information search be made through manufacturers catalogue, Hand books, magazines journal and websites, and submit a report on <b>any Two Topics</b> in a group of 3 to 4 students, report size shall not be more than 10 pages. Following topics are suggested, any other equivalent topics may be selected.</p> <ul style="list-style-type: none"> <li>i) Present scenario of electric power generation in Maharashtra state /India.</li> <li>ii) Composite materials – Types, properties &amp; application</li> <li>iii) Material handling equipments commonly used in industries.</li> <li>iv) Advances in Automobile engines.</li> <li>v) Hydraulic steering systems of Automobile.</li> <li>vi) Mechanisms used to produce straight-line motion.</li> <li>vii) Mechanisms used for generating intermittent motion.</li> <li>viii) Advanced surface coating techniques like chemical vapor deposition, ion implantation, physical vapor deposition.</li> <li>ix) Types of cutting tools- specification, materials and applications.</li> <li>x) Booking of E-Tickets for Railways/Buses/Air travel.</li> <li>xi) Profiles of 2 multinational companies.</li> <li>xii) Engine lubricants, coolants and additives</li> <li>xiii) Power steering, power windows</li> <li>xiv) ABS(anti lock braking systems)</li> <li>xv) MPFI(multi point fuel injection) system</li> <li>xvi) Role of MIDC, MSSIDC, DIC, Financial institutions in development of industrial sector.</li> <li>xvii) Solar energy systems - Components and their functions, applications</li> <li>xviii) Design data book - Study and use of types of data.</li> </ul>	10
<p><b>2. Lectures by professionals/Industry Experts-</b> Two lectures of two hour duration be arranged on any two topics suggested below or any other suitable topics <b>to acquire practical information beyond scope of curriculum.</b> Students shall prepare a brief report of each lecture as a part of their term work.</p> <ul style="list-style-type: none"> <li>i) Components of project Report</li> <li>ii) Various loan schemes of banks, LIC and other agencies for education and other purposes.</li> <li>iii) Use of plastics &amp; rubbers in Automobiles industries.</li> <li>iv) Type of processes used to protect material surfaces from environmental effect.</li> <li>v) Product life cycle.</li> <li>vi) Industrial application of mechatronics.</li> <li>vii) Special features of CNC machines</li> <li>viii) Gear manufacturing &amp; gear teeth finishing processes.</li> <li>ix) Gear boxes-industrial &amp; Automobile applications.</li> <li>x) Super-finishing operation &amp; their industrial applications.</li> <li>xi) Processing methods for plastic components.</li> <li>xii) Features of modern boilers</li> <li>xiii) Strainers and filters –Types, functions and applications</li> <li>xiv) Industrial drives-Types, components, comparison and applications.</li> </ul>	06
<p><b>3. Seminars:</b> One seminar be arranged on the subjects related to 4<sup>th</sup> semester. Or topics beyond curriculum. Each student shall submit a report up to 10 pages and deliver the seminar. batch size – 2-3 students.</p>	06

<p>Source of information – books, magazine , Journals, Website ,surveys, Topics suggested for guidance-</p> <ol style="list-style-type: none"> <li>i) Clutches- Types, Principles, working, &amp; applications.</li> <li>ii) High pressure boilers.</li> <li>iii) Heat exchangers-Types, working, applications.</li> <li>iv) Hydraulic turbines-Types, working,&amp; applications.</li> <li>v) Hydraulic pumps -Types, working, &amp; applications.</li> <li>vi) Sensors -Types, principle, &amp; applications.</li> <li>vii) Super conductor technology - Types, principle, &amp; applications.</li> <li>viii) Semi conductors-. Types, materials, &amp; applications.</li> <li>ix) Industrial breaks- Types, construction, working, &amp; applications.</li> </ol>	
<p><b>4. Industrial Visits</b> Structured industrial visits be arranged and report of the same shall be submitted by each student to form a part of the term work. No of visits- At least one Scale of industry- medium scale unit, large scale unit. Group size- practical batch Report-not exceeding 7 to 10 pages. Purpose :</p> <ul style="list-style-type: none"> <li>➤ To study the profile of industry</li> <li>➤ To see the advanced manufacturing processes &amp; machinery.</li> <li>➤ To observe working of CNC machines, work centre's ,flexible manufacturing systems</li> <li>➤ To observe working in foundry ,forging shop, press shop, heat treatment shop etc.</li> <li>➤ To observe chip less manufacturing machines &amp; processes.</li> <li>➤ To study process sheets , quality control charts &amp; production drawings, metallurgical testing laboratory</li> <li>➤ To observe Tool room, standards room etc.</li> </ul> <p>Following types of industries may be visited in &amp; around the institute.</p> <ol style="list-style-type: none"> <li>i) Foundry</li> <li>ii) Forging units</li> <li>iii) Sheet metal processing unit</li> <li>iv) Machine/ Automobile component manufacturing unit</li> <li>v) Fabrication unit/ powder metallurgy component manufacturing unit.</li> <li>vi) Machine tool manufacturing unit.</li> <li>vii) Any processing industry like chemical, textile, sugar, agriculture, fertilizer industries.</li> <li>viii) Auto workshop / four wheeler garage.</li> <li>ix) City water supply pumping station</li> <li>x) Hydro electric power plant,</li> <li>xi) Wind mills, Solar Park</li> </ol>	08

<p><b>5. Socially Relevant Activities</b>  Conduct any one activity through active participation of students and write the report.  Group of students- maximum 4  Report- Not more than 6 pages  List of suggested activities- ( activities may be thought in terms of campus improvement)</p> <ol style="list-style-type: none"> <li>i) Awareness about carbon credit</li> <li>ii) Anticorruption movement</li> <li>iii) Awareness about cyber crimes.</li> <li>iv) Developing good citizens.</li> <li>v) Management of E- WASTE</li> <li>vi) Recycling of waste materials.</li> <li>vii) Accident prevention &amp; enforcement of safely rules.</li> <li>viii) Awareness about pollution and pollution control.</li> <li>ix) Any other relevant activity may be performed)</li> </ol>	06
<p><b>6. Mini Projects</b>  Students, in a group of 4, shall perform any one activity listed below.</p> <ol style="list-style-type: none"> <li>i) Model making out of card board paper ,wood ,thermocool, plastics, metal, clay etc <ol style="list-style-type: none"> <li>a) Any new idea/principle converted into model</li> <li>b) Mechanisms</li> <li>c) Jigs/fixtures</li> <li>d) Material handling device,etc.</li> </ol> </li> <li>ii) Toy making with simple operating mechanisms</li> <li>iii) Layout of workshop/department/college</li> <li>iv) Experimental set up/testing of a parameter</li> <li>v) Display board indicating different type of machine components like bearing, fasteners, couplings ,pipe fitting, valves, cams &amp; followers, exploded views of assemblies, type of welding equipment ,welding rods (drawings, photo graphs )</li> <li>vi) Any relevant project which will make students to collect information &amp; work with their own hands.</li> </ol> <p>Students shall arrange exhibition of all mini projects in the class/hall and present the task to the audience/ experts/examiners. The student shall submit a brief report (Max. 5 pages) of the mini project.</p> <p style="text-align: center;"><b>OR</b></p> <p><b>Modular course:</b>  Modular courses on any one of the suggested or equivalent topic be undertaken by a group of 15 to 20 students.</p> <ol style="list-style-type: none"> <li>i) Advance features in CAD</li> <li>ii) Meshing of solid model using any suitable software</li> <li>iii) Developing Unfold Sheet or Hyperblank by using Blanking Software</li> <li>iv) CAM Software</li> <li>v) Basics of PLC programming</li> <li>vi) Applications of mechatronics</li> <li>vii) Piping Technology</li> <li>viii) Modern packaging technology</li> <li>ix) Enterprise Resource Planning</li> <li>x) Bio-pneumatic Robots</li> <li>xi) Bio-mimicry</li> </ol>	12
<b>Total</b>	<b>48</b>

**Learning Resources:****1. Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
01	NRDC, Publication Bi Monthly Journal	Invention Intelligence Journal	National Research Development Corporation, GOI.
02	DK Publishing	How things works encyclopedia	DK Publishing
03	Trott	Innovation mgmt.& new product development	Pearson Education
04	E.H. McGrath, S.J.	Basic Managerial Skills for All – Ninth Edition	PHI

**2. Web sites**

[www.engineeringforchange.org](http://www.engineeringforchange.org)

[www.wikipedia.com](http://www.wikipedia.com)

[www.slideshare.com](http://www.slideshare.com)

[www.teachertube.com](http://www.teachertube.com)

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