 <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 / PG / PT / MH / MI</b>																	
<b>DURATION OF COURSE : 6 SEMESTERS for ME/PG/PT/AE (8 SEMESTERS for MH/MI)</b>										<b>WITH EFFECT FROM 2012-13</b>							
<b>SEMESTER : THIRD</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 (17300)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Applied Mathematics \$	AMS	17301	03	--	--	03	100	40	--	--	--	--	--	--		
2	Basic Electronics & Mechatronics	BEM	17302	04	--	02	03	100	40	--	--	--	--	25@	10		
3	Mechanical Engineering Materials	MEM	17303	04	--	--	03	100	40	--	--	--	--	--	--		
4	Strength of Materials β	SOM	17304	03	--	02	03	100	40	--	--	--	--	25@	10	<b>50</b>	
5	Mechanical Engineering Drawing β	MED	17305	03	--	04	04	100	40	--	--	25#	10	50@	20		
6	Computer Aided Drafting β	CAD	17016	01	--	04	--	--	--	50#	20	--	--	25@	10		
7	Professional Practices-I β	PPO	17017	--	--	03	--	--	--	--	--	--	--	50@	20		
<b>TOTAL</b>				<b>18</b>	<b>--</b>	<b>15</b>	<b>--</b>	<b>500</b>	<b>--</b>	<b>50</b>	<b>--</b>	<b>25</b>	<b>--</b>	<b>175</b>	<b>--</b>	<b>50</b>	
<p>Student Contact Hours Per Week: <b>33 Hrs.</b></p> <p><b>THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.</b></p> <p>Total Marks : <b>800</b></p> <p>@ - Internal Assessment, # - External Assessment, <span style="background-color: #cccccc; padding: 2px;"> </span> No Theory Examination, \$ - Common to all branches, β - Common to AE / PS / FE</p> <p>Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work</p> <ul style="list-style-type: none"> <li>➤ 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).</li> <li>➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.</li> <li>➤ Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.</li> <li>➤ For CAD software subject MSBTE decide the contents of the practical every year.</li> </ul>																	

**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 : Third**

**Subject Title : Applied Mathematics**

**Subject Code : 17301**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	--	03	100	--	--	--	100

**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:**

Applied mathematics is designed for its applications in engineering and technology. It includes the topics integration, differential equation, probability distribution. The connection between applied mathematics and its applications in real life can be understood and appreciated.

Derivatives are useful to find slope of the curve, maxima and minima of function, radius of curvature. Integral calculus helps in finding the area. In analog to digital converter and modulation system integration is important. Differential equation is used in finding curve. Probability is used in Metrology and quality control.

The fundamentals of this topic are directly useful in understanding engineering applications in various fields.

**General Objectives:**

Students will be able to:

1. Apply derivatives to find slope, maxima, minima and radius of curvature.
2. Apply integral calculus to solve different engineering problems.
3. Apply the concept of integration for finding area.
4. Apply differential equation for solving problems in different engineering fields.
5. Apply the knowledge of probability to solve the examples related to the production process.

**Learning Structure:**

**Applications**

Apply the principles of mathematics to solve examples in all branches of Engineering Diploma.

**Procedure**

Solving problems of tangent, normal. Finding maxima, minima and radius of curvature

Solving problems on methods of integration and its properties. Finding area.

Solving examples of differential equations of first order and first degree.

Solving different examples on binomial, poisson and normal distribution

**Principle**

Methods of finding slope, curvature, maxima and minima

Methods of finding integration, definite integration and its properties

Methods of differential equations of first order and first degree

Formulae for binomial, normal, and poisson distribution

**Concept**

Geometrical meaning of derivatives, increasing and decreasing functions

Integration of standard functions. Rules of integration, integration by parts, partial fractions

Order and degree of differential equation. Formation of differential equation

Probability of repeated trails of random experiments

**Facts**

First order and second order derivatives

Derivatives, notation of integration, definition of integration

Integration, definition of differential equation

Permutation, Combination, probability of an event

**Theory:**

<b>Topic and Contents</b>	<b>Hours</b>	<b>Marks</b>
<b>Topic-1 Applications of Derivative</b> <b>Specific objectives :</b> ➤ Find slope, curvature, maximum and minimum value of functions related to different engineering applications. <ul style="list-style-type: none"> <li>• Examples for finding slope , equations of tangent and normal to the curve</li> <li>• Maxima and minima.</li> <li>• Radius of curvature.</li> </ul>	06	16
<b>Topic-2 Integral Calculus</b>		
<b>2.1 Integration ----- 20</b> <b>Specific objectives :</b> ➤ Integrate function using different method. <ul style="list-style-type: none"> <li>• Definition of integration as anti derivative, rules of integration.</li> <li>• Integration of standard functions</li> <li>• Methods of integration               <ul style="list-style-type: none"> <li>Integration by substitution.</li> <li>Integration by partial fractions.</li> <li>Integration by parts and generalized rule by parts.</li> </ul> </li> </ul>	14	44
<b>2.2 Definite Integrals ----- 16</b> <b>Specific objectives :</b> ➤ Solve problems on definite integrals using the properties. <ul style="list-style-type: none"> <li>• Definite integral- Definition, examples.</li> <li>• Properties of definite integrals without proof and simple examples.</li> </ul>	08	
<b>2.3 Application of Definite Integrals -----08</b> <b>Specific objectives :</b> ➤ Find area. <ul style="list-style-type: none"> <li>• Area under a curve.</li> <li>• Area between two curves.</li> </ul>	04	
<b>Topic 3 - Differential Equation.</b>		
<b>3.1 Differential equation</b> <b>Specific objectives :</b> ➤ Solve the differential equation of first order and first degree ➤ Solve different engineering problems using differential equation <ul style="list-style-type: none"> <li>• Differential equation- Definition, order and degree of a differential equation. Formation of differential equation containing single constant.</li> <li>• Solution of differential equation of first order and first degree for following types               <ul style="list-style-type: none"> <li>Variable separable form,</li> <li>Equation reducible to variable separable form.</li> <li>Linear differential equation.</li> <li>Homogeneous differential equation.</li> <li>Exact differential equation.</li> </ul> </li> </ul>	10	20

<b>Topic 4 - Probability</b>		
<b>4.1 Probability</b> <b>Specific objectives :</b> ----- <b>08</b> ➤ Solve different engineering problems related to probability process. <ul style="list-style-type: none"> <li>• Definition of random experiment, sample space, event, occurrence of event and types of event (impossible, mutually exclusive, exhaustive, equally likely)</li> <li>• Definition of probability, addition and multiplication theorems of probability.</li> </ul>	02	20
<b>4.2 Probability Distribution</b> ----- <b>12</b> <ul style="list-style-type: none"> <li>• Binomial distribution</li> <li>• Poisson's Distribution</li> <li>• Normal distribution</li> </ul>	04	
<b>Total</b>	<b>48</b>	<b>100</b>

**Learning Resources:****1) Books:**

<b>Sr. No</b>	<b>Title</b>	<b>Authors</b>	<b>Publication</b>
1	Mathematic for Polytechnic	S. P. Deshpande	Pune Vidyarthi Girha Prakashan' Pune
2	Calculus : Single Variable	Robert. T. Smith	Tata McGraw Hill
3	Higher Engineering mathematics	B. V Ramana	Tata McGraw Hill
4	Higher Engineering mathematics	H. K. Dass	S .Chand Publication
5	Higher Engineering Mathematics	B. S. Grewal	Khanna Publication, New Delhi
6	Applied Mathematics	P. N. Wartikar	Pune Vidyarthi Griha Prakashan, pune

**2) Websites :**

- i) [www.khan.academy](http://www.khan.academy)

**Course Name : Mechanical Engineering Group**

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

**Semester : Third**

**Subject Title : Basic Electronics & Mechatronics**

**Subject Code : 17302**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	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)**

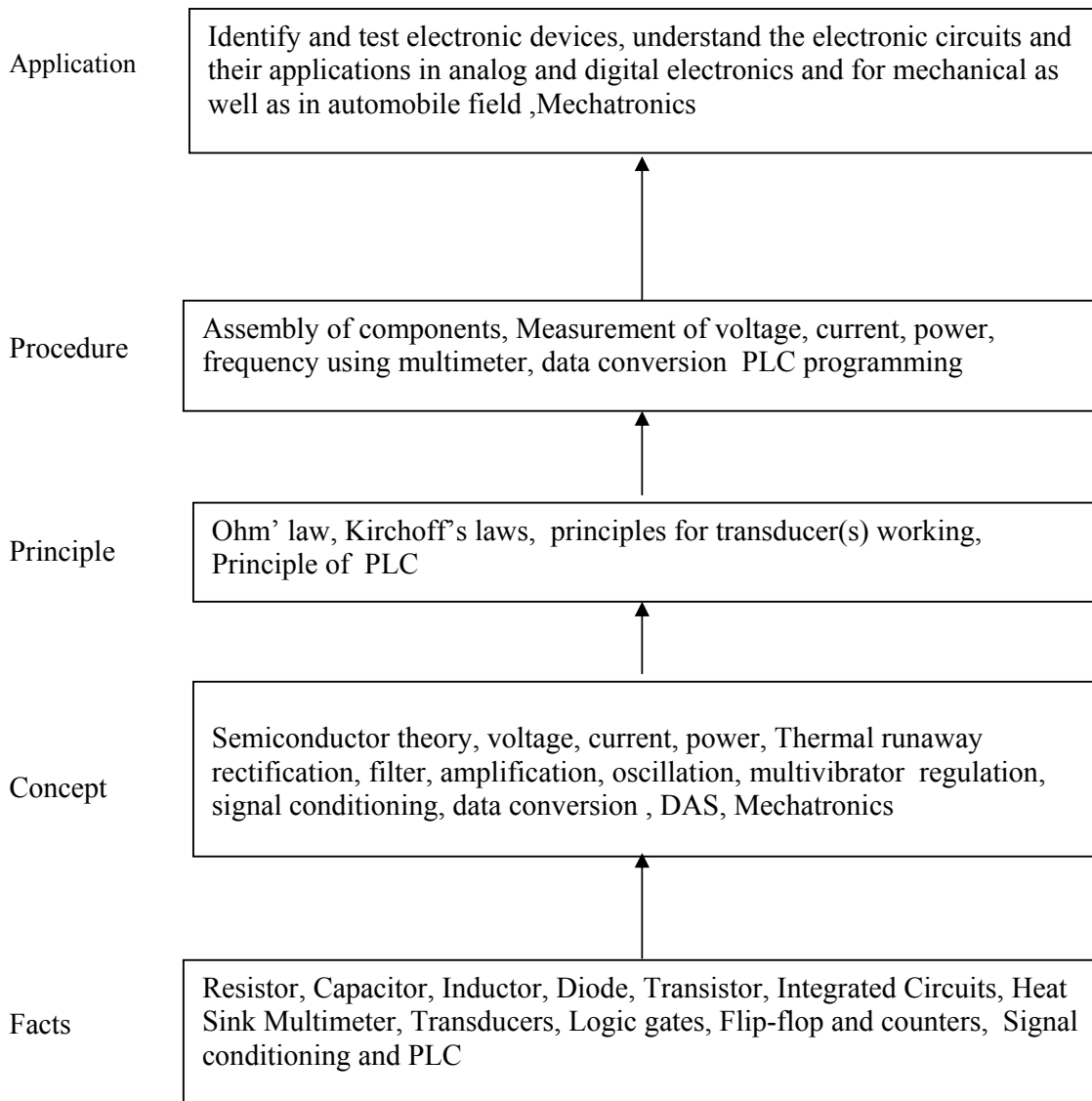
**Rationale:**

This subject is classified under core technology group and forms an important course of mechanical branch of engineering. The course envisages identification and testing of components, their principles of working and applications of various electronic devices, signal conditioning and processing. This subject introduces the concepts of mechatronics and PLC. This subject is prerequisite for the subject mechanical measurement and control as well as for mechatronics.

**General Objectives:**

The students will be able to: -

1. Identify and test different electronic components.
2. Use principles of circuit operations and its applications.
3. Distinguish various elements in analogue and digital electronics.
4. Understand applications of electronics in mechanical field for measurement and control.
5. Understand working of different types of transducers and their applications.
6. Understand concept of mechatronics and PLC.

**Learning Structure:**

## Theory

Topic and Contents	Hours	Marks
<p><b>1: Solid-State Devices and Diode Circuits</b></p> <p><b>Specific objectives</b> Students will be able to</p> <ul style="list-style-type: none"> <li>➤ Draw energy band diagram and compare various types of materials</li> <li>➤ Draw symbols ,state working principle and list out ,applications of electronics devices in electronics and mechanical field</li> <li>➤ Sketch circuit diagram , state working with waveform for rectifier circuits</li> <li>➤ Sketch block diagram and state functions of various blocks of regulated power supply</li> </ul> <p><b>Content</b></p> <p><b>1.1 Fundamentals of solid state Devices– 10 Marks</b> Material classification conductors, semiconductors and insulators, Energy band diagram intrinsic and extrinsic semiconductors Solid state Devices -- schematic symbols, working principle and applications of Diode, Zener diode, BJT, FET,UJT, Photo-devices- LDR, Photo diode, Photo-transistor, LED, 7 segment display opto-coupler, LCD type and operation [No constructional details are expected]</p> <p><b>1.2 Diode Circuits : 04 Marks</b> Rectifier circuits Circuit diagram, working principle and waveforms for Half wave, Full wave-and Bridge rectifier, comparison w. r. t efficiency, PIV , ripple factor and applications Filters circuits C, inverted L and CLC filter circuit diagram and operation of these filters.</p> <p><b>1.3 Regulated power supply 04Marks</b> Concept of load regulation , line regulation , block diagram and functions of each block [Note Mathematical calculations is not expected for any subtopic ]</p>	10	18
<p><b>2: Transistor Circuits</b></p> <p><b>Specific objectives</b> Students will be able to</p> <ul style="list-style-type: none"> <li>➤ Explain working of BJT, Biasing of BJT and concept of thermal runaway</li> <li>➤ Compare CB , CC and CE configuration</li> <li>➤ Write operation of single stage amplifier.</li> <li>➤ Draw circuits of RC, direct and transformer coupled amplifier and compare their performance</li> </ul> <p><b>Content :</b></p> <p><b>2.1 Tansistor 06 Marks</b> Working of NPN and PNP transistor, Configurations CB., CC and CE , Biasing circuits, concept of thermal runaway , construction and use of heat sink [No need of design and mathematical analysis ]</p> <p><b>2.2 BJT Circuits 08 Marks</b> BJT as an amplifier single stage amplifier, Multistage amplifier, RC coupled, direct coupled and transformer coupled amplifier, their frequency response and applications BJT as a switch</p>	08	14
<p><b>3: Analog Circuits</b></p> <p><b>Specific objectives</b> Student will be able to</p> <ul style="list-style-type: none"> <li>➤ Explain and draw block diagram of IC 741, circuits of op amp as</li> </ul>		



<p>inverting, non-inverting, differential amplifier, adder, subtractor, integrator, differentiator, and Instrumentation amplifier</p> <ul style="list-style-type: none"> <li>➤ Explain and draw block diagram of IC 555, circuits of timer as BMV, AMV and MMV</li> <li>➤ State Barkhausen criteria and compare oscillator circuits</li> </ul> <p>Content:</p> <p><b>3.1 Operational amplifier</b> <span style="float: right;"><b>08 Marks</b></span>  IC741 Block diagram, pin diagram, specifications, and applications Op amp configurations- Inverting, Non-inverting and differential circuit diagram and operation of these circuits Op amp as adder, subtractor, integrator and differentiator Instrumentation amplifier [simple numerical are expected]</p> <p><b>3.2 Timers</b> <span style="float: right;"><b>06 Marks</b></span>  IC 555–Block diagram pin diagram specifications, Concept of multivibrator IC 555 as AMV, BMV, MMV.</p> <p><b>3.3 Oscillator</b> <span style="float: right;">Marks 04</span>  Concept of oscillator, Barkhausen criteria Comparison of RC, LC and Crystal oscillator [no any special circuit is expected]</p>	08	18
<p><b>4: Digital Circuits</b></p> <p><b>Specific objectives</b></p> <p>Student will be able to</p> <ul style="list-style-type: none"> <li>➤ Draw symbol and write truth table of all logic gates, various combinational circuits, sequential circuits</li> <li>➤ Compare microprocessor and microcontroller</li> </ul> <p>Content:</p> <p><b>4.1 Logic gates</b> <span style="float: right;"><b>04 Marks</b></span>  Study of logic gates, symbol, truth table NOT, AND, OR, NAND, NOR, XOR, XNOR</p> <p><b>4.2 Combinational Circuits</b> <span style="float: right;"><b>04 Marks</b></span>  Half and Full adder, subtractor, Multiplexer, demultiplexer, decoder and encoder, applications [only block diagram, truth table and simple circuits]</p> <p><b>4.3 Sequential Circuits</b> <span style="float: right;"><b>10 Marks</b></span>  Flip Flops Block diagram of RS, JK, Master Slave JK, D and T, Triggering mechanism Application of flip flop  Basics of counter, asynchronous counter, Decade counter, Ring counter, Shift register. [only circuit diagram and operation is expected not details of timing diagram]  Concept of Microprocessor and microcontroller Features of 8085 and 8051. Comparison of microprocessor and microcontroller Applications</p>	14	18
<p><b>5: Transducers and Signal Conditioning</b></p> <p><b>Specific objectives</b></p> <p>Student will be able to</p> <ul style="list-style-type: none"> <li>➤ Define, state characteristics and Classify transducers</li> <li>➤ Draw block diagrams and explain operation of ADC, DAC, AC and DC signal conditioning.</li> <li>➤ Explain and draw block diagram of single and multi-channel DAS and data logger.</li> </ul> <p>Content :</p> <p><b>5.1 Transducers</b> <span style="float: right;"><b>06 Marks</b></span>  Definition, Classification characteristics of transducer, Active and passive, primary and secondary, Electrical, mechanical optical transducer their examples, selection criteria.</p> <p><b>5.2 Signal conditioning</b> <span style="float: right;"><b>Marks 08</b></span></p>	08	14

Introduction to Data converter ADC and DAC [only principle of operation and applications] Signal conditioning need and Block diagram of AC and DC signal conditioning, DAS - single channel multi-channel , applications Data loggers		
<b>6: Mechatronics and PLC</b> <b>Specific objectives</b> Student will be able to <ul style="list-style-type: none"> <li>➤ State meaning, need and basic concept of mechatronics.</li> <li>➤ State features of real time mechatronics</li> <li>➤ State applications, advantage disadvantages of mechatronics</li> <li>➤ State operation with block diagram of CNC, FMS, AVCS CIM Robotics,</li> <li>➤ State working of basic PLC architecture and write simple programs.</li> </ul> Content: <b>6.1 Fundamentals of mechatronics</b> <b>10 Marks</b> Concept of mechatronics, basic elements of mechatronics, Overview of mechatronics design process modeling and simulation, prototyping and deployment .Introduction to real time mechatronics system, advantages and disadvantages, applications. Functional diagram, approach to CNC, flexible manufacturing system (FMS), Computer integrated machine (CIM), Robotics, Advance vehicle condition system ( AVCS) [only brief information ] <b>6.2 Programmable Logic Controller(PLC)</b> <b>08 Marks</b> Basic PLC structure, principle of PLC, architecture and components, PLC programming, selection of PLC, Concept of Nano PLC, PLC applications, Ladder diagrams, Ladder diagram circuits Simple Ladder programming examples	16	18
<b>Total</b>	<b>64</b>	<b>100</b>

**Practical:**

Skills to be developed:

**Intellectual Skills:**

1. Identification and selection of components.
2. Interpretation of circuits and signals.
3. Understand working of mechatronics systems and PLC

**Motor Skills:**

1. Drawing of circuits.
2. Measurement of various parameters using multimeter.
3. Testing of components using IC tester.
4. Follow standard test procedure.

**List of Practical-**

1. Identify various passive components such as resistors, capacitors, inductors, switches, transformers, breadboard and cables and write their specifications.
2. Identify various active electronic components such as diode, BJT, FET, UJT, LED, Photodiode.
3. Use of multimeter (analogue and digital) for current, voltage and resistance measurement Testing of various electronics components.
4. Measure frequency and voltage using CRO.
5. Construct rectifier circuits on breadboard and observe waveforms on CRO
6. Measure load regulation of un-regulated power supply and regulated power supply.

7. Trace the given RC coupled amplifier and plot frequency response  $f$  and determine its bandwidth.
8. Construct Op Amp as inverting amplifier and Non Inverting amplifier on breadboard and observe the waveforms on CRO.
9. Verify truth tables for logic gates- . NOT, AND, OR, NAND, NOR, XOR, XNOR Testing of an IC using IC tester.
10. Assemble a square wave oscillator for 100 Hz using IC 555. (Use as table multivibrator).
11. Write simple PLC program and execute on PLC (2 exercises).

[Note: Expected group size for practical no. 1 and 2 is one, for practical no.3 to 10 is 2 and for practical no 11 it may be 4 ]

#### Assignments

- Assignments are part of term work.
- Assignment shall include observation of systems from mechatronics point of view. Individual shall prepare report consisting of functional block diagram of the system , specifications of major components and system operation
  - I. Observe and prepare report on mechatronics used in camera system
  - II. Observe and prepare report on mechatronics used in robotic system
 (Where ever possible arrange visit to manufacturing unit where mechatronics is used for production purpose and prepare report.)

#### Note

Teachers are expected to make students familiar with the Data Books and Operation Manuals and also encourage them to visit related websites.

#### Learning Resources:

##### Books:

Sr. No.	Author	Title	Publisher , Edition
01	Boylestad	Electronics devices and circuit Theory	Pearson (Tenth edition)
02	Shalivahnan	Electronics Devices and circuits	TMH
03	Baru Vijay	Basic Electronics Engg.	Wiley India Pvt.Ltd (first edition)
04	De Debasnis Ghatak Kamakhya	Basic Electronics	Pearson (First edition )
05	Bolton	Mechatronics	Pearson (Fourth edition )
06	K.P.Ramchandran, G.K.Vijayaraghavan M.S.Balsundarm	Mechatronics (intergrated mechanical electronics systems)	Wiley india pvt.ltd ,(first edition)

#### Journals – Manufactures catalogues

- IEEE/ASME Transactions on Mechatronics.
- Mechatronics Journal – Elsevier

#### 1. IS, BIS and International Codes:

- NF E 01-010 2008 – AFNOR (French standard NF E 01-010)
- XP E 01-013 2009 – AFNOR (French standard NF E 01-013)

#### 2. Websites:

<http://en.wikipedia.org/wiki/Mechatronic>

**Course Name : Mechanical Engineering Group**

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

**Semester : Third**

**Subject Title : Mechanical Engineering Material**

**Subject Code : 17303**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	--	03	100	--	--	--	100

**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)**

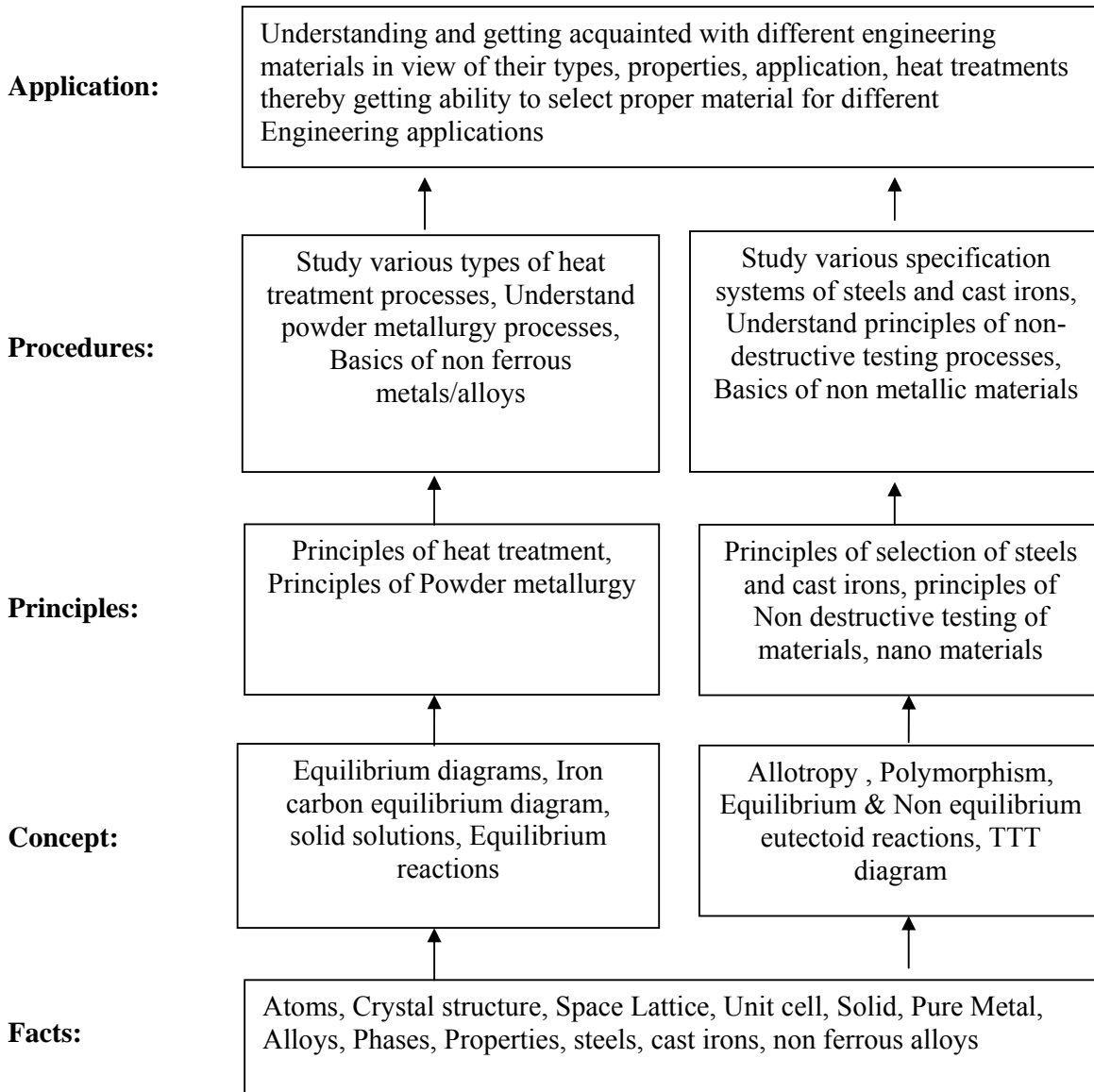
**Rationale:**

Practical field in engineering involves different materials with varied composition, properties with numerous applications. Diploma engineers should have a good knowledge of composition, properties, and applications of these materials. In order to inculcate the same, this subject is designed. Ferrous & Non ferrous metals and alloys find major applications. Amongst these, steels and cast iron are the main alloys with major applications in engineering practice. Sound knowledge about types, properties, composition and heat treatment of steels and cast irons is absolutely necessary to diploma engineers. He should be able to identify steels and cast irons by their specifications and be able to select them for proper applications. Materials like plastics polymers, are also finding importance in engineering application areas. Powder metallurgy process also finds application in manufacturing of special parts with typical properties. Non destructive testing methods are also extensively used in practice today. Diploma engineers should have basic knowledge of these areas.

**General Objectives:** Students will be able to

- Understands about basics of engineering materials as regards classification, structure and properties.
- Understand basics of structure - property relationships of heat treatments.
- Analyze various types of steels and cast irons along with their specifications.
- Understand about types, composition and field of application of various non ferrous metals and alloys & non metallic materials
- Understand about types, composition and field of application of various Non metallic materials.
- Understand about basic process of powder metallurgy and applications.
- Understand about various Nondestructive testing methods and their applications.

**Learning Structure:**



**Theory Content:**

<b>Topic and Contents</b>	<b>Hours</b>	<b>Marks</b>
<p><b>1. Engineering Materials - Structure and Properties</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ List basic types and crystal structure of materials</li> <li>➤ Compare properties of material</li> <li>➤ Define steel and cast iron</li> </ul> <p>Contents:</p> <p>1.1 Introduction, Classification of materials as amorphous and crystalline, ferrous and non ferrous, Crystal structure Properties of metals Physical Properties, Mechanical Properties, unit cell and space lattice, Concept of packing efficiency</p> <p>1.2 Introduction to steels and Cast irons as alloys of iron and carbon.</p>	06	10
<p><b>2. Equilibrium Diagrams</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Define pure metal, alloy, solid solutions</li> <li>➤ Learn different equilibrium Diagrams</li> <li>➤ Draw Iron carbon phase equilibrium diagram, locate fields of steels and cast iron on diagram</li> </ul> <p>Contents:</p> <p>2.1 Definitions of phase, pure metal, alloy and solid solutions.</p> <ul style="list-style-type: none"> <li>• Types of solid solutions -substitutional and interstitial.</li> <li>• Solid solubility</li> </ul> <p>2.2 Solidification of pure metal and Alloys:</p> <ul style="list-style-type: none"> <li>• Cooling curves equilibrium diagrams for isomorphous, Eutectic, Eutectoid systems.</li> </ul> <p>2.3 Iron Carbon Equilibrium diagram</p> <ul style="list-style-type: none"> <li>• Study of various phases</li> <li>• Critical temperatures &amp; significance</li> <li>• Reactions on Iron carbon equilibrium diagram</li> <li>• Introduction of steels and cast irons</li> <li>• Classification of steels on various basis as low, medium, high carbon steels, Hypo, Hyper eutectoid steels</li> </ul>	06	16
<p><b>3. Heat Treatment Of Steels</b> Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Represent various heat treatment processes on TTT diagram</li> <li>➤ Suggest different heat treatment processes</li> <li>➤ Compare surface heat treatment processes for different steels</li> </ul> <p>Contents: <b>-----16 Marks</b></p> <p>3.1 Transformation in steel on heating under equilibrium conditions</p> <ul style="list-style-type: none"> <li>• Transformation of pearlite to austenite</li> <li>• Transformation of Austenite to Pearlite</li> <li>• T T T diagrams/isothermal diagram for plain carbon and alloy steels</li> </ul> <p>3.1.1 Annealing:</p> <ul style="list-style-type: none"> <li>• Purposes of annealing, Annealing temperature range</li> <li>• Types of annealing like conventional / full annealing, isothermal</li> </ul>	14	24

<p>annealing, spheroidizing annealing, Process Annealing</p> <p>3.1.2 Normalizing:</p> <ul style="list-style-type: none"> <li>• Purposes of Normalizing, Temperature range,</li> <li>• Broad applications of Normalizing</li> </ul> <p>3.1.3 Hardening:</p> <ul style="list-style-type: none"> <li>• Purposes of hardening, Hardening temperature range</li> <li>• Conventional hardening process, Structure of martensite and properties</li> <li>• quenching mediums, hardening defects.</li> </ul> <p>3.1.4 Tempering:</p> <ul style="list-style-type: none"> <li>• Purpose of tempering</li> <li>• Variations of properties of hardened steel with tempering temperatures</li> <li>• Types of tempering as low, medium and high temperature tempering.</li> <li>• Martempering, Austempering and patenting processes</li> </ul> <p>3.2 Surface Heat Treatment <span style="float: right;"><b>..... 8 Marks</b></span></p> <ul style="list-style-type: none"> <li>• Need of Surface heat treatment,</li> <li>• Types of Surface heat treatments like Surface hardening and case hardening.</li> <li>• Surface hardening methods like Flame Hardening , Induction Hardening</li> <li>• Case hardening methods like Carburizing, Nitriding, Cyaniding.</li> </ul>		
<p><b>4. Steels and Cast Irons: --- 20 Marks</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ List different types of steels and cast irons</li> <li>➤ Know manufacturing processes of steels &amp; cast irons</li> <li>➤ Refer to specifications systems of steels and cast irons</li> <li>➤ Suggest suitable steels/ cast irons in specifications for particular applications.</li> </ul> <p>Contents:</p> <p>4.1 Broad Classification of steels, Plain carbon steels</p> <ul style="list-style-type: none"> <li>• Definition, Types &amp; Properties</li> <li>• Compositions and applications of low, medium and high carbon steels.</li> </ul> <p>4.2 Alloy Steels:</p> <ul style="list-style-type: none"> <li>• Definition &amp; Effects of alloying elements on properties of alloy steels.</li> <li>• Tool steels: Cold work tool steels, Hot work tool steels, High speed steels(HSS), HCHC and OHNS</li> <li>• Stainless Steels</li> <li>• Spring Steels</li> </ul> <p>4.3 Cast Irons: Classification of cast irons and applications. Types of cast irons as white, gray, nodular, malleable</p> <p>4.4 Specifications of steels and cast Irons:</p> <ul style="list-style-type: none"> <li>• Bureau Of Indian Standards BIS, AISI / SAE , British Standard B.S. specifications of steels &amp; their equivalents Specifications of cast irons</li> <li>• Selection of appropriate steels and cast irons for engineering</li> </ul>	12	20

applications like Shafts, axles, Nuts, bolts, Levers, crank shafts, camshafts, Shear blades, agricultural equipments, House hold utensils, machine tool beds, car bodies.		
<p><b>5. Non ferrous Metals and Alloys --- 10 Marks</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Select various non ferrous metals/alloys in view of their composition, properties for applications</li> </ul> <p>Contents:</p> <p>5.1 Chemical compositions, properties and applications of Copper alloys - brasses, bronzes</p> <p>5.2 Aluminium alloys --Y-alloy, Hindalium, duralium with their composition and applications. Bearing materials like white metals (Sn based), aluminium bronzes. Porous self lubricating bearings.</p>	08	10
<p><b>6. Non Metallic Materials</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Select non metallic materials in view of their composition, properties and applications</li> </ul> <p>Contents:</p> <p>6.1 Polymeric Materials</p> <ul style="list-style-type: none"> <li>• Polymers- types, characteristics,</li> <li>• Properties and uses of Thermoplastics, Thermosetting Plastics &amp; Rubbers.</li> </ul> <p>6.2 Thermoplastic and Thermosetting Plastic materials</p> <ul style="list-style-type: none"> <li>• Characteristics and uses of ABS, Acrylics. Nylons and Vinyls,</li> <li>• Epoxides, Melamines &amp; Bakelites</li> </ul> <p>6.3 Rubbers :</p> <p>Neoprene, Butadiene, Buna &amp; Silicons – Properties &amp; applications.</p> <p>6.4 Other Engineering Materials of importance -Properties and applications– Ceramics, glasses, Glass Wool. Introduction to Composite Materials like, Laminated &amp; Fibre reinforced materials Nano materials – nature, properties and applications</p>	08	12
<p><b>7. Powder Metallurgy &amp; Nondestructive Testing -- 08 Marks</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Know concepts of powder metallurgy process with their applications</li> <li>➤ Compare Different Non destructive testing processes</li> </ul> <p>Contents:</p> <p>7.1 Powder Metallurgy :</p> <ul style="list-style-type: none"> <li>• Advantages, limitations and applications of Powder Metallurgy for engineering products.</li> <li>• Brief Description of Process of Powder Metallurgy – Powder making, blending, compacting, sintering, infiltration &amp; impregnation.</li> <li>• Applications of Powder metallurgy for tungsten carbide tip tools &amp; porous bearing.</li> </ul> <p>7.2 Non destructive Testing:</p> <ul style="list-style-type: none"> <li>• Importance of Non-destructive testing, Difference between Destructive and Nondestructive testing.</li> <li>• Nondestructive testing methods - Radiography (X-Ray &amp; Gamma</li> </ul>	10	08



Ray), Ultrasonic crack detection, Dye penetrant test, Magnaflux test – Comparison & applications		
<b>Total</b>	<b>64</b>	<b>100</b>

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

Sr. No.	Title	Author	Edition	Publisher
01	A Text Book of Material Science and Metallurgy	O. P. Khanna	2005	Dhanpat Rai and Sons
02	Engineering Material and Metallurgy	Shrinivasan	1st	Tata Mc-Graw Hill
03	Material Science And Metallurgy	Dr. V.D. Kodgire	--	Everest Publishing House
04	Engg. Metallurgy	Ramarao & Vyas	1995	Nit -Din Publications,Nagpur
05	Elements of Material Science and Engineering	Lawrence H. Van Vlack	2012	Person Education
06	Introduction to Physical metallurgy	Sidney H. Avner	2006	Tata Mc Graw Hill edition (2nd)
07	Material Science & Engg. Materials	Smith	--	--
08	Physical Metallurgy	Yu Lakhtin	--	Mir Publication

2. CD's PPTs, Video clips on basics of steels, Iron Carbon Diagram, Heat Treatments, Manufacturing of steels, Powder Metallurgy and Non destructive testing

3. Charts, Models, Transparencies on basics of steels, Iron Carbon Diagram, Heat Treatments, Manufacturing of steels, Powder Metallurgy and Non destructive testing

4. Specifications of steels-standards

- a) Bureau Of Indian Standards (BIS) Specifications of steels
- b) British Specifications (B.S.) of steels
- c) American Iron & Steel Institute (AISI) / Society of Automotive Engineers (SAE) specifications of steels
- d) Mahindra Ugine Steel Company (MUSCO) steel book

5. Web sites of following companies for reference

- Mukand Iron Ltd
- Jindal steels
- Tata steels
- Rajuri steels
- Roopam steels
- TISCO
- Kalika steels

**Course Name : Mechanical Engineering Group**

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

**Semester : Third**

**Subject Title : Strength of Materials**

**Subject Code : 17304**

**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:**

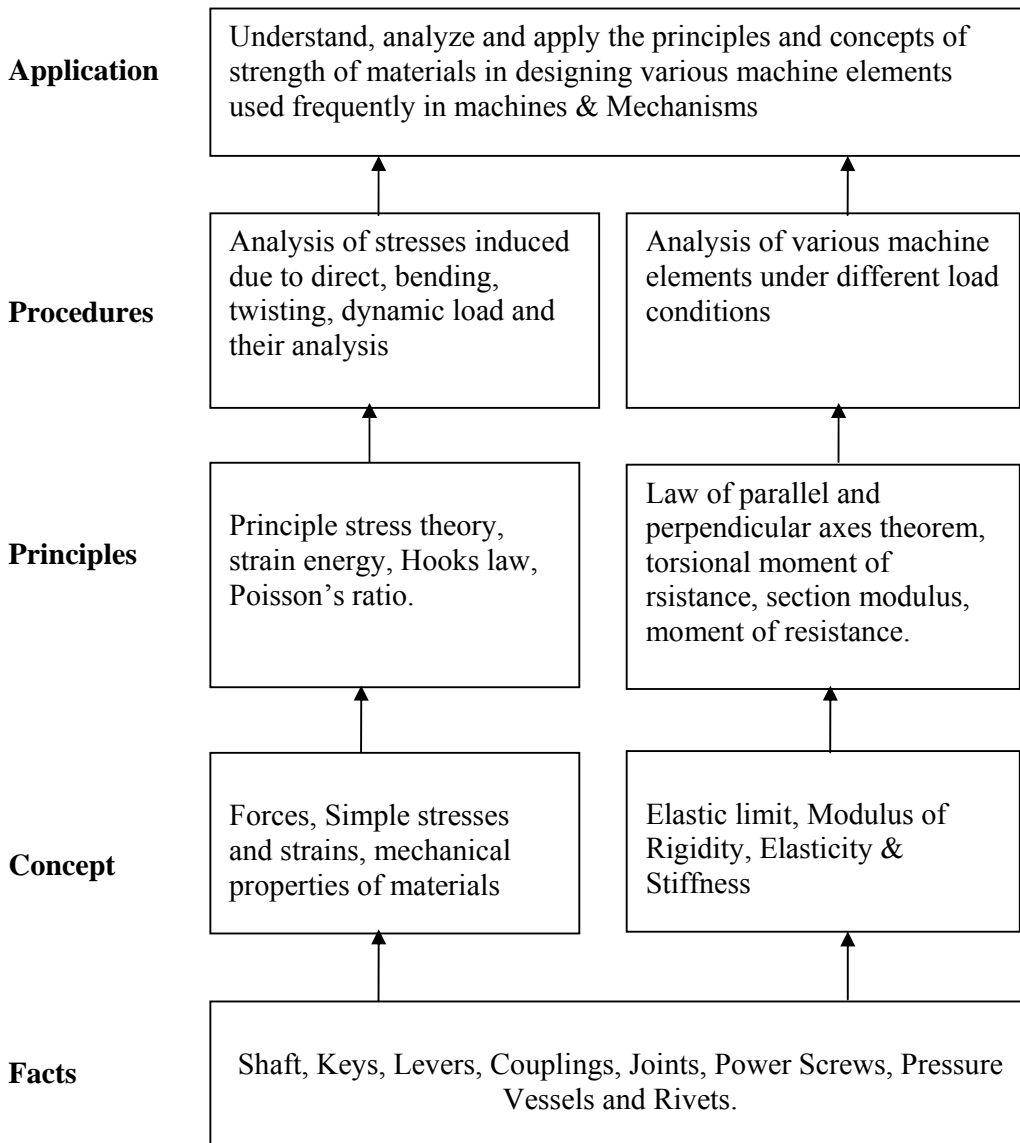
Strength of Material is a core technology subject. It aims at enabling the student to understand & analyze various types of loads, stresses & strains along with main causes of failure of machine parts. The subject is pre-requisite for understanding principles of machine design. Understanding mechanical properties of materials will help in selecting the suitable materials for various engineering applications.

**General Objectives:**

The Student will be able to:

1. Understand the fundamentals of solid mechanics.
2. Acquire elementary knowledge of stresses, strains & material properties.
3. Understand & analyze the basic principles involved in the behavior of machine parts under load in the context of designing it.
4. Understand & analyze the mechanical properties of the various materials.

**Learning structure:**



**Theory**

<b>Topic and Contents</b>	<b>Hours</b>	<b>Marks</b>
<p><b>1. Mechanical Properties of Materials, Simple Stresses &amp; Strains</b></p> <p>Specific Objectives.</p> <ul style="list-style-type: none"> <li>➤ Acquire elementary knowledge of stresses, strains and material properties.</li> <li>➤ Study and apply Euler's theory</li> </ul> <p>Contents</p> <p>1.1 Mechanical properties and Concept of Simple stresses &amp; strains. -- 8 Marks</p> <ul style="list-style-type: none"> <li>• Elasticity, Plasticity, Plastic flow, Ductility, Malleability, Stiffness &amp; Strength.</li> <li>• Types of loads, stresses- tensile, compressive, Shear, single &amp; double shear, concept of plain strain –tensile ,compressive, direct shear strain, torsional shear strain, lateral strain, Hooke's law,</li> <li>• Poisson ratio common values for C.I.&amp; M.S. Relation between stress-strain. Stress-strain diagram for tensile &amp; brittle materials, important points on the stress- strain diagram,</li> <li>• Modulus of elasticity &amp; modulus of rigidity, Volumetric Strain, Bulk modulus, relation between modulus of elasticity &amp; modulus of rigidity.</li> <li>• Thermal stresses - Temperature stresses &amp; strains of uniform section.</li> </ul> <p>1.2 Composite section. -- 4 Marks</p> <ul style="list-style-type: none"> <li>➤ Stress &amp; strains in bars of stepped &amp; uniformly varying sections subjected to axial load at ends only, composite sections having same length.</li> </ul> <p>1.3 Buckling of long columns -- 4 Marks 'Euler's theory, Rankine's theory – equivalent length of the column for the cases below</p> <ul style="list-style-type: none"> <li>• Both ends hinged, One end fixed and other free, Both ends fixed, One end fixed and other end hinged. (simple numerical only)</li> </ul>	10	16
<p><b>2. Principal stresses and planes.</b></p> <p>Specific Objectives.</p> <ul style="list-style-type: none"> <li>➤ Acquire elementary knowledge of hoop stresses &amp; principal stresses.</li> </ul> <p>Contents</p> <p>2.1 Concept of Principal stresses and Principal planes. Stresses on an oblique section of a body subjected to -- 4 Marks</p> <ul style="list-style-type: none"> <li>• Direct stresses on one plane.</li> <li>• Direct stresses on mutually perpendicular planes.</li> <li>• Direct and Shear stress on one plane.</li> <li>• Direct and Shear stress on mutually perpendicular plane (No derivations).</li> <li>• Mohr's circle method for finding principle stresses and planes (only simple numericals).</li> </ul> <p>2.2 Thin Cylindrical shell -- 4 Marks</p> <ul style="list-style-type: none"> <li>• Stresses in thin closed cylindrical vessels subjected to internal pressure, Hoop stress, Radial &amp; Axial Stress.(Simple numericals only)</li> </ul>	05	08
<b>3. Bending Moment &amp; Shear Force</b>	08	16

<p>Specific Objectives.</p> <ul style="list-style-type: none"> <li>➤ Understand &amp; analyse the basic principles involved in the behaviour of machine parts under load in the context of designing it</li> </ul> <p>Contents</p> <p>3.1 Concept &amp; definition of Shear force &amp; bending moment</p> <ul style="list-style-type: none"> <li>• Relation between rate of loading, shear force &amp; bending moment.</li> <li>• Shear force &amp; bending moment diagrams for cantilevers, simply supported beam &amp; over hanging beam subjected to point loads &amp; uniformly distributed load. Location of point of contra flexure</li> </ul>		
<p><b>4. Moment of Inertia</b></p> <p>Specific Objectives.</p> <ul style="list-style-type: none"> <li>➤ Determine Area Moment of Inertia of regular and composite sections.</li> </ul> <p>Contents</p> <ul style="list-style-type: none"> <li>• 4.1 Concept &amp; definition of Moment of inertia, Parallel &amp; perpendicular axes theorem.</li> <li>• (No derivation)</li> <li>• Moment of inertia of solid sections-square, rectangular, circular, semicircular, Triangular Hollow sections- square, rectangular &amp; circular cross sections only.</li> <li>• Moment of Inertia of angle section, Channel section, Tee- section, I - section about centroidal axis &amp; any other axis parallel to centroidal axis.</li> <li>• Polar moment of inertia.</li> </ul>	06	16
<p><b>5. Bending Stresses</b></p> <p>Specific Objectives.</p> <ul style="list-style-type: none"> <li>➤ Acquire and apply knowledge of bending stresses &amp; shear stresses</li> </ul> <p>Contents</p> <p>5.1 Theory of simple bending,</p> <ul style="list-style-type: none"> <li>• Assumptions in the theory of bending, moment of resistance, section modulus, neutral axis. Stress distribution diagram for Cantilever &amp; simply supported beam. Equation of bending (Simple numericals based on formula) -- 6 marks</li> </ul> <p>5.2 Concept of direct &amp; transverse shear stress. .</p> <p>Transverse Shear stress equation (No derivation).</p> <p>Shear stress distribution diagrams Average shear stress &amp; Maximum shear stress for rectangular &amp; circular section -- 6 marks</p>	06	12
<p><b>6. Direct and Bending Stresses</b></p> <p>Specific Objectives.</p> <ul style="list-style-type: none"> <li>➤ Acquire and apply knowledge of bending stresses and direct stresses.</li> </ul> <p>Contents</p> <p>6.1 Concept of Axial load, eccentric load, direct stresses, bending stresses, maximum &amp; minimum stresses.</p> <p>Stress distribution diagram. -- 4 marks</p> <p>Problems on the above concepts for strut, machine parts such as offset links, C-clamp, Bench vice, Drilling machine frame etc. -- 8 marks</p> <p>Condition for no tension in the section, core of section -- 4 marks</p>	07	16
<p><b>7. Torsion</b> 16 Marks</p> <p>Specific Objectives.</p> <ul style="list-style-type: none"> <li>➤ Understand and apply the concept of pure torsion and stresses due to Power Transmission</li> </ul>	06	16

Contents		
7.1 Concept of Pure Torsion, <ul style="list-style-type: none"> <li>• Assumptions in theory of pure Torsion, Torsion equation for solid and hollow circular shafts, stress distribution across solid circular shaft.(No derivation)</li> <li>• Power transmitted by a shaft. --10 marks</li> </ul>		
7.2 Comparison between Solid and Hollow Shafts subjected to pure torsion (no problem on composite and non homogeneous shaft) -- 6 marks		
<b>Total</b>	<b>48</b>	<b>100</b>

**Practicals:**

Skills to be developed:

**Intellectual Skills:-**

1. Identify different stresses in machine parts.
2. Interpret the test results.
3. Test different metals & compare experimental results.
4. Calculate the shear force & bending moment.

**Motor Skills:-**

1. Use of instruments and equipments.
2. Sketching of standard specimen.
3. Prepare machines for tests.
4. Observe & compare behaviour of different materials during test.
5. Draw shear force & bending moment diagram for different types of loading on beams.

**Practicals:**

1. Know your laboratory to understand the difference Machines / their components and purpose.
2. Understand different components, their purpose and operations of "Universal Testing Machines" by conducting a trial on sample test specimen.
3. Understand different components, their purpose and operations of Extensometer by conducting a trial on sample test specimen.
4. Tension test on mild steel and aluminum specimen by using Universal Testing Machine (UTM) to calculate yield stress, ultimate stress, breaking stress, percentage elongation and moduli of Elasticity.
5. Compression test on cast iron specimen by using "Universal Testing Machine".
6. Determine the shear strength of mild steel bar in single and double shear by using "Universal Testing Machine"
7. Determine the Brinell hardness number of mild steel specimen and also its equivalent by the other method.
8. Izod or charpy test on M.S., copper, aluminum and brass specimen to calculate energy absorbed.

9. Conduct torsion test on mild steel bar and find breaking torsional shear strength and stiffness.
10. To calculate and draw the S. F. D. and B. M. D. for cantilever, simply supported and overhang beams.
11. To determine principal stresses and to locate principal planes for a given loading by analytical and graphical (Mohr's circle) methods.

**Note - Use relevant IS codes for conducting the tests.**

**List of Assignments:**

1. Problems on Shear force & bending moment diagram to be drawn on graph paper. (Minimum four)
2. Problems on principal plane and principal stresses by Mohr's circle method. (Minimum four)

**Learning Resources:**

**1. Books:**

Sr. No.	Title	Author	Edition	Publisher
01.	Strength of material	R.S.Khurmi	Reprint 2005	S.Chand Company Ltd. Delhi
02.	Fundamentals of Strength of Materials	Debabrata Nag & Abhijit Chanda	Reprint 2011	Wiley India
03.	Strength of Materials	S.S. Ratan	Second Edition 2008, Reprint 2011	Tata McGraw Hill New Delhi
04.	Strength of Materials	R. Subramanian	Second Edition 2010	Oxford University Press
05.	Strength of Material	S Ramamrutham & R. Narayanan	6 <sup>th</sup> Edition	Dhanpat Rai & Publication New Delhi
06.	Strength of Material	S. S. Bhavikatti	Third edition	Vikas publishing House Pvt. Ltd

**2. ISO, IS, BS Codes:**

- I S:1982(PART -I),
- I S:5242-1979,
- I S:1500-1983,
- I S:1598-1977,
- I S:1757-1973,
- I S:1717,
- I S:800,

**Course Name : Mechanical Engineering Group**

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

**Semester : Third**

**Subject Title : Mechanical Engineering Drawing**

**Subject Code : 17305**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	04	04	100	--	25#	50@	175

**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)**
- **Students should use two separate A3 size sketchbooks, one for class work and another for assignment.**
- **Students should solve assignment on each topic.**
- **Use half imperial size drawing sheet for term work.**

**Rationale:**

A Mechanical Engineer, irrespective of their field of operation in an industry, is expected to possess a thorough understanding of drawing, which includes clear visualization of objects and the proficiency in reading and interpreting a wide variety of production drawings. Besides, they are also expected to possess certain degree of drafting skills depending upon job function, to perform day to day activity i.e. communicating and discussing ideas with supervisors and passing on instructions to subordinates unambiguously. This course envisages reinforcing and enhancing the knowledge and skill acquired in the earlier two courses viz. Engineering Graphics & Engineering Drawing.

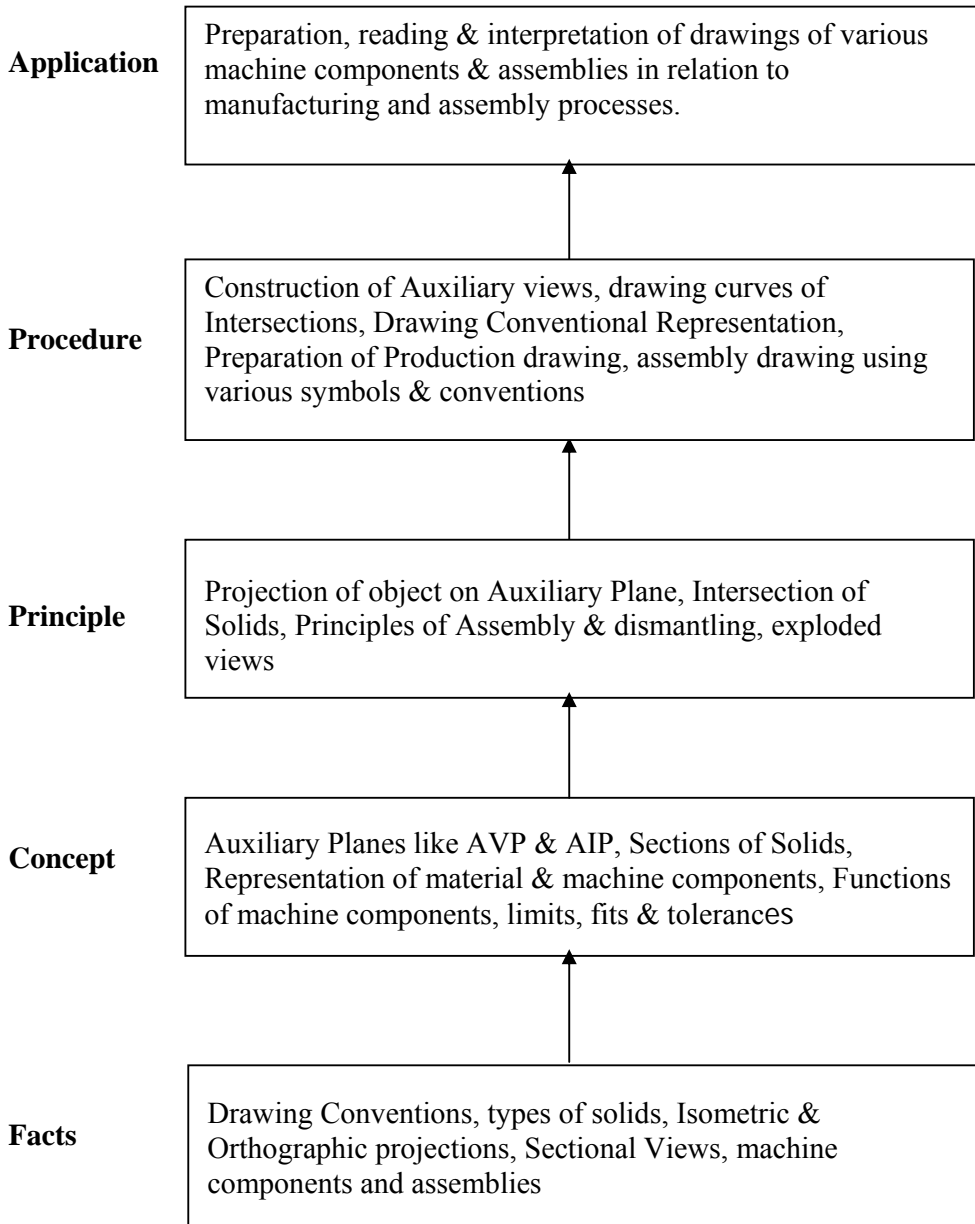
**Objectives:**

The student will be able to –

1. Interpret simple industrial drawings.
2. Interpret instructions related to manufacturing of components.
3. Use IS convention of representing various machine components.
4. Appreciate the significance & use of tolerances of size, forms & positions.



**Learning Structure:**



**Theory:**

Topics and Contents	Hours	Marks
<b>1. Auxiliary views: -</b> Specific Objectives <ul style="list-style-type: none"> <li>➤ Understand and draw the projection of objects on auxiliary planes</li> </ul> 1.1 Study of auxiliary planes, Projection of objects on auxiliary planes. Completing the regular views with the help of given auxiliary views (Use first angle method of projection)	06	08
<b>2. Intersection of solids:-</b> Specific Objectives <ul style="list-style-type: none"> <li>➤ Visualize and draw Curves of intersection of the surfaces of different solids</li> </ul> Curves of intersection of the surfaces of the solids in the following cases 2.1 Prism with prism, Cylinder with cylinder, Prism with Cylinder When (i) the axes are at 90° and intersecting (ii) The axes are at 90° and Offset 2.2 Cylinder with Cone When axis of cylinder is parallel to both the reference planes and cone resting on base on HP and with axis intersecting and offset from axis of cylinder	10	16
<b>3. Conventional Representation:-</b> Specific Objectives <ul style="list-style-type: none"> <li>➤ Understand and draw the projection of Conventional Representation</li> </ul> 3.1. Standard convention using SP – 46 (1988) 3.2 Materials- C.I., M.S, Brass, Bronze, Aluminium, wood, Glass, Concrete and Rubber 3.3 Long and short break in pipe, rod and shaft. 3.4 Ball and Roller bearing, pipe joints, cocks, valves, internal / external threads. 3.5 Various sections- Half, removed, revolved, offset, partial and aligned sections. 3.6 Knurling, serrated shafts, splined shafts, and keys and key ways 3.7 Springs with square and flat ends, Gears, sprocket wheel, chain wheels 3.8 Countersunk & counter bored holes. 3.9 Tapers	06	12
<b>4. Production Drawings</b> Specific Objectives <ul style="list-style-type: none"> <li>➤ Understand attributes of Production Drawing and Process Sheet of various components</li> <li>➤ Interpret various symbols shown on the drawing and selection of manufacturing processes accordingly</li> </ul> 4.1 Limits, fits and tolerances 4 marks Definitions, Introduction to ISO system of tolerancing- unilateral and bilateral and its representation on drawing, dimensional tolerances, elements of interchangeable system, hole & shaft base systems, tolerance diagram, Selection of fit (clearance, transition and interference) for engineering applications. 4.2 Geometrical tolerances 4 marks Definitions, Tolerances of form and position and its geometric representation-tolerance frame, datum feature, magnitude of tolerance and symbol, interpretation of a given symbol on drawing, simple examples. 4.3 General welding symbols 4 marks	06	16

Symbolic representation in Engineering practices and its interpretation. 4.4 Characteristics of surface roughness 4 marks Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods, using ISO code. Relation of surface roughness values with manufacturing processes.		
<b>5. Details to Assembly drawing</b> Specific Objectives ➤ Visualize and draw Details to Assembly ➤ Understand the procedure for assembly of components i. Introduction- Basic principles of process of assembly. ii. Couplings – Universal couplings & Oldham's Coupling iii. Bearing – Foot Step Bearing & Pedestal Bearing iv. Tool Post – Lathe (Including Square tool post), shaper v. Machine vice & Pipe Vice vi. Screw Jack vii. Valves- Steam Stop Valve, Non – Return Valve viii. IC engine components assembly	10	24
<b>6. Assembly to Details</b> Specific Objectives ➤ Visualize and draw Details from Assembly drawing ➤ Understand the sequence of dismantling the assembly into components i. Introduction – basic principles of dismantling process ii. Pedestal Bearing iii. Lathe Tail Stock iv. Drilling Jig v. Piston & connecting rod assembly, clutch, shoe brake vi. Cross head and Stuffing box Assembly vii. Hydraulic, pneumatic Valves (Not containing more than eight parts) viii. Fast & loose pulley	10	24
<b>TOTAL</b>	<b>48</b>	<b>100</b>

**Note: - For topic no. 5 and 6 any other assembly containing at least 6 to 10 components may be considered.**

**Skills to be developed for Practical:**

**Intellectual Skills:**

- To interpret the projection of objects on auxiliary planes
- Understand interpenetration of solids.
- Interpret Conventional symbols as per IS code SP46.
- Interpret limits, fits and tolerances on a given drawing.
- Understand Production drawing of m/c components
- Identify various components in a given assembly and find the sequence of dismantling it
- Visualize details of components and determine the sequence of components assembly.

**Motor Skills:**

- To draw the projection of objects in auxiliary planes

- Draw front view and top view of solids Penetrating one with other and find the shape of the interpenetration curve.
- Assign and draw surface roughness values and symbols on a part drawing.
- Conventionally represent limit, fits and tolerances on a given drawing as per the functional requirements of components.
- To draw the production drawing of m/c components.
- Prepare bill of materials in assembly drawing.
- To dismantle machine and prepare production drawing of various components of assembly.

<b>List of Practical:</b>	
1. Auxiliary views ➤ One sheet containing minimum two problems	4 hours
2. Intersections of Solids ➤ One Sheet containing at least three problems.	8 hours
3. Conventional Representation ➤ Conventional Representation of machine components as per SP – 46 (1988) - one sheet ➤ Limit, Fit, Tolerances, geometric tolerances, Machining Symbols, welding symbols – one sheet	12 hours
4. Production Drawing of at least one component- one sheet.	6hours
5. Assembly to details drawing ➤ Draw the given assembly and prepare component drawings, including conventional representation, tolerances and surface finish symbols. Prepare part list contained, name of components, quantity, material specifications and remarks - One sheet	14 hours
6. Details to Assembly drawing ➤ From a given drawings of components prepare an assembly with two views. Prepare a table containing name of component, quantity, material specifications and remarks, show overall dimensions of the assembly	14 hours
7. Two problems on assembly drawings using any CAD Package and print it. Students will prepare a drawing discuss in 5 & 6 .(Assembly containing maximum 6 to 7 components)	14 hours
8. Dismantle any machine assembly having 6 to 10 part. Prepare the sketches in sketchbook with dimension and then draw assembly.-----6 hours	6 hours

**List of Assignments:**

1. Auxiliary views: At least two problems
2. Intersections of Solids: At least four problems
3. Assembly to details drawing: At least one problem
4. Details to Assembly drawing: Solve at least two problems.

**Note: Above assignment is the part of term work.**

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

Sr. No.	Author	Title	Publication & Edition
1	N.D.Bhatt	Machine Drawing	Charotar Publication, Anand, Reprint 2010

2	L. K. Narayanan, P. Kannaich, K.VenkatReddy	Production Drawing	New Age International Publication, 2010
3	N Sidheswar P Kannaiah V V S Sastry	Machine Drawing	Tata McGraw Hill Education Pvt. Ltd., 2010
4	N. D.Junnarkar	Machine Drawing	Pearson, Third Impression 2011
5	Goutam Pohit Goutam Ghosh	Machine Drawing with AutoCAD	Pearson, Reprint 2009
6	Basudeb Bhattacharyya	Machine Drawing	Oxford, 2011
7	IS Code SP 46 (1988)	Code of practice for general engineering drawing.	Engineering Drawing Practice for School and colleges, 2005

**Course Name : Mechanical Engineering Group**

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

**Semester : Third**

**Subject Title : Computer Aided Drafting**

**Subject Code : 17016**

**Teaching and Examination Scheme**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	04	--	--	50#	--	25@	75

**Rationale:**

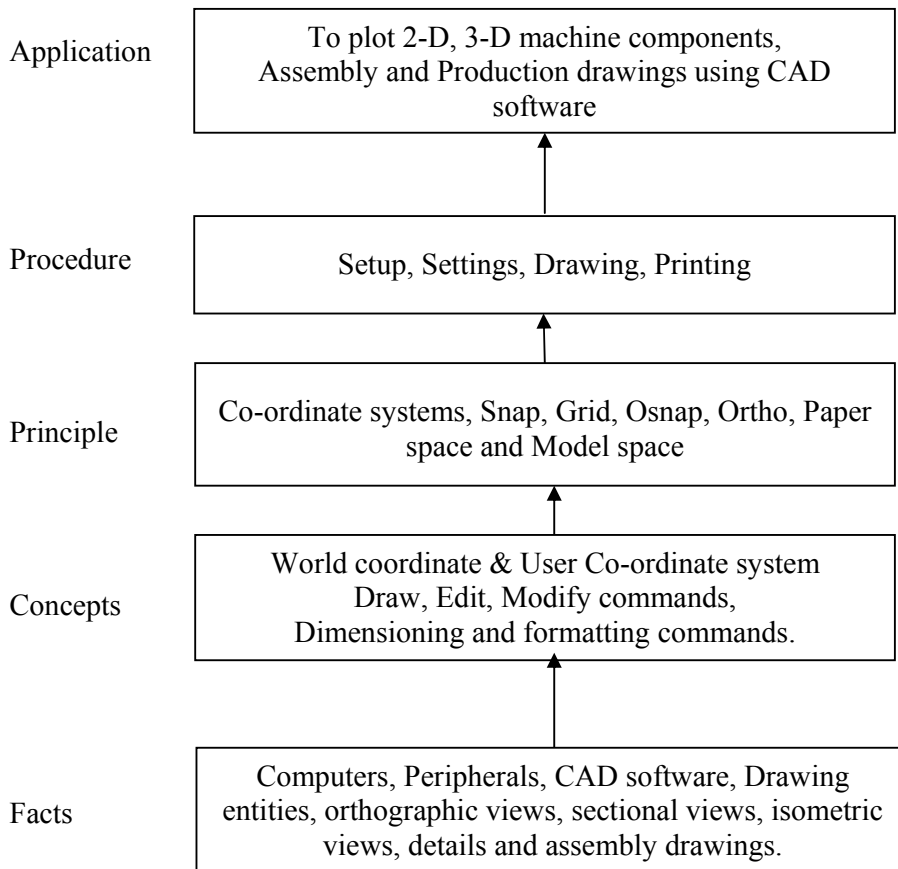
Now a day a manual drafting is obsolete in industry. Computers being the inevitable part in an engineer's life due to its inbuilt characteristics which helps him to do various task with acceleration. Using computers and CAD software it is easy to create and modify drawings ultimately it saves time. It also may be useful to generate assembly and manufacturing drawings.

In mechanical industry operating skills are required for computer aided drafting operations of machine components, handling of printers & plotters. This subject is also useful to apply concepts in 3 D modeling.

**General Objectives:**

Students will be able to

- 1) Draw, edit and modify 2D drawings.
- 2) Give dimensions, tolerances and geometrical tolerances.
- 3) Draw Isometric drawing and 3 D drawing.
- 4) Plot a drawing.

**Learning Structure:**

**Theory:**

<b>Topic and Content</b>	<b>Hours</b>
<p><b>1: Introduction to Computer Aided Drafting</b> <span style="float: right;"><b>02 Hours</b></span></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Understand and use basics of CAD systems.</li> </ul> <p><b>Content:</b></p> <p><b>1.1 Introduction to Computer Aided Drafting (CAD)-</b> Applications, Various Softwares for Computer Aided Drafting</p> <p><b>1.2 Co-ordinate system-</b> Cartesian &amp; Polar-Absolute, Relative mode.</p> <p><b>1.3 CAD initial settings commands</b> - Snap, grid, ortho, osnap, limits, units, filters, itscale, mbuttonpan</p> <p><b>1.4 Object Selection methods</b> – picking, window, crossing, fence, last, previous etc.</p>	02
<p><b>2: Zoom and formatting Commands</b> <span style="float: right;"><b>02 Hours</b></span></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ View drawing.</li> <li>➤ Format drawing entities.</li> </ul> <p><b>Content:</b></p> <p><b>2.1 Zoom Commands</b> – all, previous, out, in, extent, realtime, dynamic, window, pan.</p> <p><b>2.2 Formatting commands</b> - Layers, block, linetype, lineweight, color.</p>	02
<p><b>3: Draw and Enquiry commands</b> <span style="float: right;"><b>02 Hours</b></span></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Draw 2 D drawings</li> <li>➤ Measure length and area</li> </ul> <p><b>Content:</b></p> <p><b>3.1 Draw Command</b> - Line, arc, circle, rectangle, polygon, ellipse, spline, block, hatch</p> <p><b>3.2 Enquiry commands</b> - distance, area</p>	02
<p><b>4: Edit and Modify commands</b> <span style="float: right;"><b>03 Hours</b></span></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Rectify 2 D drawings.</li> <li>➤ Modify 2 D drawings</li> </ul> <p><b>Content:</b></p> <p><b>4.1 Modify Command</b> - Erase, oops, break, trim, copy, move, mirror, offset, fillet, chamfer, array, extend, rotate, scale, lengthen, stretch, measure, divide, explode, align.</p> <p><b>4.2 Grips editing-</b> Move, Copy, Stretch.</p>	03
<p><b>5: Dimensioning, Text and Plot Commands</b> <span style="float: right;"><b>03Hours</b></span></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Apply dimensions.</li> <li>➤ Write text or remarks.</li> <li>➤ Plot a drawing.</li> </ul> <p><b>Content:</b></p> <p><b>5.1 Dimensioning commands</b> - Dimension styles, Dimensional Tolerances and Geometrical Tolerances.</p> <p><b>5.2 Text commands</b> - dtext, mtext command.</p> <p><b>5.3 Plotting a drawing</b> - paper space, model space, creating table, plot commands.</p>	03
<p><b>6: Isometric and 3D Drawings</b> <span style="float: right;"><b>04 Hours</b></span></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Draw and modify 3 D drawings.</li> </ul>	04



<ul style="list-style-type: none"> <li>➤ Find materials mass property.</li> <li>➤ Draw isometric drawings.</li> </ul> <p><b>Content:</b></p> <p><b>6.1 3D Edit Commands</b> -Pline, 3Dpoly, pedit, join splinedit commands.</p> <p><b>6.2 View Commands</b> - View ports, UCS, WCS commands</p> <p><b>6.3 3D Object and 3D operations</b> – 3 D Object - Cube, Cylinder, Cone, Sphere, Wedge. 3 D operations - extrude, revolve, 3Dmirror, 3Dmove, 3Dpan, 3Drotate, 3Darray, slice, sweep. Boolean operations – union, subtract, intersection. Using Isometric style option of snap command draw isometric drawing</p> <p><b>6.4 Shade and Enquiry commands</b> – mass property, Shade and render command.</p>	
<b>Total</b>	<b>16</b>

**Note:** Multimedia projection facility shall be used during lecture sessions along with computer facility e.g. laptop, computer, LCD projector.

**Skills to be developed:**

**Intellectual skills:**

- 1) Select and develop coordinate system.
- 2) Interpret a drawing to draw in CAD software.
- 3) Select & use appropriate CAD commands for given situation.

**Motor Skills:**

- 1) Use pull down menu and their submenu, toolbars
- 2) Setting the initial drawing setup.
- 3) Draw, edit and modify drawings.
- 4) Use printers and plotters for plotting production drawings.

**Practical:**

**List of Practical's:**

1. Set the initial view.
2. Use of Draw command.
3. Use of Edit command.
4. Use of Modify command.
5. Apply dimensions.
6. Draw Isometric drawing.
7. Draw 3 D drawings.
8. Plotting of drawings on A2/A3 size sheet.

**Guideline for Practical:** One student per computer terminal.

**Note:** Use of any one Computer Aided Drafting Software of Latest Version is recommended.

**Practical Examination:** (2 Hours for each student)

Creation of 2 D / 3D / Isometric drawings for the given part or drawing, followed by oral examination based on above term work.

(One computer terminal per each student)

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

Sr. No.	Author	Title	Publisher / Edition
1	Sham Tickoo	Autocad: A Problem-Solving Approach	Thomson Learning EMEA, Limited
2	George Omura	Mastering Auto CAD	BPB Publication
3	George Omura	ABC's of Auto CAD	BPB Publication
4	Gautam Purohit & Gautam Ghosh	M/c Drawing with AutoCad	Pearson Publication
5	T Jeyapoovan	Engineering Graphics Using AutoCAD	Vikas Publishing House Pvt. Ltd. Fifth Edition
6	--	Various software manuals	--

**2. CDs, PPTs.:**

1. Beginners AutoCAD 2011 Tutorial DVD, Advanced AutoCAD 2011 Tutorial DVD, 2
2. Learning AutoCAD 2012 Tutorial DVD – Publisher – Infinite Skills Inc. Email :  
directsales@infiniteskills.com
3. EKHO Institute presents Professional AutoCAD Training Videos
4. Learning AutoCAD 2012 Tutorial DVD - Video Training by Infinite Skills.

**3. Websites:**

<http://www.we-r-here.com/cad/tutorials/index.htm>  
<http://www.cadtutor.net/tutorials/autocad/>  
[http://www.caddprimer.com/AutoCAD\\_training\\_tutorial/AutoCAD\\_training\\_lessons.htm](http://www.caddprimer.com/AutoCAD_training_tutorial/AutoCAD_training_lessons.htm)  
<http://www.autocadmark.com/>  
<http://www.autocadtutorials.net/>

**Equipment List:**

- 1) Latest Configuration Computers which can be able to run latest any Computer Aided Drafting Software. (At least One Computer per student in practical session.)
- 2) Any latest Authorised Computer Aided Drafting Software (20 seats).
- 3) Plotter of size A2/A3
- 4) LCD Projector

**Course Name : Mechanical Engineering Group****Course Code : AE/ME/PG/PT/MH/MI****Semester : Third****Subject Title : Professional Practices-I****Subject Code : 17017****Teaching and Examination Scheme:**

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

**Rationale:**

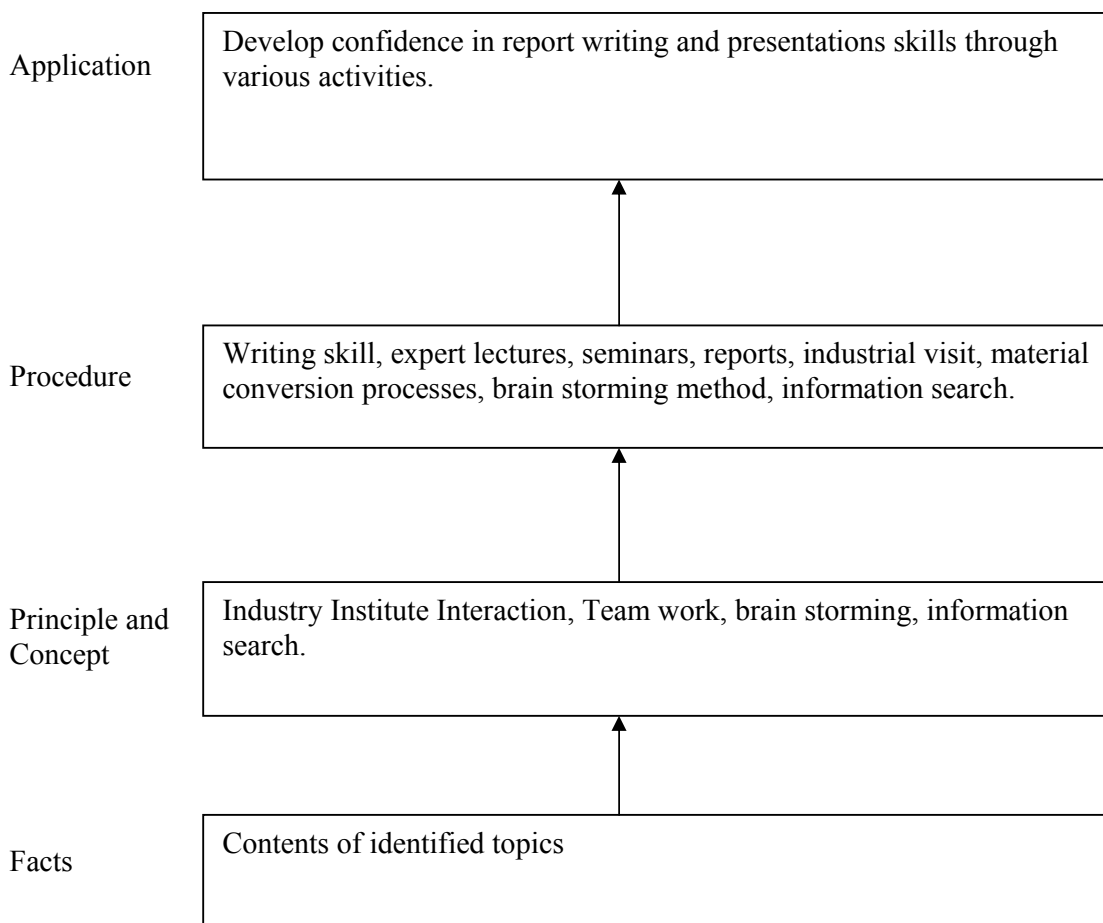
The purpose of introducing Professional practices is to fulfill the need of students to stand in today's global market with knowledge and confidence. Practical aspects of engineering can be learned through industrial visits, industry expert lectures, seminars, searching alternative solutions and validation of the selected alternatives. Subject like professional practices allow the students to think independently using integrated knowledge of various subjects and give opportunity of working with their own hands. The exercises included in this subject are useful to create social awareness and developing them into good citizens of tomorrow.

**General Objectives**

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.

**Learning Structure:**



**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.

**Content:**

Topic & Content	Hours
<p><b>1. Information search:</b> Information search be made through manufacturers catalogues, suppliers, traders, workshops, journals &amp; websites etc. and submit a report on <b>any two topics</b> in a group of 3 to 4 students. Following topics are suggested. Any other equivalent topic can also be selected. Report size shall be around 7 – 10 pages.</p> <ol style="list-style-type: none"> <li>i) Any one type of valve. Dismantle the valve and prepare part list with quantity material specifications, measure the dimensions of component &amp; prepare the detailed drawings of all components specifying dimensional &amp; geometric tolerances for important surfaces giving machining symbols.</li> </ol> <p style="text-align: center;">OR</p> <ol style="list-style-type: none"> <li>i) Draw the assembly in working position showing sectional elevation &amp; plan views with overall dimensions.</li> <li>ii) List the types of A/c motors commonly used for various industrial applications write specifications of any two motors and show their performance characteristics using manufacturers catalogue.</li> <li>iii) List 10 materials (Ferrous &amp; nonferrous metals &amp; alloys and non metals) Give their specifications, state their important properties &amp; its applications.</li> <li>iv) List the components in a transmission system of 2 wheeler &amp; 4 wheeler automobiles and explain their functions in detail identify their materials.</li> <li>v) Non destructive testing – methods &amp; applications (minimum 3 methods)</li> <li>vi) IS codes related to impact test, hardness test, bend test of steels.</li> <li>vii) Collection of information of domestic electric heating appliances like hot water boiler, electric iron, electric cooker, microwave oven, toaster etc. Describe their working principles, controls &amp; safety features.</li> <li>viii) Heat treatment processes for steels – purpose, modified properties &amp; applications.</li> <li>ix) Advances in material technology – smart materials, shape memory alloys, Nano materials.</li> </ol>	06
<p><b>2. Lectures by professionals / industry experts</b> Two lectures of 2 hour duration are arranged on <b>any two topics</b> suggested below or any other suitable topics so that the students get oriented to the industrial environment &amp; working. Students are required to prepare a brief report of each lecture as a part of their term work.</p> <ol style="list-style-type: none"> <li>i) Organizational structure, various functional departments &amp; their inter relations, types of products manufactured or services provided.</li> <li>ii) Role of diploma engineers (Mech, Auto, Prod,) in an organization, responsibilities to be taken and future scope.</li> <li>iii) Work culture</li> <li>iv) Industrial growth in India and new opportunities &amp; avenues available to</li> </ol>	06

<p>diploma engineers.</p> <p>v) Time management</p> <p>vi) Developing product quality &amp; reliability</p> <p>vii) Creative &amp; innovative thinking approach</p> <p>viii) Personality Development</p> <p>ix) Interview technique / group discussion technique</p> <p>x) E – banking – credit card, debit card, ATM operation</p>	
<p><b>3. Group Discussion – One exercise</b></p> <p>Group discussions on any one of the following topics are suggested or any other general / social /educational / technology related topics. Group size - divide practical batch into groups of 7 to 10 students, time for group discussion 15 to 20 minutes.</p> <p>i) Current topics from news papers / T.V. news related to social, education &amp; technology</p> <p>ii) Energy crisis in India</p> <p>iii) Lokpal Vidheyak (Act)</p> <p>iv) Corruption prevention</p> <p>v) Reservation policy</p> <p>vi) Policies at institutional level – dress code, campus discipline &amp; cleanliness</p> <p>vii) Ban on plastic carry bags.</p> <p>viii) Pollution control</p> <p>ix) Population control</p> <p>x) Brain drain</p> <p>xi) Diploma (Mechanical Engineering group) opting for Computer and Information Technology jobs.</p> <p>xii) Right to information act</p> <p>xiii) Anti-Ragging act.</p> <p>Students should prepare a report on salient points discussed on the topic &amp; summarize concluding remarks.</p>	04
<p><b>4. Seminar</b></p> <p>Seminar on any one topic specified in the list given below or any topic suggested under information search &amp; expert lecture.</p> <p>Time for presentation – 10 minutes per group of 2 to 3 students,</p> <p>Prepare power point presentation and submit seminar notes not more than 10 pages mentioning source of information – books, magazines, journals, websites, surveys, etc.</p> <p>Topics –</p> <p>i) Fasteners &amp; its industrial applications</p> <p>ii) Powder metallurgy technique</p> <p>iii) Non-destructive testing</p> <p>iv) Couplings – types &amp; applications</p> <p>v) Bearings - types &amp; applications</p> <p>vi) Accident prevention &amp; safely measures</p> <p>vii) Fuel injection systems</p> <p>viii) Modern features of automobiles</p> <p>ix) Welding technology</p> <p>x) Selection of electric motors</p> <p>xi) Industrial drives- Types, advantages and limitations, Applications</p> <p>xii) ISO system of limit, fits &amp; tolerances</p> <p>xiii) Type of screw threads &amp; their applications.</p>	08

<p><b>5. Industrial Visits</b>  Structured industrial visits are arranged and report of the same be submitted by the individual student to form a part of the term work.  No of visits – at least two  Scale of industry – Small scale unit, medium scale unit  Group size – practical batch containing not more than 20-25 students,  Report 2 to 5 pages.  Purpose –</p> <ol style="list-style-type: none"> <li>a. Get familiar with industry environment</li> <li>b. Know the organizational structure</li> <li>c. Working of functional departments &amp; their inter relation</li> <li>d. Products manufactured, services provided</li> <li>e. Identification of materials used and material flow from raw materials to finished products</li> <li>f. Study the production processes &amp; types of machines used</li> <li>g. Layout of machinery &amp; equipments in general</li> <li>h. List of material handling equipment</li> </ol> <p>Following types of industries may be visited or any industrial units existing in the area or nearby areas.</p> <ol style="list-style-type: none"> <li>i) Manufacturing units</li> <li>ii) Chemical Process industry/cotton/grain processing industry/dairy etc.</li> <li>iii) Service stations - Auto repairs work shop / garage, farm implements.</li> <li>iv) ST workshop / city transport workshops.</li> <li>v) Material testing laboratories in industries or reputed organizations.</li> </ol>	08
<p><b>6. Individual Assignments</b>  <b>Any two assignments</b> from the list suggested based on the subjects in the 3<sup>rd</sup> semester (Any other suitable assignments may be chosen)</p> <ol style="list-style-type: none"> <li>i) Material selection, specifications &amp; properties desirable of 10 different machine components.</li> <li>ii) Select 5 different plain carbon steels &amp; alloy steels used for manufacturing machine components &amp; specify heat treatment processes to improve material properties, give brief description of one of the heat treatment processes.</li> <li>iii) List the various properties &amp; applications of following materials. <ol style="list-style-type: none"> <li>a) Thermo plastic plastics b) Thermo setting plastics c) Rubber d) Ceramics</li> </ol> </li> <li>iv) Any two problems on bending moment diagram, shear force diagram, deflection of beams &amp; torsion topics of strength of materials.</li> <li>v) Any two problems from applied mathematics <ol style="list-style-type: none"> <li>a) Problems on area under the curve &amp; volume of revolution</li> <li>b) Problems on applications of differential equations</li> </ol> </li> <li>v) Any two problems on finding principal stresses by using Mohr's circle, finding magnitude &amp; position of maximum shear stresses.</li> <li>vi) Prepare a questionnaire for conducting interview of a successful entrepreneur &amp; conduct the interview.</li> <li>vii) List 5 different engineering applications of transformers stating the types, &amp; specifications, write the working principle of auto transformer.</li> <li>viii) Draw the electric wiring diagram for a) staircase b) water pump-motor set.  List the electrical components used in the electric circuit.</li> </ol>	10
<p><b>7. Socially Relevant activities</b>  Conduct <b>any one activity</b> through active participation of students &amp; 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</p>	06

improvement)	
i) Go green movement	
ii) Literacy camps	
iii) Building ethical & moral values	
iv) Conservation of electrical energy	
v) Water conservation	
vi) Clean campus / city	
vii) Awareness to avoid use of plastic carry bags	
viii) Educating students / people about firefighting equipment	
ix) Rain water harvesting	
x) Traffic management within campus / city.	
<b>Total</b>	<b>48</b>

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

Sr. No.	Author	Title	Publisher
01	NRDC, Publication Bi Monthly Journal	Invention Intelligence Journal	National Research Development Corporation, GOI.
02	DK Publishing	How things works encyclopedia	DK Publishing
03	E.H. McGratj, 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)