STUDY AND EVALUATION SCHEME

FOR

1. ELECTRONICS & COMMUNICATION ENGINEERING
2. ELECTRONICS ENGINEERING (DIGITAL ELECTRONICS)
3. ELECTRONICS ENGINEERING (MEDICAL ELECTRONICS)

SEMESTER - II

Code No.	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
		L	T	P	Internal Assessment		External Assessment Exam				
					Theory	Practical	Written Paper		Practical		
					Max Marks	Max. Marks	Max. Marks	Hrs.	Max. Marks	Hrs.	
*1	Communication Techniques - II	3	-	-	50	-	100	3	-	-	150
*2	Applied Maths - II	3	2	-	50	-	100	3	-	-	150
3	Electrical Machines	3	-	3	50	25	100	3	50	3	225
4	Electronic Components and Materials	4	-	-	50	-	100	3	-	-	150
5	Electronic Devices and Circuits - I	3	1	3	50	25	100	3	50	3	225
6	Electrical & Electronics Workshop	-	-	6	-	50	-	-	100	3	150
7	Engineering Drawing	-	-	6	-	25	100	3	-	-	125
**	Student Centered activities	-	-	3							
	TOTAL	16	3	21	250	125	600	-	200	-	1175

* Subjects common with Mechanical, Production, Automobile Engineering, Civil

** Student centered activities will include: extension lectures, field visits, Soft Skills, seminars, debates, hobby clubs, library studies, awareness regarding ecology and environment, conservation of energy (Petroleum products, electricity etc), social service camps and other co-curricular activities including games. Advanced planning for each semester has got to be made

Communication Technique –II

L	T	P
3	-	-

RATIONALE

Diploma holders are supposed to communicate verbally and in written forms. Further technical report writing forms another essential requirement of these people. Keeping in view above requirements, this subject has been added to develop necessary competencies in written and oral communication. Efforts should be made to give practice of communication to the students.

Contents

Note: Weightage for each topic for external examination is given in the brackets.

1. **Précis writing:** (15%)
   Précis writing of simple passages of about 250 words.

2. **Concepts of Communication:** (20%)
   Importance of communication, one way and two way communication, methods of communication – oral, written and non-verbal, barriers to communication and techniques of overcoming the barriers, concept of effective communication, telephonic communication, public speaking and attending interviews.

3. **Correspondence:** (40%)
   (i) Business, official, social letters and letters to pres. Two questions of 10 marks each are to be attempted out of four.
   (ii) Telegrams, press release, advertisement, notices and memorandum. Two questions of 10 marks each are to be attempted out of four.

4. **Report Writing:** (15%)
   Choice to attempt one out of three topic is to be given.

5. **Practice of writing resume and applications for job.** (10%)

APPLIED MATHEMATICS-II

	L	T	P
Pds/Week	3	2	-

RATIONALE

The course aims at developing analytical abilities in basics of applied mathematics such as: differential and integral calculus and solution of first order differential equations. Besides applications of the above elements in engineering, the course of study will also provide continuing education base to them.

NOTE: Weightage of each topic for external examination is given in the brackets

DETAILED CONTENTS

1. **COMPLEX NUMBERS** **(5%)**
   - (i) Euler's exponential form (modulus argument form)
   - (ii) Hyperbolic function, relation between hyperbolic and circular functions.
   - (iii) Phaser, addition of sinusoidal form, Phaser diagram of R-L, R-C, and L-R-C circuits.

2. **DIFFERENTIAL CALCULAS.** **(40%)**
   - (i) Functions, concept of evaluation of following limits.

$$\text{Limit}_{x\to 0}\ \frac{\sin x}{x}, \qquad \text{Limit}_{x\to a}\ \frac{x^n - a^n}{x - a},$$

$$\text{Limit}_{x\to 0}\ (1+x)^{x}, \qquad \text{Limit}_{x\to a}\ \frac{a^x - 1}{x},$$

   - (ii) Differential coefficient. Its physical application. As rate measure, Geometric interpretation as slope of a curve. Differentiation from first prim of functions like x^n, a^x, Log x , Sin x, Cos x and Tan x. Differentiation of sum, product and quotient of functions.
   - (iii) Differentiation of Trigonometric and inverse Trigonometric functions. Differentiation of function of a function, Implicit functions, parametric functions, Logarithmic differentiation.
   - (iv) Application of differentiation in finding errors, Tangent and normal of curves. Maxima of functions.

3. **INTEGRAL CALCULAS.** **(35%)**
   - (i) Integration as inverse operation of differentiation. Integral of standard functions. Integration by substitution, by parts and by partial fractions.
   - (ii) Evaluation of integral of rational and irrational functions of the form.

$$\frac{dx}{ax^2+bx+c} \qquad ax^2+bx+c \quad dx$$

(iii) Simple definite integrals. Reduction formulae. Evaluation of $\int Sin^n x\,dx$, $\int Cos^n x\,dx$, $\int Sin^m x \cdot Cos^n x\,dx$.(m,n positive integers)

(iv) Applications of integration to finding area under a curve and axes, volume of solid of revolution of area about axes (simple problems). Mean value and R.M.S. value of a function.

(v) Numerical integrations. Approximate evaluation of definite integral by Trapezoidal rule and by Simpson's rule (without proof).

4. **PARTIAL DIFFERENTIATION.** **(10%)**

(i) First order and second order partial derivatives of functions of two variables.

(ii) Euler's theorem on partial differentiation of homogeneous functions. Total differentiation.

5. **SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS. (10%)**

(i) Order and degree of a differential equation. Solving first order first degree differential equation – variable separable form, Homogeneous form and linear differential equation.

(ii) Solving second order differential equation – complementary function, particular integral with functions of the form e^x, Sin ax, Cos ax, x^3, on the right hand side of the equation.

(iii) Applications to L-C-R electric circuits.

ELECTRICAL MACHINES

L	T	P
3	-	3

Rationale:

The nature of jobs an electronic technician ahs to perform varies widely. Any electronic system (tape recorder, VCR, TV receiver) is a combination of electronic circuits and electrical components (small electrical motor, different types of switches etc.).In order to carry out his job function effectively, apart from the knowledge and skills of electronics, he must possess sound knowledge about basic principles of working of electrical machines and equipment. The practical work done in this subject will help in developing skills of operation, repairing and testing of electrical machines and components (small electrical motor and transformer etc.)

Detailed Contents

1. Transformers (20%)

(i) Principles of operation and constructional details of single phase and three phase transformers, core type and shell type transformers, difference between single phase and three phase transformers and advantages and disadvantages.
(ii) Voltage regulation of transformer
(iii) Losses in transformer
(iv) Efficiency, condition for maximum efficiency and all day efficiency
(v) Auto transformers and instrument transformer (CT and PT)

2. Generalized Treatment of Electrical Machines (10%)

(i) Introduction
(ii) Definition of motor and generator
(iii) Basic principles of generator and motor
(iv) Torque due to alignment of two magnets and the concept of torque angle.
(v) Basic electromagnet laws
(vi) EMF induced in a coil rotating in a magnetic field
(vii) Elementary concept of an electrical machine
(viii) Common features of rotating electrical machines

3 DC Machines (20%)

(a) Main Constructional features and principles of working
(b) Function of the commutator for motoring and generating action
(c) Armature winding
(d) Factors determining induced emf
(e) Factors determining electromagnetic torque
(f) Principles of generating and motoring
(g) Action and relationship between terminal voltage and induced emf.
(h) Factors determining the speed of a DC motor
(i) Different types of excitation
(j) Performance and characteristics of different types of Dc machines
(k) Starting of DC machines, motors and starters.
(l) Applications of DC machines

4. Three Phase Supply (10%)

(i) Advantage of three phase supply system over single phase system
(ii) Star – Delta connections
(iii) Relation between phase and line voltages of single phase and three phase systems
(iv) Power and power factor in three phase system and their management

5. AC Motors (20%)

(i) Brief introduction about three phase induction motors, its principle of operation
(ii) Types of induction motors and constructional features of squirrel cage and slip ring motors.
(iii) Starting and speed control, star delta and DOL (Direct On Line) starters.
(iv) Reversals of direction of rotation of 3 phase motors.
(v) Application of induction motors.

6. Single Phase and Fractional Kilowatt Motors (20%)

(i) Introduction, principle of operation of single phase motors, types of single phase motors and their constructional details (split phase, capacitor start, capacitor start and run, shaded pole)
(ii) A.C series Motors or Universal motors.
(iii) Introduction to servo-motors and stepper motors.

List of Practical

1. Conversion of galvanometer into ammeter and voltmeter.
2. To measure power and power factor in a 3-phase system with
   (a) Balanced load
   (b) Unbalanced load by the two wattmeter method and any one method.
3. To find the value of capacitance and power factor of a capacitor by a approximate method.
4. To draw the equivalent circuit of a transform. and to determine efficiency and regulation by performing
   (a) Open circuit test (b) Short circuit test
5. To measure the induced emf of a separately excited DC generator as a function of field current.
6. To measure the terminal voltage of a separately excited DC generator as a function of load current.
7. To measure the terminal voltage of a DC shunt generator as a function of load current
8. To measure the speed of separately excited DC motor as a function of load torque at the rated armature voltage.
9. To measure the speed of a DC series motor as function of load torque at rated armature voltage.
10. To determine the efficiency of a DC shunt motor by the measurement of losses (Sunburn's Method)
11. To observe the difference in the effect of switching on a single phase capacitor start induction motor with
    (a) The capacitor disconnected
    (b) The capacitor connected

Also to determine how to reverse the direction of rotation.

ELECTRONIC COMPONENTS & MATERIALS

L	T	P
4	-	-

RATIONALE

The study of Electronic Components and Materials is important from the point of view of manufacturing, testing and maintenance of electronic devices and systems. Students should understand the construction, identification, characteristics, specifications, merits, limitations and applications of electronic components and materials.

DETAILED CONTENTS

1. Materials **(50%)**

Classification of materials into conducting, semi conducting and insulating materials through a brief reference to atomic Structure.

(a) Conducting Materials:

(i) Resistivity and factors affecting resistivity such as temperature, alloying and mechanical stressing

(ii) Classification of conducting materials into low resistivity and high resistivity materials. Some examples of each and their typical applications.

(b) Insulating Materials:

(i) Electrical properties – volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) and dielectric constant

(ii) Thermal properties – heat resistance, classification according to temperature endurance, thermal conductivity

(iii) Plastics – classification into thermo plastic and thermo-setting categories; examples of each and their typical applications

(iv) Important relevant (electrical, mechanical and thermal) characteristics and applications of the following materials:

Mica	Epoxy Glass	Polythene
Ceramic	Asbestos	Polyester
Glass	Varnish	Phosphor – Bronze alloy
Cotton	Lacquer	Beryllium – copper alloy
Jute	Enamel	Soldering lead alloy
Teflon	Paper (dry and impregnated)	Copper
Acrylics	Rubber	Silver, gold
Silicon grease	Silicon rubber	
Bakelite	PVC	

(c) Magnetic Materials:

(i) Different magnetic materials; (Dia, para, ferro) their properties

(ii) Ferromagnetism, ferrimagnetisms, domains, permeability, Hysteresis loop (including coercive force and residual magnetism and magnetic saturation)

(iii) Soft and hard magnetic materials, their examples and typical applications

2. Components **(50%)**

(i) Capacitor Polyester, Metallised Polyester ceramic paper, mica and electrolytic types, constructional details and testing, specifications, temperature and frequency stability and other limitations. Mutual comparison.

(ii) Resistors-carbon film, carbon composition wire wound and variable types (presets and potentiometers) Constructional details and testing, specifications, temperature and frequency dependence and noise considerations. Mutual comparison

(iii) Transformers Inductors and RF Coils: Methods of manufacture of inductors, RF coils and small transformers (upto 1 KVA) and their testing. Properties of cores Need and types of shielding.

(iv) Surface Mounted Devices (SMD)

(v) Connectors, Relays and Switches:

(vi) Various types of switches, e.g. slide, rotary, push, toggle. Micro-switches etc. Their symbols, specifications and applications

(vii) Concept of 'make' and 'break' contacts in relays. Operating current, Holding current, various types of relays. Their symbols, specifications and applications.

(viii) Various types of connectors. Their symbols specifications and applications

ELECTRONIC DEVICES & CIRCUITS – I

L	T	P
3	1	3

RATIONALE

The course provides the students with Basic understanding of the principles of common electronic devices and circuits of importance. The knowledge regarding the application of various circuits and devices. Practical experience in the design, fabrication and testing of circuits

DETAILED CONTENTS

1. **Introduction** **(5%)**

Introduction to active and passive components, passive components, fixed and variable resistors their various types and specializations including thermistor, LDR and VDR fixed and variable capacitors, their various types and important specifications and colour codes.

2. **Semiconductor Physics** **(10%)**

Intrinsic semiconductors – Conductivity, atomic and crystal structure of germanium and silicon, covalent bonds, generation and recombination, effect of temperature on conductivity of intrinsic semiconductors; energy level diagrams of conductor, insulator and intrinsic semiconductors. Extrinsic semiconductor materials – Doping of impurity, P and N type semi-conductors and their conductivity. Minority and majority carriers ; Drift and Diffusion currents.

3. **Semiconductor Diode**: **(15%)**

P – N junction diode, mechanism of current flow in P-N junction, drift and diffusion current, depletion layer, potential barrier, behaviour of P-N junction characteristics, Zener and avalanche breakdown, concept of junction capacitance in forward and reverse bias conditions. Semiconductor diode characteristics, static and dynamic resistance and their calculation from diode characteristics. Dynamics resistance of diode in terms of diode current.

$$\gamma_D = 25/1_D$$

Diode (P – N junction) as rectifier, hald wave rectifier, full wave rectifier including bridge rectifier, relationship between D.C. output voltage and A.C. input voltage, rectification efficiency and ripple factor for rectifier circuits, filter circuits : Shunt capacitor, series inductor, capacitor input, filter, bleeder resistance, physical explanations of the working of the filters and typical applications of each type. Different types of diodes; brief idea and typical applications of power diodes, zener diodes; variactor diodes and point contact diode. Important specification of rectifier diode and zener diode.

4. **Introduction to bipolar Transistor** **(20%)**

Concept of bipolar transistor as two junction three terminal device having two kinds of current carriers; PNP and NPN transistors, their symbols and mechanisms of current flow: explanation of fundamental current relations.

$I_E = I_B + I_C$ and $I_E = a\, I_E + I_{CBO}$

Concept of leakage current I_{CBO}, effect of temperature of leakage current CB, CE and CC configurations. Common base configuration (CB): input and output characteristics; determination of transistor parameters input and output dynamic

resistance, current amplification factor. Common emitter configuration: current relations in CE configuration, collector current in terms of base current and leakage current (I_{CBO}) relationship between the leakage current in CB and CE configuration input and output characteristics, determination of dynamic input and output resistances and current amplification factor β from the characteristics. Common collector configuration: expression of emitter current in terms of the base current and leakage current in CC configuration. Comparison of CB and CE configuration with regard to dynamic input and output resistance, current gain and leakage current, preference of CE configuration over CB configuration. Transistor as an amplifier in CE configuration. DC load line, its equation and drawing it on collector characteristics. Determination of small signal voltage and current gain of a basic transistor amplifier using CE output characteristics and DC load line; concept of power gain as product of voltage gain and current gain.

5. Transistor Biasing and stabilization of Operating Point (20%)

Different transistor biasing circuits for fixing the operating point, temperature and 'β_{dc}' on operating point, need for stabilization of operating point, effect of fixing operating point in cut off and saturation region on performance of the amplifier. Calculation of operation point for different biasing circuits. Simple design problems in potential divider biasing circuit.

6. SINGLE STAGE TRANSISTOR AMPLIFIER (20%)

Single stage CE amplifier circuit with proper biasing components, Ac load line and its use in:

(i) Calculation of current and voltage gain of a single amplifier circuit.

(ii) Explanation of phase reversal of the output voltage with respect to input voltage

Transistor hybrid low frequency model in CE configuration, 'h' parameters and their physical significance, typical values of the parameters.

Expressions for voltage gain, current gain, input and output impedance for a single stage CE amplifier circuit in 'h' parameters, approximation.

7. FIELD EFFECT TRANSISTOR (FET) (10%)

Construction, operation, characteristics and equivalent circuit of JFET and its circuit application. Construction, operation, characteristics and equivalent circuit of MOSFET in depletion, enhancement modes and its circuit applications. CMOS, advantages and applications Comparison of JFET, MOSFET, BJT simple FET amplifier circuit and its working principles (without analysis).

LIST OF PRACTICALS

Practice in the use of following electronic instruments.

Multi-meter – ordinary as well as electronic (analog/digital type).

Regulated power supply. LF signal generator, CRO.

1. Experiments to be Performed

i) Measurement of voltage at various settings (low and high voltages) of regulated power supply by using analog and digital multi-meters.

ii) Measurement of voltage and current by loading the regulated power supply.

iii) To obtain various voltages like + 15V, + 5V and measure them with the help of analog and digital multi-meter.

iv) Practice in the use of signal generator and CRO: measurement of DC and AC. voltages, time period/frequency of sine/square wave using triggered sweep CRO.

2. Identification and familiarization of passive components.
Experiments to be performed:
   i) Measurement of resistors by an ordinary multi-meter and an electronic multi-meter and their verification on the basis of colour code &specification.
   ii) Measurement of transformer turn ratio of a transformer and to note its specification.
   iii) Note the variations in resistance by calibration of :
      a) Light on LDR (b) temperature on a thermister.

3. Semiconductor diode characteristics
   i) Identification of types of packages, terminals and noting different ratings using data books for various types of semiconductor diodes (germanium point contact, silicon low power and high power and switching diode).
   ii) Plotting of forward V-I characteristics for a junction P.N. diode (silicon and germanium diodes)

4. Rectifier circuits using semiconductor diode, measurement of input and output voltage and plotting of input and wave shape for :
   i) Half wave rectifier (ii) full wave rectifier, (iii) bridge rectifier diode circuits.

5. Plot forward and reverse V-I characteristics for a zener diode.

6. Plot the wave shapes of a full wave rectifier with shunt capacitor, series inductor, and pie filter circuit.

7. Plotting input and output characteristics and calculation of parameters of a transistor in common base configuration.

8. Plotting input and output characteristics and calculation of parameters of a transistor in common emitter configuration.

9. Transistor biasing circuit. Measurement of operating point (I_C and V_{CE}) for a :
   i) Fixed bias circuit
   ii) Potential divider biasing circuit.
   (Measurement can be made by changing the transistor in the circuits by another of same type number).

10. Single stage common emitter amplifier circuit.
   i) Measurement of voltage gain at 1 KHz for different load resistances.
   ii) Measurement of input and output impedance of the amplifier circuit.

11. a) Plot the FET characteristics and determine the FET parameters from its characteristics.
   b) Measure voltage gain and plot the frequency response of JFET or MOSFET amplifier circuit.

ELECTRICAL & ELECTRONICS WORKSHOP

L	T	P
-	-	6

RATIONALE

This subject is gateway to the technological/industrial processes. The mental and manual abilities will be developed to handle engineering materials with hand tools with quality and safety consciousness. The elementary abilities developed in carpentry, fitting, sheet metal and jointing shops earlier and in electric & electronics shops during this study will find applications in other subjects. The emphasis given on practical work will provide the students the primary experience of working in team.

DETAILED CONTENTS

1. Identification and familiarization with the following electronic instruments :
   a) Multi-meter digital (Three and half digit)
   b) CRO (Single Beam/ Dual Trace/DSO) function of every knob on the front panel
   c) Audio-oscillator sine and square wave output
   d) Power supply fixed voltage and variable voltage, single output as well as dual output.

2. Identification and familiarization with commonly used tools; statement of their uses. Identification and familiarization with active and passive components; colour code and types of resistor and potentiometers (including VDR, LDR and thermister); some small practical exercises on measurement of these components; identification of diode and transistor terminals. Identification of other components including LED, LCD, UJT, FET, Coils, relays, switches (SPDT, DPDT, etc) connectors, micro-switches, read relays, transformer (mains, audio and RF etc) Linear and Digital IC's, Thyristors, etc.

NOTE: Demonstration Boards for the above components should be made.

3. Study of wires & cables and develop technical skill to cut, strip, join and insulate two length of wires/cables (repeat with different types of wires/cables)

4. To develop technical skill to connect/solder/crimp different kinds of wires/cables (included shielded cable) to different types of Power / General purpose / Audio / Video / Telephone plug, socket, jacks, terminal, binding posts, terminal strip, connector's. The task should include making complete recording / Playback / Antena / Speaker loads for common consumer electronics products such as Radio, T.V., VCR, cassette recorder, Hi-Fi equipment, Head set, Microphone etc.

5. Study of soldering techniques:
   (a) Various tools for Soldering (Soldering iron, Soldering station or temperature control soldering iron), Exposure to Modern Soldering Process.
   (b) Soldering material (solder wire, flux, cleaning fluid)
   (c) Develop skill to cut, bend, insert and solder components (Resistance, Resistors Capacitors, diodes, Transistors. I.F.T. type coil, IC's etc.) on a PCB.
   (d) Demonstrate the skill to assemble components on PCB, wiring of a small Ckt on a PCB.

6. Study of De-Soldering Techniques:
   (a) Various tools for De-soldering (De-Soldering Pump, De-Soldering Gun, De-Soldering strip/wick), Exposure to modern De-Soldering process.
   (b) Demonstrate the skill to remove and clean the components, wires from a given equipment or PCB.

SUGGESTIONS FOR ACHIEVEMENT OF OBJECTIVES

For making students familiar with electronic components (active as well as passive), tools, accessories, equipment (listed as above) tutorial lessons should be used. The students must be taken to electronics laboratory and taught rating limitations, symbol, connection procedures. The workshop practice period should be used for gaining familiarity by physical examination, testing, wiring, mounting, connecting and jointing exercises. General purpose equipment listed above should be operated and used by them. Such parameters as amplitude, frequency phase, time period, rise and fall time of pulse waveforms, transistor parameters, circuit resistance should be measured by students in the laboratory.

The situation requiring the use of low power and high power soldering irons and tips should be discussed and should be a part of training.

The use of de-soldering wick, desoldering tool, solder sucker, desoldering of ICS and multi-pin components need to be taught. Variety of soldering exercises involving different types of wires and cables should be included as practical work.

Electric Shop

- Demonstration of tools commonly used in Electric Shop
- Safety precaution, electric shock treatment
- Demonstration of common Electric material like : wires, fuses, ceiling fans, batteries, cleats and allied items

- Demonstrate (or explain) the joining (or connecting) methods or/and mounting and dismantling method as well as uses of the items mentioned below :
  a) Various types of single, multi-cored insulated screened pour, Audio video, general purpose wires/cables
  b) Various types of plugs, sockets, connectors suitable for general purpose audio video use. Some of such connectors area : 2 and 3 pin mains plug and sockets, Banana plugs and sockets, BNG, RCA, DIN, UHF, Ear phone speaker connector, telephone jacks and similar male and female connectors and terminal strips.
  c) Various types of switches such as : normal/miniature toggle, slide, push button piano key, rotary, SPST,SPDT,DPST,DPDT, band selector, multi-way Master Mains Switch.
  d) Various types of protective devices such as: Wire fuse, cartridge fuse, slow acting/fast acting fuse, HRC fuse, thermal fuse, single/multi-pole miniature circuit breakers, over and under current relays.
- Demonstration of voltmeter, Ammeter, Multimeter (Digital and analog) & Energy meter

➢ Job : Wiring Practice in batten wiring, plastic casing-capping and conduit

- Job : Control of one lamp by one switch / two switches
- Job : Control of one socket by one switch & two sockets by two switches
- Job : Control of one bell by one switch
- Job : Assemble a Tube light
- Job : Dismantle study, find out fault, repair the fault, assemble and test domestic appliances like Electric Iron, Electric Mixer, Ceiling & Table fan, Tube light, Water heater (Geyser) and desert cooler
- Job : Laying out of complete wiring of a induction motor (Single-phase and Three-phase)

ENGINEERING DRAWING

L	T	P
-	-	6

Rationale:

Engineering drawing known as the language of engineers is a widely used means of communication among the designers, engineers, technicians' draftsmen and craftsmen in the industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. The diploma holder is required to read and interpret the designs and drawings, provided to him for actual execution of the job. This course aims at building a foundation for comprehension of this language of engineering profession.

Detailed Contents

Introduction to instruments and materials used in drawing.

Plate No. 1	Free hand sketching	**(5%)**
Plate No.2	Conventional representation of lines, materials, breaks, electric and electronic symbols.	**(5%)**
Plate No.3	Free hand lettering and numerals in 3,5,8 and 12 mm series. Vertical and inclined lettering at 75^0. Instrumental single stroke lettering in 12 mm.	**(10%)**
Plate No.4	Dimensioning techniques	
Plate No.5	Three views of an object in 1^{st} angle projection.	**(8%)**
Plate No.6	Six views of an object in 1^{st} angle projection.	**(8%)**
Plate No.7	Three views of an object in 3^{rd} angle projection.	**(8%)**
Plate No.8	Six views of an object in 3^{rd} angle projection.	**(8%)**
Plate No.9	Identification of surfaces from different objects including inclined and curved surfaces.	
Plate No.10	Sections – conventional representation of materials, general conventions of revolved and removed sections.	**(8%)**
Plate No.11	Representation of pictorial/isometric view of a simple object.	**(8%)**
Plate No.12	Isometric views of simple objects including slant and curved surfaces.	**(8%)**
Plate No.13	Isometric of circle, semicircle, arcs and angles.	**(8%)**
Plate No.14	Missing views and lines.	**(8%)**
Plate no.15	Scales, diagonal scale, scale of chords.	**(8%)**