3.1 FUNDAMENTALS OF ELECTRICAL ENGINEERING

L T P

Periods/week 5 - 3

RATIONALE

For a diploma holder in electrical engineering, it becomes imperative to know the fundamentals of the subject in order to grasp the knowledge of the field. This subject will provide acquaintance with various terms knowledge of fundamental concepts of electricity, magnetism and various principles related to it.

Unit 1. Basic concepts of Electrical energy **(10 Periods)**

Basic Electrical Quantities: Basic concept of charge, current, voltage, resistance, power, energy and their units , Conversion of units of work, power and energy from one form to another, resistance, inductance and capacitance in series and parallel and their applications in solving electrical network problems.

Unit 2. DC Circuits **(15 Periods)**

Ohm's law, Kirchhoff's laws and their applications in solving electrical network problems. Network theorems such as superposition theorem, Thevenin's theorem, Norton's theorem and Maximum power transfer theorem.

Unit 3. Batteries **(10 Periods)**

Basic idea about primary and secondary cells, Working principle, construction and applications of Lead acid, Nickel Cadmium and Silver Oxide Cells , Capacity and efficiency of lead acid battery , Charging methods used for lead acid accumulator , Care and maintenance of a lead acid battery , Grouping of cells in series and parallel (simple numerical problems), Testing of lead Acid battery for fully charged conditions and their specifications ,Application of lead acid battery , Idea about batteries used in UPS.

UNIT 4. Magnetism and Electromagnetism: **(15Periods)**

4.1 Introduction to electromagnetism, Magnetic field around a straight current carrying conductor and a solenoid and methods to find its direction, force between two parallel current carrying conductors.
4.2 Force on a conductor placed in the magnetic field
4.3 Series magnetic circuits, simple problems
4.4 Concept of hysteresis, loop and hysteresis loss.

UNIT 5. Electromagnetic Induction: **(15 Periods)**
5.1 Faraday's Laws of electromagnetic induction
5.2 Lenz's law
5.3 Fleming's Right and Left Hand Rule

5.4 Principle of self and mutual induction
5.5 Principle of self and mutually induced e.m.f. and simple problems
5.6 Inductances in series and parallel 5.7 Energy stored in a magnetic field
5.8 Concept of eddy currents, eddy current loss.

Unit 6. AC Circuits **(15 Periods)**

6.1 Concept of a.c. generation (single phase and three phase), Difference between a.c and d.c , Concept of alternating current and voltage, equation of instantaneous values, average value, r.m.s value, form factor.
6.2 AC through pure resistance, inductance and capacitance.
6.3 Alternating voltage applied to RL,RC and RLC series and parallel circuits (impedance triangle, phasor diagram and their solutions).
6.4 Concept of susceptance, conductance and admittance

LIST OF PRACTICALS
1. Determination of voltage-current relationship in a dc circuit under specific physical conditions and to draw conclusions (to verify ohm's law).
2. (a) To verify that Rt = R1+R2+…. where R1, R2... etc. are resistances connected in series.
(b) To verify 1/Rt= 1/R1+1/R2+.....Where R1, R2.... etc. are resistances connected in parallel.
3. Verification of Kirchhoff's current and voltage laws applied to DC circuits.
a) To construct a circuit arrangement consisting of resistances in series, parallel combination.
b) Identification of node points in the circuit.
c) To see that algebraic sum of currents at node point is zero d) To see that algebraic sum of emfs and voltage drops in a closed loop is zero.
4. To observe the a.c and d.c wave shapes on CRO.
5. To find ratio of inductance values of a coil having air /iron core respectively and to see the effect of introduction of a magnetic core on coil inductance.
6. To construct an RL and RC circuit and to measure
a) Impedance of the circuit b) Phase angle between voltage and current c) Construct impedance triangle.
7. Measurement of power and power factor of a single phase RLC circuit. To calculate KVA and KVAR
8. Measurement of power and power factor of a 3-phase circuit by using CT AND PT .
9. Testing a battery for its charged condition i.e testing of gravity

INSTRUCTIONAL STRATEGY

Basic electrical engineering being a fundamental subject need to be handled very carefully and in a manner such that students develop clear understanding of principles and concepts and develop skill in their application in solving related problems. Teacher may lay emphasis on laboratory experiments and give lot of tutorial work to students in order to given them an opportunity in mastering the basics in solving related problems.

RECOMMENDED BOOKS

1. Fundamentals of Electrical Engineering by Sahdev, Uneek Publication, Jalandhar
2. Basic Electrical Engineering by PS Dhogal, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. Electrical Science by VK Mehta, S Chand and Co., New Delhi
4. Electrical Engineering by DR Arora, Ishan Publications, Ambala
5. Electrical Technology by JB Gupta, SK Kataria and Sons, New Delhi
6. Electrical Technology by BL Theraja, S Chand & Co., New Delhi
7. Electrical Science by S. Chandhni, R Chakrabarti and PK Chattopadhyay. Narosa Publishing House Pvt. Ltd., New Delhi 8. Basic Electrical Engineering by Mool Singh, Galgotia Publication Pvt. Ltd., New Delhi
9. Principles of Electrical Engineering by BR Gupta, S Chand & Co., New Delhi 10. Handbook of Electrical Engineering by SL Bhatia, Khanna Publishers, New Delhi.
10. Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi
11. Electronic Principles by SK Sahdev, Dhanpat Rai & Co., New Delhi
12. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
13. Electronic Components and Materials by SM Dhir, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Period)	Marks Allocation (%)
1	10	14
2	15	18
3	10	14
4	15	18
5	15	18
6	15	18
TOTAL	80	100

3.2 ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

	L	T	P
Periods/week	**4**	**-**	**2**

RATIONALE

A diploma holder in Electrical Engineering will be involved in maintenance, repair and production of electrical equipment and systems. In addition, he may be required to procure, inspect and test electrical and electronic engineering materials. Knowledge of various types of materials will be needed in order to execute the above mentioned functions. He may also have to decide for an alternative when a particular material is either not readily available in the market or its cost becomes prohibitive.

DETAILED CONTENTS

UNIT1 **(03 PERIODS)**

1.1 Classification
Classification of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands.

UNIT 2 **(12PERIODS)**

2.1 Conducting Materials
Introduction
2.2 Resistance and factors affecting it such as alloying and temperature etc.
2.3 Classification of conducting material as low resistivity and high resistivity materials, Low resistance materials
a. Copper- General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electrical engineering
b. Aluminium - General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium, solderability, contact resistance. Applications of aluminium in the field of electrical engineering
c. Steel - General properties as conductor: Resistivity, corrosion, temperature coefficient, density, mechanical properties, solderability, Applications in the field of electrical engineering Introduction to bundle conductors and its applications Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), and their practical applications with reasons for the same
2.4 Applications of special metals e.g. Silver, Gold, Platinum etc.
2.5 High resistivity materials and their applications e.g., manganin, constantin, nichrome, mercury, platinum, carbon and tungsten, Tantalum.
2.6 Superconductors and their applications.

UNIT3 **(05 PERIODS)**

3.1 Review of Semi-conducting Materials :Semi Conducting material such as Germanium, Silicon, Carbon-their atomic structure/application/against , pure and impure semi conductors and their use for making electronic devices. Material used for special purpose semiconductor, diode, contacts, power transistor, substrate, integrated circuits and power handling devices.

UNIT4. **(12 PERIODS)**

Insulating materials; General Properties

4.1 Electrical Properties Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant.

4.2 Physical Properties Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness.

4.3 Thermal Properties Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics.

4.4 Chemical Properties Solubility, chemical resistance, weatherability.

4.5 Mechanical properties, mechanical structure, tensile structure

UNIT 5. **(13PERIODS)**

Insulating Materials and their applications

5.1 Plastics a. Definition and classification b. Thermosetting materials: Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and melamine - formaldehyde), epoxy resins - their important properties and applications c. Procedure of preparation of plastic (PVC) d. Thermo-plastic materials: Polyvinyl chloride (PVC), polyethelene, silicons, their important properties and applications.

5.2 Natural insulating materials, properties and their applications.

a. Mica and Mica products

b. Asbestos and asbestos products

c. Ceramic materials (porcelain and steatite)

d. Glass and glass products

e. Cotton

f. Silk

g. Paper (dry and impregnated)

h. Rubber, Bitumen

i. Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation

j. Enamels for winding wires

k. Glass fibre sleeves

5.3 Gaseous materials; Air, Hydrogen, Nitrogen, SF6 their properties and applications

UNIT6. **(19 PERIODS)**

Magnetic Materials

6.1 Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop including coercive force and residual magnetism, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect, method of reduction of eddy current loss and hysteresis loss

6.2 Soft Magnetic Materials

a) Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines

b) Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine

c) Nickel-iron alloys

d) Soft Ferrites

6.3 Hard magnetic materials - Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications

6.4. Special Materials
Thermocouple, bimetals, leads soldering and fuses material, mention their applications.

6.5. Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc

LIST OF PRACTICALS

1. A market survey of different Electrical and Electronics materials available in market will be conducted by students. They will submit a report, which will include names, types, specifications, identification, testing of components, manufacturing details and related cost.
2. Case study/data manuals of different wires/cables/fuses/sockets etc.A report will be submitted by the students.

INSTRUCTIONAL STRATEGY

The teacher should bring different materials, electronic components and devices in the class while taking lectures and explain and make students familiar with them. Also he may give emphasis on practical applications of these devices and components in the field. In addition, the students should be given exercises on identification of materials used in various electronic gadgets etc .and be encouraged to do practical work independently and confidently

RECOMMENDED BOOKS

1. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi Electronic
2. Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi Electrical
3. Engineering Materials by Sahdev, Uneek International Publications
4. Electronic Components and Materials by SM Dhir, Tata Mc Graw Hill, New Delhi
5. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
6. Electrical and Electronics Engineering Materials BR Sharma and Others, Satya Parkashan, New Delhi
7. Electrical and Electronics Engineering Materials DR Arora, Ishan Publications, Ambala City Electrical Engineering Materials by Rakesh Dogra, SK Kataria and Sons, NEW Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Period)	Marks Allocation (%)
1	03	5
2	12	18
3	05	09
4	12	18
5	13	20
6	19	30
TOTAL	**64**	**100**

3.3 ELECTRONICS DEVICES AND CIRCUITS

	L	T	P
Periods/week	**5**	**-**	**3**

RATIONALE

At present, electronics gadgets are being extensively used in various manufacturing processes in industries, power system operations, communication systems, computers etc. Even for an electrical diploma holder, it is absolutely necessary to have a basic understanding of electronic components, their function and applications. This understanding should facilitate in operation and maintenance equipment, which are electronically controlled.
In this course, topics like semi-conductor theory, semi-conductor Diodes, Bipolar transistors, rectifiers, single stage and multistage amplifiers and field effect transistors have been included.

DETAILED CONTENTS

UNIT 1. Atomic structure **(14 periods)**

1.1. Introduction, Brief history of development of electronics, Active and passive components
1.2. Semi-conductor Theory, Atomic structure, crystalline structure, Energy band theory of crystals, energy band structure of insulator, semiconductor and conductor, generation and recombination of electron hole pairs. Energy band structure of Silicon and Germanium, Concept of Doping, intrinsic and extrinsic semiconductors, Effect of temperature on intrinsic and extrinsic semiconductors.

UNIT 2. Semiconductor Diodes **(14 Periods)**

2.1.PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier, effect of forward and reverse biasing in a PN junction. Concept of junction capacitance in forward and reverse biased conditions,
2.2Ideal diode, Semiconductor diode characteristics, static and dynamic resistance
2.3 Use of diode as half wave and full wave rectifiers (centre tapped and bridge type), ripple factor, rectifier efficiency, Operation of filter circuits, Diode ratings/specifications , Various types of diodes such as zener diode, varactor diode, Schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications, Use of zener diode for voltage stabilization

UNIT 3. Bi-polar Junction Transistors **(20 Periods)**

3.1Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current, Transistor configurations: common base (CB), common emitter (CE) and common collector (CC), current relation and their input/output characteristics; comparison of the three configurations

3.2 Transistor biasing, its need, operating point, effect of temperature on the operating point of a transistor and need of stabilization of operating point, Different biasing circuits, limitations, Use of data book to know the parameters of a given transistor

UNIT 4 Transistor as an amplifier (18 Periods)

4.1 Single-Stage Transistor Amplifiers, CE configuration, function of each component, working of single stage transistor amplifier, physical and graphical explanation, phase reversal, Frequency response of a single stage transistor amplifier

4.2Multi-Stage Transistor Amplifiers, Need of multi-stage transistor amplifiers – different types of couplings, their purpose and applications, RC coupled two-stage amplifiers, circuit details, working, frequency response, applications, Loading effect in multistage amplifiers, Elementary idea about direct coupled amplifier, its limitations and applications, Transformer coupled amplifiers, its frequency response.

UNIT 5 Field Effect Transistor & OP Amps (14 Periods)

5.1 FET - Construction, operation, characteristics and applications of a N channel JFET and P channel JFET, JFET as an amplifier, JFET applications, Types, construction, operation, characteristics and applications of a MOSFET, Comparison between BJT, JFET and MOSFET

5.2 Operational Amplifiers-Characteristics of an ideal operational amplifier and its block diagram, Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current, Operational amplifier as an inverter, scale changer, voltage follower, adder, subtractor, differentiator, and integrator

LIST OF PRACTICALS

1. a) Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits
b) Measurement of resistances using multimeter and their comparison with colour code values
2. V-I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance
3. a) V-I characteristics of a zener diode and finding its reverse breakdown voltage
b) Fabrication of a zeener diode voltage stabilizer circuit using PCB
4. Observation of input and output wave shapes of a half wave rectifier.
5. Observation of input and output wave shapes of a full wave rectifier.
6. Plotting input and output characteristics of a transistor in CB configuration
7. Plotting input and output characteristics of a transistor in CE configuration
8. To study the effect of coupling capacitor on lower cutoff frequency and upper cutoff frequency by plotting frequency response of two stage RC coupled amplifier
9. To plot V_I characteristics of a FET
10. To use IC (op-amplifier) as
i) Inverter ii) Adder iii) Subtractor iv) Intergrator

INSTRUCTIONAL STRATEGY

This subject gives the knowledge of fundamental concepts of basic electronics. The teacher should give emphasis on understanding of concepts and various term used in the subject. The students be made familiar with diodes, transistors, resistors, capacitors, inductors etc. and electrical measuring instruments etc. Practical exercises will reinforce various concepts. Application of Semiconductor Diodes, Transistors, Field Effect Transistors etc must be told to students.

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi

2. Electronic Principles by SK Sahdev, Dhanpat Rai & Co., New Delhi

3. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi

4. Electronic Components and Materials by SM Dhir, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi

5. Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi

6. Electronics Devices and Circuits by Millman and Halkias; McGraw Hill
7. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill Education Pvt Ltd, New Delhi
8. Basic Electronics – Problems and Solutions by Albert Malvino and David J. Bates; Tata McGraw Hill Education Pvt Ltd, New Delhi
9. Basic Electronics by J.S. Katre, Sandeep Bajaj, Tech. Max. Publications, Pune
10. Analog Electronics by DR Arora, Ishan Publications, Ambala City
11. Analog Electronics by JC Karhara, King India Publication, New Delhi
12. Electrical Devices and Circuits by Rama Reddy, Narosa Pulishing House Pvt. Ltd., New Delhi
13. Electronic Devices and Circuits by Dharma Raj Cheruku and Battula Tirumala Krishna: Pearson Education (Singapore) Pvt Ltd., Indian Branch, 482 F.I.E Patparganj, Delhi- 92
14. Basic Electronics by JB Gupta, SK Kataria and Sons, New Delhi
15. Grob's Basic Electronics- A text Lab Manual (Special Indian Edition) by Schultz, Tata McGraw Hill Education Pvt Ltd, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

UNIT 1	Time Allotted (Period)	Marks Allocation (%)
1	14	20
2	14	20
3	20	20
4	18	20
5	14	20
Total	**80**	**100**

3.4 FUNDAMENTALS OF MECHANICAL AND CIVIL ENGINEERING

	L	T	P
Periods/week	**5**	**-**	**3**

RATIONALE

A diploma holder has to assist in activities of installation, operation andmaintenance etc of different machines and equipment. These activities are not branch specific and insteadrequire him to know basics of civil and
mechanical engineering. The subject of Fundamentals of
Mechanical and Civil Engineeringhas been included to impart basic knowledge of Civil and Mechanical engineering to the students.

DETAILED CONTENTS

PART-A
MECHANICAL ENGINEERING

Theory

1. Transmission of Power (20Periods)

1.1 Transmission of power through belt, rope drives and pulleys, gears and chains
1.2 Different type of pulleys and their application
1.3 Chain drives and its comparison with belt drive
1.1Gear drives, types of gears, simple gear trains and velocity ratio

2. Air Conditioning System (24Periods)

2.1 Basic principle of refrigeration and air conditioning
2.2 Working of centralized air conditioner
2.3Concept of split air conditioner and its applications

3. Pumps -Types and their uses (06Period)

PART B
CIVIL ENGINEERING

Theory

4.Construction Materials (12Periods)

Properties and uses of various construction materials such as stones, bricks, lime, cement and timber along with their properties, physical/ field testing and uses, elements of brick ,Masonry

5.Foundations (08Periods)

i)Bearing capacity of soil and its importance

ii)Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines, Walls and there classification, load bearing, non load bearing partition and cavity wall.

6.Concrete (06Periods)

Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/ field testing of concrete, mixing of concrete

7.RCC (04Periods)

Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building

LIST OF PRACTICLES

1. Observe operation of a centrifugal pump and location of common faults

2. Decide the type of foundation too be used for various types of electrical machinery and installation. Prepare a foundation for installation of a motor/ generator.

3. Identify various types of drives used in an IC engines and describe their function

4. Observe operation of air conditioning system. Identify locations of faults.

5. Trace the various paths of hot gases, cool gases, control system in a split air conditioner model. Identify the possible location of faults/ malfunctioning.

SUGGESTED DISTRIBUTION OF MARKS

Topic no.	Time allotted(periods)	Marks allotted(%)
1	20	17
2	24	27
3	06	06
4	12	25
5	08	10
6	06	08
7	04	07
Total	80	100

3.5 ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS

	L	T	P
Periods/week	**5**	**-**	**3**

RATIONALE

This subject deals with the various instruments, their construction and working which control the various parameters and operations in any industry. Electrical supervisor employed for maintenance of electrical equipment/ machinery is required to diagnose faults, rectify them and test the total system for good performance. Thus there is a need of introducing diploma holders to the basics of Instrumentation. Basics of instrumentation has been dealt with in this subject.

DETAILED CONTENTS

UNIT 1 **(12 Periods)**

Measurements

1.1 Importance of measurement, Basic measuring systems, advantages and limitations of each measuring systems, generalized measurement system, Types of measuring instruments, Essentials of indicating instruments – deflecting, controlling and damping torque .

1.2 Transducers

Theory, types of transducers construction and use of various transducers like resistance, inductance, capacitance, electromagnetic, piezoelectric type.

UNIT2 **(23Periods)**

2.1. Ammeters and Voltmeters (Moving coil and moving iron type)

Concept of ammeters and voltmeters and difference between them 2.2 Extension of range of voltmeters and ammeter 2.3 Construction and working principles of moving Iron and moving coil instruments 2.4 Merits and demerits, sources of error and application of these instruments

2.2.Wattmeters (Dynamometer Type)

Construction, working principle, merits and demerits of dynamometer type wattmeter, sources of error. three phase power measurement by :

1. one wattmeter method
2. two wattmeter method
3. three wattmeter method

2.3. Energy meter (Induction type)

Construction, working principle, merits and demerits of single-phase and three-phase energy meters ,Errors and their compensation, Simple numerical problems .

UNIT 3 **(20 Periods)**

3.1 Measurement of Displacement and Strain

Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as bounded, unbounded wire and foil type etc. Gauge factor, sources of errors and its compensations. Use of electrical strain gauges, strain gauge bridges and amplifiers.

3.2 Force, Pressure Measurement, and Torque Measurement

Different types of force measuring devices and their principles, Load cells, - Manometers, diaphragms, Bourdon, bellows, manometer, diaphragm pressure gauges, basic principles,

constructional brief and use, pickups, their principle, construction and applications. Use of pressure cells.Measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements.

3.3 Flow measurement.
Basic principles of magnetic and ultrasonic flow meters, flow coefficient, Reynolds number and rotameter.

3.4 Measurement of Temperature
Bimetallic thermometer, pressure thermometers, thermoelectric thermometers, resistance thermometers, thermocouple, thermisters and pyrometer, errors in temperature measurements in rapidly moving fluids, industrial thermocouple.

Unit 4 **(15 Periods)**

4.1 Miscellaneous Measuring Instruments
Construction, working principle and application of Meggar, Earth tester,Analog Multimeter, Digital multi-meter, basic principle, constructional brief, display system, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp-on meter)
4.2 Instrument Transformers: Construction, working and applications a) CT b) PT

UNIT 5 Electronic Instruments **(10 Periods)**
5.1 Cathode Ray Oscilloscope: Block diagram, working principle of CRO. Applications of CRO.
5.2 . LCR meters and Q meter
Study of LCR meter and its applications Digital LCR and Q meter
5.3 Signal conditioning and telemetry with small simple examples .

INSTRUCTIONAL STRATEGY

The teacher should explain the scope of various measuring devices and their practical applications in the field. The transducers and measuring devices must be shown to the students and they should be trained in the reaction, operation, maintenance and calibrations. Frequent visits to nearby process industries will be of immense help to the students.

RECOMMENDED BOOKS

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad

2. Electronic Measurement and Instrumentation by JB Gupta, SK Kataria and Sons, New Delhi

3. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi

4. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi

5. Industrial Instrumentation by Umesh Rathore, SK Kataria and Sons, New Delhi

LIST OF PRACTICALS

1. Use of analog and digital multimeter for measurement of voltage, current (a.c/d.c) and resistance.
2. To calibrate 1-phase energy meter by direct loading method.
3. To measure the value of earth resistance using earth tester.
4. To measure power, power factor in a single-phase circuit, using wattmeter and power factor meter and to verify results with calculations.
5. Measurement of power and power factor of a three-phase balanced load by two wattmeter method.
6. Measurement of voltage and frequency of a sinusoidal signal using CRO time base as well as Lissajous pattern and draw wave shape of signal.
7. Measurement of power in a 3 phase circuit using CT, PT and 3-phase wattmeter.
8. Use of LCR meter, digital LCR meter for measuring inductance, capacitance and resistance.
9. To record all electrical quantities from the meters installed in the institution premises.
10. To measure Energy at different Loads using Single phase Digital Energy meter.
11.Measurement of displacement by LVDT.
12 Measurement of pressure using strain gauge.
13 Measurement of temperature using Thermocouple.
14 Measurment of water level using water level sensors.
15. Measurement of humidity using hygrometer kit.

SUGGESTED DISTRIBUTION OF MARKS

Topic	**Time Allotted (Period)**	**Marks Allocation (%)**
1	12	15
2	23	30
3	20	25
4	15	18
5	10	12
Total	**80**	**100**

3.6 ELECTRICAL WORKSHOP PRACTICE

L T P

Periods/week - 6

RATIONALE

An electrical diploma holder will be required to inspect, test and modify the work done by skilled workers working under him. In addition, many a times, it will become necessary for him to demonstrate the correct method and procedure of doing a job. In order to carry out this function effectively, in addition to conceptual understanding of the method or procedure, he must possess appropriate manual skills. The subject aims at developing special skills required for repairing, fault finding, wiring in electrical appliances and installations.

DETAILED CONTENTS

1. Study of electrical safety measures as mentioned in the Electricity Rules and shock treatment including first aid

2. Types of wiring and to make different light control circuits in the following types of wiring Casing and capping, (PVC) conduct, baten wiring
3. Study of ISI standard for MCBs and ELCBs Conduct one test on MCB on above basis

4. Wiring of main distribution board with four outgoing circuits for light and fan loads including main switch and MCBs Types of wiring and to make different light control circuits in the following types of wiring.
   4.1 Casing and Capping (PVC) wiring
   4.2 Conduit wiring (surface/concealed)

5. Construction of distribution and extension board with two 5A sockets and two I5A sockets, a fuse and indicator with series test lamp provision controlled by their respective switches.

6. Testing of domestic wiring installation using meggar.

7. Fault finding and repair of a tube light circuit.

8. Carry out pipe/ plate earthing for a small house and 3 phase induction motor. Testing the earthing using earth tester.

9. Connection of single phase and three phase motors through an appropriate starter.

10. Winding/ rewinding of a fan (ceiling and table) and choke.

11. Repair of domestic electric appliances such as electric iron, geyser, fan, heat convector, desert cooler, room heater, electric kettle, electric oven, electric furnace and weighing machine

Note: Students may be asked to study control circuit of a passenger lift, automatic milling machine, etc. using relays.

SUGGESTION