# ELECTRICAL TECHNOLOGY
## SCHEME OF STUDIES

| | | | T | P | C | Page |
|---|---|---|---|---|---|---|
| 1ST YEAR | | | | | | |
| Gen | 111 | Islamiat/Pakistan Studies | 1 | 0 | 1 | 1 |
| Eng | 112 | English | 2 | 0 | 2 | 10 |
| Math | 123 | Applied Mathematics-I | 3 | 0 | 3 | 13 |
| Ch | 132 | Applied Chemistry | 1 | 3 | 2 | 20 |
| Comp | 122 | Computer Applications | 1 | 3 | 2 | 27 |
| ET | 115 | Principles of Electrical Engineering | 3 | 6 | 5 | 32 |
| ET | 121 | Basic Electrical Drawing | 0 | 3 | 1 | 42 |
| ET | 146 | Workshop Practice-I | 1 | 15 | 6 | 47 |
| | | i) Wiring 1 6 3 | | | | |
| | | ii) Metal Work 0 3 1 | | | | |
| | | iii) Wood Work 0 3 1 | | | | |
| | | iv) Welding 0 3 1 | | | | |
| | | **T o t a l** | **12** | **30** | **22** | |
| 2ND YEAR | | | | | | |
| Gen | 211 | Islamiat & Pakistan Studies | 1 | 0 | 1 | 57 |
| Math | 283 | Applied Mathematics-II | 3 | 0 | 3 | 66 |
| Phy | 222 | Applied Physics | 1 | 3 | 2 | 72 |
| Mgm | 221 | Business Management & Industrial Economics | 1 | 0 | 1 | 79 |
| ET | 213 | D.C. Machines & Batteries | 2 | 3 | 3 | 84 |
| ET | 223 | Electrical Instruments & Measurements | 2 | 3 | 3 | 90 |
| ET | 233 | Utilization of Electrical Energy | 2 | 3 | 3 | 106 |
| ET | 242 | Installation Planning & Estimating | 1 | 3 | 2 | 111 |
| ET | 251 | Applications of Computers in Elect. Tech. | 0 | 3 | 1 | 115 |
| ET | 263 | Basic Electronics | 2 | 3 | 3 | 116 |
| ET | 271 | Workshop Practice-II (Basic Machine Shop) | 0 | 3 | 1 | 123 |
| | | **T o t a l** | **15** | **24** | **23** | |
| 3RD YEAR | | | | | | |
| Gen | 311 | Islamiat/Pakistan Studies | 1 | 0 | 1 | 126 |
| Mgm | 321 | Business Communication | 1 | 0 | 1 | 133 |
| Mgm | 311 | Industrial Management & Human Relations | 1 | 0 | 1 | 137 |
| ET | 316 | A.C. Machines | 4 | 6 | 6 | 143 |
| ET | 322 | Power Plant & Energy Conservation | 2 | 0 | 2 | 154 |
| ET | 335 | Transmission, Distribution and Protection of Electrical Power Systems | 4 | 3 | 5 | 159 |
| ET | 343 | Telecommunication | 2 | 3 | 3 | 175 |
| ET | 353 | Repair & Maintenance of Electrical Equipment | 1 | 6 | 3 | 180 |
| ET | 364 | Digital & Industrial Electronics | 3 | 3 | 4 | 187 |
| | | **T o t a l** | **19** | **21** | **26** | |

**Eng-112 ENGLISH**

**Total contact hours**

| | | |
|---|---|---|
| Theory | 64 | T P C |
| Practical | 0 | 2 0 2 |

**AIMS** At the end of the course, the students will be equipped with cognitive skill to enable them to present facts in a systematic and logical manner to meet the language demands of dynamic field of commerce and industry for functional day-to-day use and will inculcate skills of reading, writing and comprehension.

**COURSE CONTENTS**

**ENGLISH PAPER "A"**

**1 PROSE/TEXT 16 hours**

1.1 First eight essays of Intermediate English Book-II

**2 CLOZE TEST 4 hours**

2.1 A passage comprising 50-100 words will be selected from the text. Every 11th word or any word for that matter will be omitted. The number of missing word will range between 5-10. The chosen word may or may not be the one used in the text, but it should be an appropriate word.

**ENGLISH PAPER "B"**

**3 GRAMMAR 26 hours**

3.1 Sentence Structure.
3.2 Tenses.
3.3 Parts of speech.
3.4 Punctuation.
3.5 Change of Narration.
3.6 One word for several
3.7 Words often confused

**4. COMPOSITION 8 hours**

4.1 Letters/Messages
4.2 Job application letter
4.3 For character certificate/for grant of scholarship
4.4 Telegrams, Cablegrams and Radiograms, Telexes, Facsimiles
4.5 Essay writing
4.6 Technical Education, Science and Our life, Computers, Environmental Pollution, Duties of a Student.

**4 hours**

**5. TRANSLATION** **6 hours**

5.1 Translation from Urdu into English.
For Foreign Students: A paragraph or a dialogue.

**RECOMMENDED BOOKS**

1. Intermediate English Book-II.
2. An English Grammar and Composition of Intermediate Level.
3. A Hand Book of English Students By Gatherer.

**Eng-112 ENGLISH**

**INSTRUCTIONAL OBJECTIVES**

**PAPER-A**

**1. DEMONSTRATE BETTER READING, COMPREHENSION AND VOCABULARY**

1.1 Manipulate, skimming and scanning of the text.
1.2 Identify new ideas.
1.3 Reproduce facts, characters in own words
1.4 Write summary of stories

**2. UNDERSTAND FACTS OF THE TEXT**

2.1 Rewrite words to fill in the blanks recalling the text.
2.2 Use own words to fill in the blanks.

**PAPER-B**

**3. APPLY THE RULES OF GRAMMAR IN WRITING AND SPEAKING**

3.1 Use rules of grammar to construct meaningful sentences containing a subject and a predicate.
3.2 State classification of time, i.e present, past and future and use verb tense correctly in different forms to denote relevant time.
3.3 Identify function words and content words.
3.4 Use marks of punctuation to make sense clear.
3.5 Relate what a person says in direct and indirect forms.
3.6 Compose his writings.
3.7 Distinguish between confusing words.

**4. APPLY THE CONCEPTS OF COMPOSITION WRITING TO PRACTICAL SITUATIONS**

4.1 Use concept to construct applications for employment, for character certificate, for grant of scholarship.
4.2 Define and write telegrams, cablegrams and radiograms, telexes, facsimiles
4.3 Describe steps of a good composition writing.
4.4 Describe features of a good composition.
4.5 Describe methods of composition writing
4.6 Use these concepts to organize facts and describe them systematically in practical situation.

**5. APPLIES RULES OF TRANSLATION**

5.1 Describe confusion.
5.2 Describe rules of translation.
5.3 Use rules of translation from Urdu to English in simple paragraph and sentences.

**Math-123 APPLIED MATHEMATICS-I**

| **Total Contact Hours** | | T | P | C | |
|---|---|---|---|---|---|
| Theory | 96 | | 3 | 0 | 3 |
| Practical | Nil | | | | |

**AIMS** After completing the course, the students will be able to solve problems of Algebra, Trigonometry, Vectors, Boolean Algebra, Complex numbers and Analytic Geometry, develop skills in the use of mathematical instruments and acquire mathematical clarity and insight in the solution of technical problems.

**COURSE CONTENTS**

**1. QUADRATIC EQUATIONS** **6 hours**

1.1 Standard Form
1.2 Solution
1.3 Nature of roots
1.4 Sum and product of roots
1.5 Formation
1.6 Problems

**2. BINOMIAL THEOREM** **6 hours**

2.1 Factorials
2.2 Binomial expression
2.3 Binomial co-efficient
2.4 Statement
2.5 The general term
2.6 The binomial series
2.7 Problems.

**3. PARTIAL FRACTIONS** **6 hours**

3.1 Introduction
3.2 Linear distinct factors case I
3.3 Linear repeated factors case II
3.4 Quadratic distinct factors case III
3.5 Quadratic repeated factors case IV
3.6 Problems

**4. FUNDAMENTALS OF TRIGONOMETRY** **6 hours**

4.1 Angles
4.2 Quadrants
4.3 Measurements of angles
4.4 Relation between sexagesimal and circular system

4.5 Relation between length of a circular arc and the radian measure of its central angle
4.6 Problems

**5. TRIGONOMETRIC FUNCTIONS AND RATIOS** **6 hours**

5.1 Trigonometric functions of any angle
5.2 Signs of trigonometric functions
5.3 Trigonometric ratios of particular angles
5.4 Fundamental identities
5.5 Problems

**6. GENERAL IDENTITIES** **6 hours**

6.1 The Fundamental Law
6.2 Deductions
6.3 Sum and difference formulae
6.4 Double angle identities
6.5 Half angle identities
6.6 Conversion of sum or difference to products
6.7 Problems

**7. SOLUTION OF TRIANGLES** **6 hours**

7.1 The law of Sines
7.2 The law of Cosines
7.3 Measurement of heights and distances
7.4 Problems

**8. VECTORS AND PHASORS** **12 hours**

8.1 Scalars and Vectors
8.2 The unit Vectors i, j, k
8.3 Direction Cosines
8.4 Dot product
8.5 Cross product
8.6 Analytic expressions for dot and cross products
8.7 Phasors
8.8 Significance of j operator
8.9 Different forms
8.10 Algebraic operations
8.11 Problems

**9. COMPLEX NUMBERS** **9 hours**

9.1 Introduction and properties
9.2 Basic operations

9.3 Conjugate
9.4 Modulus
9.5 Different forms
9.6 Problems

**10. BOOLEAN ALGEBRA AND GATE NETWORKS 15 hours**

10.1 Concept and basic laws
10.2 Sums of product and product of sums
10.3 Binary, decimals and octals, presentation of decimal numbers in BCD
10.4 Interconversion of numbers
10.5 OR Gates and AND Gates
10.6 Logical Expressions and their simplification
10.7 Demorgan's theorems
10.8 NAND Gates and NOR Gates
10.9 Problems

**11. PLANE ANALYTIC GEOMETRY AND STRAIGHT LINE 6 hours**

11.1 Coordinate system
11.2 Distance formula.
11.3 Ratio formulas.
11.4 Inclination and slope of line.
11.5 Slope formula.
11.6 Problems.

**12. EQUATIONS OF THE STRAIGHT LINE 6 hours**

12.1 Some important forms
12.2 General form
12.3 Angle formula.
12.4 Parallelism and perpendicularity
12.5 Problems

**13. EQUATIONS OF THE CIRCLE. 6 hours**

13.1 Standard and Central forms of equation.
13.2 General form of equation.
13.3 Radius and coordinates of center.
13.4 Problems

**RECOMMENDED BOOKS**

1. Ghulam Yasin Minhas, Technical Mathematics Vol - I, Ilmi Kitab Khana, Lahore.
2. Riaz Ali Khan, Polytechnic Mathematic Series Vol I and II, Majeed Sons, Faisalabad
3. Sana Ullah Bhatti, A Text Book of Algebra and Trigonometry, Punjab Text Book Board, Lahore.
4. Sana Ullah Bhatti, A Text Book of Analytic Geometry and Calculus, Punjab Text Book

Board, Lahore.

**Math-123 APPLIED MATHEMATICS-I**

**INSTRUCTIONAL OBJECTIVES**

**1.2 USE DIFFERENT METHODS FOR THE SOLUTION OF QUADRATIC EQUATION**

1.1 Define a standard quadratic equation.
1.2 Use methods of factorization and method of completing the square for solving the equations.
1.3 Derive quadratic formula.
1.4 Write expression for the discriminant.
1.5 Explain nature of the roots of a quadratic equation.
1.6 Calculate the sum and product of the roots.
1.7 Form a quadratic equation from the given roots.
1.8 Solve problems involving quadratic equations.

**2. APPLY BINOMIAL THEOREM FOR THE EXPANSION OF BINOMIAL AND EXTRACTION OF ROOTS.**

2.1 State binomial theorem for positive integral index.
2.2 Explain binomial coefficients:
(n,0), (n,1).....(n,r)....., (n,n)
2.3 Derive expression for the general term.
2.4 Calculate the specified terms.
2.5 Expand a binomial of a given index.
2.6 Extract the specified roots.
2.7 Compute the approximate value to a given decimal place.
2.8 Solve problems involving binomials.

**3. APPLY DIFFERENT METHODS FOR RESOLVING A SINGLE FRACTION INTO PARTIAL FRACTIONS USING DIFFERENT METHODS**

3.1 Define a partial fraction, a proper and an improper fraction.
3.2 Explain all the four types of partial fractions.
3.3 Set up equivalent partial fractions for each type.
3.4 Explain the methods for finding constants involved.
3.5 Resolve a single fraction into partial fractions.
3.6 Solve problems involving all the four types.

**4. UNDERSTAND THE SYSTEMS OF MEASUREMENT OF ANGLES.**

4.1 Define angles and the related terms.
4.2 Illustrate the generation of an angle.
4.3 Explain sexagesimal and circular systems for the measurement of angles.

4.4 Derive the relationship between radian and degree.
4.5 Convert radians to degrees and vice versa.
4.6 Derive a formula for the circular measure of a central angle.
4.7 Use this formula for solving problems.

**5. UNDERSTAND BASIC CONCEPTS AND PRINCIPLES OF TRIGONOMETRIC FUNCTIONS.**

5.1 Define the basic trigonometric functions/ratios of an angle as ratios of the sides of a right triangle.
5.2 Derive fundamental identities.
5.3 Find trigonometric ratios of particular angles.
5.4 Draw the graph of trigonometric functions.
5.5 Solve problems involving trigonometric functions.

**6. USE TRIGONOMETRIC IDENTITIES IN SOLVING TECHNOLOGICAL PROBLEMS**.

6.1 List fundamental identities.
6.2 Prove the fundamental law.
6.3 Deduce important results.
6.4 Derive sum and difference formulas.
6.5 Establish half angle,double and tripple angle formulas.
6.6 Convert sum or difference into product and vice versa.
6.7 Solve problems.

**7. USE CONCEPT, PROPERTIES AND LAWS OF TRIGONOMETRIC FUNCTIONS FOR SOLVING TRIANGLES.**

7.1 Define angle of elevation and angle of depression.
7.2 Prove the law of sines and the law of cosines.
7.3 Explain elements of a triangle.
7.4 Solve triangles and the problems involving heights and distances.

**8. UNDERSTAND PRINCIPLES OF VECTORS AND PHASORS**

8.1 Define unit vectors i, j, k.
8.2 Express a vector in the component form.
8.3 Explain magnitude, unit vector, direction cosines of a vector.
8.4 Explain dot product and cross product of two vector.
8.5 Deduce important results from dot and cross product.
8.6 Define phasor and operator j.
8.7 Explain different forms of phasors.
8.8 Perform basic Algebraic operation on phasors.
8.9 Solve problems on phasors.

**9. USE PRINCIPLES OF COMPLEX NUMBERS IN SOLVING TECHNOLOGICAL PROBLEMS.**

9.1 Define a complex number and its conjugate.
9.2 State properties of complex numbers.
9.3 Give different forms of complex numbers.
9.4 Perform basic algebraic operations on complex numbers.
9.5 Solve problem involving complex numbers.

**10. SOLVE TECHNICAL PROBLEMS USING PRINCIPLES OF BOOLEAN ALGEBRA**

10.1 Explain fundamental concepts of boolean algebra
10.2 Explain binary numbers, octal numbers, decimal numbers and their interconversion.
10.3 Explain digital addition and multiplication and its applications to OR gates and AND Gates
10.4 Illustrate complimentation and inversion
10.5 Evaluate logical expression
10.6 List basic Laws of Boolean Algebra
10.7 Explain De-Morgan's theorem
10.8 Explain basic duality of boolean algebra
10.9 Derive boolean expression
10.10 Explain combination of GATES
10.11 Illustrate sum of products and product of sum
10.12 Derive product of sum expression
10.13 Explain NAND Gates and NOR Gates
10.14 Use the map methods for simplifying expressions
10.15 Explain sub-cubes and covering

**11. UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY** 11.1 Explain the rectangular coordinate system.
11.2 Locate points in different quadrants.
11.3 Derive distance formula.
11.4 Describe the ratio formula
11.5 Derive slope formula
11.6 Solve problems using the above formulae.

**12. USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.**

12.1 Define equation of a straight line.
12.2 Derive slope intercept and intercept forms of equations of a straight line.
12.3 Write general form of equations of a straight line.
12.4 Derive an expression for angle between two straight lines.
12.5 Derive conditions of perpendicularity and parallelism of two straight lines.
12.6 Solve problems using these equations/formulae.

**13. SOLVE TECHNOLOGICAL PROBLEMS USING EQUATIONS OF CIRCLE**

13.1 Define a circle.
13.2 Describe standard, central and general forms of the equation of a circle.
13.3 Convert general form to the central form of equation of a circle.
13.4 Deduce formula for radius and coordinates of the center of a circle.
13.5 Derive equation of the circle passing through three points.
13.6 Solve problems involving these equations.

**Ch-132 APPLIED CHEMISTRY**

| **Total Contact Hours** | | T | P | C |
|---|---|---|---|---|
| Theory | 32 | 1 | 3 | 2 |
| Practical | 96 | | | |

**Pre-requisite:** The student must have studied the subject of elective chemistry at Secondary school level.

**AIMS** After studying this course a student will be able to:

1. Understand the significance and role of chemistry in the development of modern technology.
2. Becomes acquainted with the basic principles of chemistry as applied in the study of relevant Technology.
3. Knows the scientific methods for production, properties and use of materials of industrial & technological significance.
4. Gain skill for the efficient conduct of practicals in a chemistry lab.

**1. INTRODUCTION** **2 Hours**

1.1 The scope and significance of the subject.
1.2 Orientation with reference to Technology.
1.3 Terms used & units of measurements in the study of chemistry.

**2. FUNDAMENTAL CONCEPTS OF CHEMISTRY** **2 Hours**

2.1 Symbols, Valency, Radicals, formulas.
2.2 Chemical Reactions & their types.
2.3 Balancing of equations by ionic method.

**3. ATOMIC STRUCTURE** **2 Hours**

3.1 Sub-atomic particles.
3.2 Bohrs Atomic Model.
3.3 The periodic classification of elements and periodic law
3.4 General characteristics of a period and group.

**4. CHEMICAL BOND** **2 Hours**

4.1 Nature of chemical Bond.
4.2 Electrovalent bond with examples.
4.3 Covalent Bond(Polar and Non-polar, sigma & Pi Bonds with examples.
4.4 Co-ordinate Bond with examples.

**5. SOLIDS AND LIQUIDS** **3 Hours**

5.1 The liquid and Solids state.

5.2 The liquids and their general properties (Density, viscosity, surface tension capillary action etc).
5.3 Solids and their general properties.
5.4 Crystal structure of solids
5.5 Crystals of Si and Ge.

**6. WATER** **3 Hours**

6.1 Chemical nature and properties.
6.2 Impurities.
6.3 Hardness of water (types, causes & removal)
6.4 Scales of measuring hardness (Degress Clark, French, PPM, Mgm per litre).
6.5 Boiler feed water, scales and treatment.
6.6 Sea-water desalination, sewage treatment.

**7. ACIDS, BASES AND SALTS** **2 Hours**

7.1 Definitions with examples.
7.2 Properties, their strength, basicity & Acidity.
7.3 Salts and their classification with examples.
7.4 pH-value and scale.

**8. OXIDATION & REDUCTION** **2 Hours**

8.1 The process with examples.
8.2 Oxidizing and Reducing agents.
8.3 Oxides and their classifications.

**9. NUCLEAR CHEMISTRY** **2 Hours**

9.1 Introduction.
9.2 Radioactivity (Alpha, beta and gamma rays).
9.3 Half life process.
9.4 Nuclear reaction & transformation of elements.
9.5 Isotopes and their uses.

**10. ALLOYS** **2 Hours**

10.1 Introduction with need.
10.2 Preparation and properties.
10.3 Some important alloys and their composition.

**11. CORROSION** **2 Hours**

11.1 Introduction with causes.
11.2 Types of corrosion.
11.3 Rusting of Iron
11.4 Protective measures against corrosion.

**12. ELECTRO CHEMISTRY** **2 Hours**

12.1 Ionization and Arrhenius theory of Ionization.
12.2 Electrolytes and Electrolysis.
12.3 Faraday's Laws and numericals related to them.
12.4 Application of Electrolysis (Electron, lathing etc).
12.5 Electro Chemical cells.

**13. ELECTRICAL INSULATING MATERIALS.** **2 Hours**

13.1 Introduction.
13.2 Solid insulators with chemical nature.
13.3 Liquid insulators with chemical nature.
13.4 Gaseous insulators with chemical nature.
13.5 Uses and their classification.

**14. SEMI CONDUCTORS.** **2 Hours**

14.1 Introduction
14.2 Atomic structure of silicon and germanium.
14.3 Bonding & Conductivity.
14.4 Energy bands in a semiconductor.

**15. ETCHING PROCESS.** **2 Hours**

15.1 The process and its aims.
15.2 Etching reagents.
15.3 Applications of processors.

**RECOMMENDED BOOKS**

1. Intermediate Text-Books of chemistry I & II
2. ILMI Applied Science by SH. Ata Mohammed
3. Materials science by J.C.Anderson & Leaver.
4. Polytechnic Chemistry by G.N.Ready (ELBS & Nelson, Hong Kong).
5. Chemistry for engineers by Eric Gyngell.

## Ch-132 APPLIED CHEMISTRY

## INSTRUCTIONAL OBJECTIVES

**1. UNDERSTAND THE SCOPE, SIGNIFICANCE AND ROLE OF THE SUBJECT.**

1.1 Define chemistry and its terms.
1.2 Define the units of measurements in the study of chemistry.
1.3 Explain the importance of chemistry in various fields of specialization.
1.4 Explain the role of chemistry in this technology.

**2. UNDERSTAND LANGUAGE OF CHEMISTRY AND CHEMICAL REACTIONS.**

2.1 Define symbol, valency, radical, formula with examples of each.
2.2 Write chemical formula of common compounds.
2.3 Define chemical reaction and equations.
2.4 Describe types of chemical reactions with examples.
2.5 Explain the method of balancing the equation by ionic method.

**3. UNDERSTAND THE STRUCTURE OF ATOMS AND ARRANGEMENT OF SUB ATOMIC PARTICLES IN THE ARCHITECTURE OF ATOMS.**

3.1 Define atom.
3.2 Describe the fundamental sub atomic particles
3.3 Distinguish between atomic no. mass no. and between isotope and isobars.
3.4 Explain the arrangements of electrons in different shells and sub energy levels and understand bohr's atomic model.
3.5 Explain the grouping and placing of elements in the periodic table especially Si & germanium.
3.6 State the periodic law of elements.
3.7 Explain the trend of properties of elements based on their position in the periodic table.
3.8 Explain general characteristics of a period and a group.

**4. UNDERSTAND THE NATURE OF CHEMICAL BONDS.**

4.1 Define chemical Bond.
4.2 State the nature of chemical bond.
4.3 Differentiate between electrovalent and covalent bonding.
4.4 Explain the formation of polar and non polar, sigma and pi-bond with examples.
4.5 Describe the nature of coordinate bond with examples.

**5. UNDERSTAND THE STATES OF MATTER AND DISTINGUISHES SOLIDS FROM GASES.**

5.1 Describe the liquid and solid states of matter.
5.2 State the general properties of liquid.
5.3 State the general properties of solid.

5.4 Explain the formation of crystals and their types.
5.5 Describe the crystal structure of Si and Ge.

**6. UNDERSTAND THE CHEMICAL NATURE OF WATER.**

6.1 Describe the chemical nature of water with its formula.
6.2 Describe the general impurities present in water.
6.3 Explain the causes and methods to remove hardness of water.
6.4 Express hardness in different units like mg/litre. p.p.m, degrees Clark and degrees French.
6.5 Describe the formation and nature of scales in boiler feed water.
6.6 Explain the method for the treatment of scales.
6.7 Explain the sewage treatment and desalination of sea water.

**7. UNDERSTAND THE NATURE OF ACIDS, BASES AND SALTS.**

7.1 Define acids, bases and salts with examples.
7.2 State general properties of acids and bases.
7.3 Differentiate between acidity and basicity.
7.4 Define salts, give their classification with examples.
7.5 Explain pH value of solution and pH scale.

**8. UNDERSTAND THE PROCESS OF OXIDATION AND REDUCTION.**

8.1 Define oxidation.
8.2 Illustrate the oxidation process with examples.
8.3 Define reduction.
8.4 Explain reduction process with examples.
8.5 Define oxidizing and reducing agents and give at least six examples of each.
8.6 Define oxides.
8.7 Classify the oxides and give examples.

**9. UNDERSTAND THE FUNDAMENTALS OF NUCLEAR CHEMISTRY.**

9.1 Define nuclear chemistry and radio activity.
9.2 Differentiate between alpha, beta and gamma particles.
9.3 Explain half life process.
9.4 Explain at least six nuclear reactions resulting in the transformation of some elements.
9.5 State the uses of isotopes.

**10. UNDERSTAND THE NATURE OF ALLOYS USED IN THE RESPECTIVE TECHNOLOGY.**

10.1 Define alloy.
10.2 Explain different methods for the preparation of alloys.
10.3 Explain important properties of alloys.
10.4 Explain the composition, properties and uses of alloys.

**11. UNDERSTAND THE PROCESS OF CORROSION**.

11.1 Define corrosion.
11.2 Describe different types of corrosion.
11.3 State the causes of corrosion.
11.4 Explain the process of rusting of iron.
11.5 Describe methods to prevent/control corrosion.

**12. UNDERSTAND THE APPLICATION OF ELECTROCHEMISTRY IN DIFFERENT FIELDS OF INDUSTRIES.**

12.1 Define ionization, electrolyte and electrolysis.
12.2 Describe Arrhenius theory of ionization.
12.3 State Faraday's laws of electrolysis.
12.4 Apply Faraday's laws of different fields of industry.
12.5 Solves numerical problem on Faraday's Laws.
12.6 Explain the construction and working of Daniel cell and lead accumulator.

**13. KNOW THE USE OF INSULATING MATERIALS.**

13.1 Define insulator, conductor.
13.2 Classify solid, liquid and gaseous insulators with their chemical nature.
13.3 Describe their uses.

**14. UNDERSTAND THE NATURE AND CHEMISTRY OF SEMI CONDUCTORS.**

14.1 Define semi conductors.
14.2 Draw the atomic structure of silicon and germanium.
14.3 Describe the process of bonding and conductivity in conductors and semi conductors.
14.4 Explain energy bands in semi conductors.

**15. USE ETCHING PROCESS IN DIFFERENT FIELDS OF TECHNOLOGY.**

15.1 Define etching process and its aims.
15.2 Enlist the chemicals/reagents used in the process.
15.3 Explain the use of the process in the technology.

**Ch-132 APPLIED CHEMISTRY**

**LIST OF PRACTICALS**

1. To introduce the common apparatus,glassware and chemical reagents used in the chemistry lab.
2. To purify a chemical substance by crystallization.
3. To separate a mixture of sand and salt.
4. To find the melting point of substance.
5. To find the pH of a solution with pH paper.
6. To separate a mixture of inks by chromatography.
7. To determine the co-efficient of viscosity of benzene with the help of Ostwald vasomotor.
8. To find the surface tension of a liquid with a stalagmometer.
9. To perform electrolysis of water to produce Hydrogen and Oxygen.
10. To determine the chemical equivalent of copper by electrolysis of Cu SO.
11. To get introduction with the scheme of analysis of salts for basic radicals.
12. To analyse 1st group radicals ($Ag^{+}$ - $Pb^{++}$ - $Hg^{+}$).
13. To make practice for detection 1st group radicals.
14. To get introduction with the scheme of II group radicals.
15. To detect and confirm II-A radicals ($hg^{++}$, $Pb^{++++}$, $Cu^{+}$, $Cd^{++}$, $Bi^{+++}$).
16. To detect and confirm II-B radicals $Sn^{+++}$, $Sb^{+++}$, $As^{+++}$).
17. To get introduction with the scheme of III group radicals ($Fe^{+++}$ - $Al^{+++}$, $Cr^{+++}$)
18. To detect and confirm $Fe^{+++}$, $Al^{+++}$ and $Cr^{+++}$.
19. To get introduction with he scheme of IV group radicals.
20. To detect and confirm $An^{++}$ and $Mn^{++}$ radicals of IV group.
21. To detect and conform $Co^{++}$ and $Ni^{++}$ radicals of IV group.
22. To get introduction with the Acid Radical Scheme.
23. To detect dilute acid group.
24. To detect and confirm $CO''_3$ and $HCO'_3$ radicals.
25. To get introduction with the methods/apparatus of conducting volumetric estimations.
26. To prepare standard solution of a substance.
27. To find the strength of a given alkali solution.
28. To estimate $HCO'_3$ contents in water.
29. To find out the %age composition of a mixture solution of $KNO_3$ and KOH volumetrically.
30. To find the amount of chloride ions (Cl') in water volumetrically.

**RECOMMENDED BOOKS**


1. Text Book of Intermediate Chemistry (Part I and II)
2. Sh. Atta Mohammad, Ilmi Applied Science.
3. J.N. Reddy, Polytechnic Chemistry, Tata Mc-Graw Hill Co., New Delhi.
4. Qammar Iqbal, Chemistry for Engineers and Technologists.

## Comp-122 INTRODUCTION TO COMPUTER APPLICATIONS

| **Total contact hours** | | |
|---|---|---|
| Theory | 32 Hours | T P C |
| Practicals | 96 Hours | 1 3 2 |

**AIMS** This subject will enable the student to be familiar with the operation of a Micro-computer. He will also learn DOS, BASIC language and word processing to elementary level.

**COURSE CONTENTS**

**1. ELECTRONIC DATA PROCESSING (EDP) 6 Hours**

1.1 Basics of computers
1.2 Classification of computers
1.3 Block diagram of a computer system
1.4 Binary number system
1.5 BIT, BYTE, RAM, ROM, EROM, EPROM
1.6 Input and output devices
1.7 Secondary storage media details
1.8 Processors and types
1.9 Using computer for system software
1.10 Using computers for application software.
1.11 Common types of software and their application.

**2. DISK OPERATING SYSTEM (DOS) 6 Hours**

2.1 Internal commands
2.2 External commands
2.3 Batch files
2.4 Advance features.

**3. BASIC LANGUAGE 10 Hours**

3.1 Introduction to high level languages
3.2 Introduction to BASIC
3.3 REM Statement
3.4 Assignment statement
3.5 Input statement
3.6 Read-Data statement
3.7 IF-THEN statement
3.8 IF-THEN Else statement
3.9 FOR-NEXT statement
3.10 DIM statement

3.11 L PRINT statement
3.12 STOP statement
3.13 END statement
3.14 Logic of a BASIC Programme
3.15 Running a BASIC Programme
3.16 Saving and Retrieving a Programme
3.17 Advance features

**4. WORD PROCESSING** **7 Hours**

4.1 Starting word processor session
4.2 Opening a document
4.3 Saving a document
4.4 Ending word processor session (Temporarily)
4.5 Retrieving a document
4.6 Spell check
4.7 Margins and tab setting
4.8 Aligning Paragraph
4.9 Printing a document
4.10 Advance features

**5. COMPUTER GRAPHIC IN BASIC** **3 hours**

5.1 Graphic fundamentals
5.2 Points and lines
5.3 Dots in space
5.4 A lightening blot
5.5 Shapes
5.6 Expanding circles and rectangles

**RECOMMENDED BOOKS**

1. Ron S. Gottfrid, Programming with BASIC,
2. Any Word Processor Latest Release (e.g., Word, Word-Perfect etc).
3. ABC'S of DOS (latest release).
4. Judd Robbins, Mastering DOS 6.0 and 6.2

## Comp-122 INTRODUCTION TO COMPUTER APPLICATIONS

## INSTRUCTIONAL OBJECTIVES

**1. UNDERSTAND ELECTRONIC DATA PROCESSING (EDP).**

- 1.1 Know basics of computers.
- 1.2 Know classification of computers.
- 1.3 Know block diagram of a computer system.
- 1.4 Know binary number system.0
- 1.5 Know some general terms used in computers.
- 1.6 Know input and output devices.
- 1.7 Know secondary storage media.
- 1.8 Explain processor and its types.
- 1.9 Know the use of computer for system software.
- 1.10 Know use of computers for application software.
- 1.11 Explain commonly used application of softwares

**2. UNDERSTAND DISK OPERATING SYSTEM (DOS).**

- 2.1 Know internal command of DOS.
- 2.2 Know external commands of DOS.
- 2.3 Describe batch files.
- 2.4 Identify advanced features

**3. UNDERSTAND BASIC LANGUAGE.**

- 3.1 Explain high level languages.
- 3.2 Explain Basic language.
- 3.3 Describe Rem statement
- 3.4 Describe assignment statement
- 3.5 Explain Input statement
- 3.6 Explain Read-Data statement
- 3.7 Explain If-Then Statement
- 3.8 Explain If-then-Else Statement
- 3.9 Explain For-Next Statement
- 3.10 Explain DIM Statement
- 3.11 Explain LPRINT statement
- 3.12 Explain stop statement
- 3.13 Explain end Statement
- 3.14 Describe Logic of Basic program
- 3.15 Describe running a Basic Program
- 3.16 Describe saving & retrieving Basic Program
- 3.17 Describe some Advance features of Basic program

**4. UNDERSTAND WORD PROCESSING SESSION**

4.1. Describe word-processing
4.2 Name command to be entered on Dos-prompt to load word-processor
4.3 Identify initial screen
4.4 Describe the command to open a document
4.5 Describe the procedure for naming the document
4.6 Explain importance of giving extension to a document
4.7 Describe saving and retrieving a document
4.8 Explain importance of saving the work at regular intervals
4.9 State temporarily Ending word-processing session & document retrieval
4.10 State procedure to re-enter word processor
4.11 State procedure to re-open the document and editing
4.12 Describe spell-check facility
4.13 Describe Margins & Tab Setting
4.14 Describe to align paragraph
4.15 Describe Re-editing techniques
4.16 Describe procedure to set-up printer
4.17 Describe command for printouts
4.18 Explain multiple-copy printout procedure
4.19 Explain some advance features
4.20 Describe procedure of condensed printing
4.21 Describe procedure for change of fonts

**5. UNDERSTAND PROGRAMMING INSTRUCTIONS FOR COMPUTER GRAPHIC IN BASIC LANGUAGE**

5.1 Identify graphic fundamentals in basic language
5.2 Draw points and lines
5.3 Draw dot in space
5.4 Draw lighting blot
5.5 Draw shapes
5.6 Draw expanding circles and rectangles

**Comp-122 INTRODUCTION TO COMPUTER APPLICATIONS**

**LIST OF PRACTICALS** **96 hours**

**DOS**

1 Identify key board, mouse, CPU, disk drives, disks, monitor & printer
2 Practice for booting up of a computer system with DOS system disk and power off system at DOS prompt
3 Practice for CLS, VER, VOL, DATE & TIME commands
4 Practice for COPY, REN commands
5 Practice for DEL, TYPE, PATH, PROMPT, COPY CON, MD, CD, RD commands
6 Practice of the practicals at S. No. 3, 4, 5
7 Practice for FORMAT command with /s, /4, /u switches
8 Practice for DISKCOPY, DISKCOMP commands
9 Practice for SCANDISK, XCOPY, DELTREE, TREE, LABEL commands
10 Practice for PRINT, UNDELETE commands
11 Practice for the practicals at S. No. 8, 9, 10, 11
12 Practice for creating a batch file

**BASIC**

1 Practice for loading & unloading BASIC software and identify role of function keys in Basic
2 Identify role of various keys in continuation with ALT key in BASIC programming
3 Practice for CLS, LOAD, SAVE, FILE, RENUM command by loading any existing BASIC Program
4 Practice for editing any existing BASIC Program
5 Prepare BASIC Program to display sum of two numbers using INPUTS
6 Prepare BASIC Program to display sum of two numbers using READ-DATA
7 Prepare BASIC Program to multiply two numbers
8 Prepare BASIC Program to calculate Area of Rectangle, when length and width are given
9 Prepare BASIC Program to calculate area of a circle when radius/diameter is given
10 Prepare very simple BASIC Programs using IF-THEN-ELSE and FOR-NEXT statement
11 Identify DIM statement
12 Practice for LPRINT statement for various Programs hard-copy output

**WORD PROCESSING**

1 Practice for loading & unloading a word processor
2 Practice for creating document & saving it
3 Practice for spell-check facility of the word-processor
4 Practice for editing an existing document
5 Practice for various word-processing Menu Options
6 Practice for printing a document
7 Practice for margin and TAB setting and document alignment
8 Practice for some advance features

**ET-115 PRINCIPLES OF ELECTRICAL ENGINEERING**

| **Total Contact Hours:** | | **T** | **P** | **C** |
|---|---|---|---|---|
| Theory: | 96 | 3 | 6 | 5 |
| Practicals: | 192 | | | |

**AIMS** Understanding electricity involves the sound familiarity with the established laws and concepts, and their application in different situations. Thus solving problems also forms part of the cognition of these concepts.

This course aims at providing a strong foundation in these basic concepts and laws of electricity, alongwith an appreciation of the magnitudes of the quantities involved or to be guessed, through solving numerical problems. The concepts are further strengthened through extensive Laboratory work.

**COURSE CONTENTS**

**UNIT-I D.C. FUNDAMENTAL (37 Hrs.)**

**1. ELECTRIC CURRENT AND OHM'S LAW**

1.1 Electron Theory.
1.2 Conductor, Insulator, semiconductor.
1.3 Resistance, conductance.
1.4 Ohm's Law.
1.5 Laws of Resistance
1.6 Effect of temperature on Resistance.
1.7 Temperature coefficient of resistance.
1.8 Resistances in series and parallel.
1.9 Division of voltage in series circuit.
1.10. Division of current in parallel circuit.
1.11 Equivalent resistance of complex network.

**2. NETWORK THEOREMS**

2.1 Kirchhoff's law I - current law.
2.2 Kirchhoff's law II-voltage law.
2.3 Active & Passive circuits, node, branch, and loop in Electrical circuits.
2.4 Application of Kirchhoff's laws.
2.5 Problem solving with Kirchhoff's Laws in D.C. circuit. (Simple problems)
2.6 Superposition theorem.
2.7 Maximum power transfer theorem.
2.8 Thevenin’s theorem.

**3. WORK, POWER AND ENERGY**

3.1 Heating effect of current.

3.2 Joule's Law.
3.3 Thermal efficiency.
3.4 Conversion of electrical energy into Mechanical energy.
3.5 Energy billing.
3.6 Problem solving on above

**4. MAGNETIC EFFECT OF ELECTRIC CURRENT**

4.1 Laws of magnetic force.
4.2 Absolute and relative permeability.
4.3 Magnetic field due to a straight current carrying conductor.
4.4 Magnetic field of coil
4.5 Cork-Screw rule.
4.6 Effect of iron core in a coil.
4.7 Fleming's right hand rule.
4.8 Mechanical force on a current carrying conductor in a magnetic field.
4.9 Fleming's left hand rule.

**5. ELECTROMAGNETIC INDUCTION**

5.1 Faraday's Laws of electromagnetic Induction.
5.2 Dynamically and statically induced EMF.
5.3 Lenz's Law.
5.4 Concept of self and mutual induction.
5.5 Self inductance, its units and combination.

**6. ELECTROSTATICS**

6.1 Static Electricity.
6.2 Absolute and relative permeability of a medium.
6.3 Laws of Electrostatic.
6.4 Capacitor.
6.5 Types of capacitors.
6.6 Capacitance.
6.7 Capacitors in series and parallel.
6.8 Charging of a capacitor.
6.9 Equation of charging of a capacitor.
6.10 Discharging of a capacitor and its equations.

**UNIT-II A.C FUNDAMENTALS. (12 HRS.)**

**7. FUNDAMENTALS OF A.C**

7.1 Definition of Alternating current & voltage.
7.2 Principle of working of Alternating current generator.
7.3 Simple loop Alternator, Relationship between Speed, poles and frequency.
7.4 Sinusoidal Emf Equation, other wave forms, triangular, square wave etc.

7.5 Definition of cycle, period, Frequency, amplitude, instantaneous value.
7.6 Average value, Effective value. R.M.S value. Form factor. Peak factor.
7.7 Representation of A.C. through vectors.
7.8 Phasor Diagrams, Phase difference, Polar form of A.C quantities.
7.9 j Notation

**8. VECTOR DIAGRAMS PRACTICE**

**9. SINGLE PHASE A.C. CIRCUIT (22 HRS.)**

9.1 A.C through pure Resistance and Vector Diagram.
9.2 A.C through pure Inductance and Vector Diagram.
9.3 A.C through pure Capacitance and Vector Diagram.
9.4 A.C through pure Resistance & Inductance in series including wave forms and Phasor diagram.
9.5 Voltage, current and power relation in A.C. R/L circuit.
9.6 A.C through Resistance and Capacitance connected in series including wave forms and phaser diagram.
9.7 R.L.C series circuit.
9.8 Impedance Triangle, Phase angle, power factor.
9.9 Active and Reactive component. Actual power, Apparent Power, Reactive Power, relationship.
9.10 Problems on simple series circuits.
9.11 Parallel A.C circuits.
9.12 Solution of Parallel circuits by vector and admittance method.
9.13 Solution of simple problems with Phasor Algebra.
9.14 Power factor improvement with static capacitor.
9.15 Solving problems involving power factor improvement.
9.16 Resonance circuit.
9.17 Series, parallel resonance circuit.
9.18 Problems on resonant circuit.

**UNIT-III POLY-PHASE FUNDAMENTALS (25 HRS.)**

**10. POLY-PHASE A.C. CIRCUIT**

10.1 Generation of two Phase, three Phase emf.
10.2 Advantages of Poly Phase system.
10.3 Current in Neutral in a 3 Phase circuit.
10.4 Power Equation.
10.5 Star & Delta connection, Relation ship between line and Phase values.
10.6 Comparison of Star and Delta connections, their uses, and conversion.
10.7 Power in a three Phase Balanced load.
10.8 Vector diagram of a Star and Delta connected load.
10.9 Measurement of Power with three watt meters and its vector diagram.

10.10 Measurement of power with one watt meter without the use of Neutral wire.
10.11 Measurement of power with two watt meters and its vector diagram.
10.12 Measurement of Reactive power in a three Phase circuit.
10.13 Calculation of P.F. with Active and reactive power.
10.14 Phase sequence.
10.15 Power factor improvement and problems solving.
10.16 Advantages of 3 Phase supply over single Phase supply.
10.17 Problem solving on 3 Phase circuits.

## ET-115 PRINCIPLES OF ELECTRICAL ENGINEERING

## INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

| S.NO. | MAJOR TOPICS | NO. OF PERIODS | NO. OF QUESTIONS IN Q. PAPER |
|---|---|---|---|
| 1. | D.C. fundamentals | 35+2 | |
| | a. Electric current, ohm's law, & Kirchhoff's laws. | | 1 |
| | b. Work, Power & Energy. | | 1 |
| | c. Electromagnetic induction & electrostatic. | | ½ |
| 2. | A.C. fundamentals | 10+2 | 1½ |
| 3. | Single phase A.C. circuits | 20+2 | 1½ |
| 4. | Poly phase A.C. circuits | 25 | 1½ |
| | Total: | 96 | 7 |

## UNIT-I: D.C. FUNDAMENTALS.

### 1. UNDERSTAND BASIC CONCEPTS OF ELECTRICITY

1.1 State Electron theory.
1.2 Compare conductor, Insulator & semi-conductor.
1.3 Explain Resistance, conductance and state units.
1.4 Define electrical current and state its units.
1.5 Define potential difference and state its units.
1.6 State Ohm`s law.
1.7 Explain laws of resistance.
1.8 State effects of temperature on Resistance.
1.9 Calculate temperature co-efficient of Resistance.
1.10 Determine total resistances in series & parallel circuits.
1.11 Calculate division of voltage in series circuits.
1.12 Calculate division of current in parallel circuits.
1.13 Draw equivalent circuits of complex networks.

### 2. UNDERSTAND KIRCHHOFF'S LAWS

2.1 State Kirchhoff`s Ist Law - (current Law).

2.2 State Kirchhoff`s 2nd Law - (voltage Law).
2.3 Define active, passive circuit, node, branch & loop circuit.
2.4 Give examples for applications of Kirchhoff's Laws.
2.5 Solve simple problems on Kirchhoff's Laws in D.C.circuits.
2.6 State superposition theorem.
2.7 State Maximum power transfer theorem.
2.8 Solve circuits through Thevenin's Theorem.

**3. UNDERSTAND WORK, POWER & ENERGY**

3.1 Explain heating effect of current.
3.2 State Joule's Law of current.
3.3 Define thermal efficiency.
3.4 State formula for conversion of Electrical Energy to Mechanical Energy.
3.5 Calculate Energy billing of an installation.
3.6 Solve problems on Thermal Efficiency.

**4. UNDERSTAND MAGNETIC EFFECTS OF ELECTRIC CURRENT**

4.1 Explain Laws of Magnetic force.
4.2 Define Absolute & Relative permeability.
4.3 Describe Magnetic field of a straight current carrying conductor.
4.4 Determine Magnetic field of a coil.
4.5 State cork-screw rule.
4.6 Describe effect of iron core in a coil.
4.7 State Fleming's Right hand & Left hand rules.
4.8 Explain mechanical force on a current carrying conductor in a magnetic field.

**5. UNDERSTAND ELECTROMAGNETIC INDUCTION**

5.1 State Faraday's Laws of Electromagnetic Induction.
5.2 Define Dynamically & statically induced e.m.f.
5.3 Explain Lenz's Law
5.4 Explain self & Mutual Inductances.
5.5 State units of Inductance.

**6. UNDERSTAND FUNDAMENTALS OF ELECTROSTATICS**

6.1 Define the term static-electricity.
6.2 Describe Absolute & Relative Permeability of a Medium.
6.3 State Laws of Electrostatics.
6.4 Explain the term capacitance.
6.5 List types of capacitors.
6.6 Solve problems on capacitors in series & Parallel.
6.7 Explain charging & Discharging of capacitors along with equations.

**UNIT-II: A.C. FUNDAMENTALS.**

**7. UNDERSTAND A.C. FUNDAMENTALS**

7.1 Define alternating current & voltage.
7.2 Describe principle of working of A.C. Generator.
7.3 Explain simple loop Alternator & relationship between speed, poles and frequency.
7.4 Derive sinusoidal E.M.F. equation.
7.5 Define terms for a wave-form cycle, period, frequency, amplitude, & Instantaneous value.
7.6 Define the terms average value, Effective value, R.M.S. value, form factor & peak factor.
7.7 State equation of various AC values.
7.8 Define form Factor.
7.9 Describe polar forms of A.C. quantities.
7.10 Explain the term phase difference.
7.11 Draw phasor diagrams.
7.12 Explain how AC quantities can be represented by vectors.

**8. UNDERSTAND A.C. CIRCUITS (SINGLE PHASE)**

8.1 Explain the effects of A.C. supply through pure resistance, inductance & Capacitance with their vector diagrams.
8.2 Describe the effects of A.C. supply through RL abd RC Series circuits with the help of waveforms and vector diagrams.
8.3 Derive voltage current & power relation in A.C. circuits.
8.4 Solve examples on R.L.C. series circuit.
8.5 Define terms Impedance triangle, phase angle & power factor
8.6 Describe active & reactive component, Actual power, Apparent power & reactive power with relation ships.
8.7 Explain parallel A.C circuits (R.L.C).
8.8 Solve problems on parallel A.C. circuits
8.9 Explain power factors improvement with static capacitor bank.
8.10 Solve simple problems on power factor improving circuits.
8.11 Write relationship for V.I.Z. for resonance circuit in series & parallel.
8.12 Solve simple problem on resonance circuit.

**UNIT-III: POLYPHASE FUNDAMENTALS.**

**9. UNDERSTAND POLYPHASE A.C. CIRCUITS**

9.1 Explain generation of two-phase & 3-phase e.m.f.
9.2 Explain advantages of A.C. polyphase system.
9.3 State value of current in neutral in a 3-phase balanced circuit.
9.4 State power equation for 3-phase system.
9.5 Draw & explain star & delta connections.

9.6 Calculate relationship between line & phase values in star/delta.
9.7 Compare star & delta connections with their uses.
9.8 Calculate power in 3-phase balanced load.
9.9 Solve problems on 3-phase balanced load.
9.10 Draw vector diagrams of star & delta connected loads.
9.11 Calculate power with three watt-meters alongwith vector diagrams.
9.12 Explain Measurements of power with one wattmeter without the use of neutral wire.
9.13 Describe Measurement of power with two wattmeters alongwith its vector diagram.
9.14 Describe Measurement of Reactive power in a three phase circuit.
9.15 Solve problems on P.F with active & reactive power.
9.16 Explain phase sequence meter.
9.17 Explain power factor improvement methods.
9.18 Solve problems on power factor improvements.
9.19 Explain advantages of 3-phase supply over single phase supply.
9.20 Solve problems on 3-phase circuits.(Balanced load)

## ET-115 PRINCIPLES OF ELECTRICAL ENGINEERING

## LIST OF PRACTICALS

Note: Students should demonstrate concern for personal and equipment safety while working in Electrical Labs

1. Study of simple Electrical Instruments (Ammeter, Voltmeter etc, etc).
2. Determination of the resistances of
   a) Sliding Rheostat.
   b) Voltmeter.
   c) Incandescent lamp.
3. Determination of resistance of a wire by micrometer.
4. Determination of temperature co-efficient of copper by ammeter-voltmeter methods.
5. Verification of ohm's law.
6. Verification of laws of combination of resistances.
7. Study of various types of resistors and determination of resistance by color coding.
8. Measurement of power by Voltmeter-ammeter method and watt meter.
9. Study of connections of thermal relay.
10. Measurement of energy by energy meter.
11. Verification of Kirchhoff's Laws.
12. Determination of the efficiency of an electric Kettle.
13. Make an electromagnet.
14. Study of the force on a current-carrying conductor in magnetic field.
15. Verification of Faraday's laws of electromagnet induction.
16. Study of Generator and Transformer.
17. Study the production of e.m.f in coupled coils by changing current in one coil.
18. Problem solving session.
19. Study of self-induction of a coil and effect of introducing iron core in it.
20. Study of various types of capacitors and Inductors.
21. Determination of the capacity of capacitors by colour coding.
22. Verification of the laws of the combination of capacitors.
23. Determination of breakdown voltage of a low-voltage capacitor.
24. Test week: Every student should be given independent different practicals and teacher should count its performance towards sessional marks.
25. Study of C.R.O. and measurement of sine wave.
26. Determination of average and R.M.S values and sine wave (on graph paper)
27. Determination of inductance of a choke coil using ammeter and voltmeter method.
28. Determination of impedance of a resistive-inductive series circuit.
29. Study of phase displacement by C.R.O.
30. Determination of power consumed by a fan/choke by 3-ammeter method.
31. Vector Diagrams practice.
32. Determination of power-factor of a single phase circuit using voltmeter, ammeter and

watt meter.

33 Measurement of power factor of a single phase circuit using a power factor meter.
34. Determination of resonance frequency of a series circuit using variable frequency oscillator.
35. Study of the effects of capacitors on the power of an inductive circuit.
36. Study of an elementary poly phase generator.
37. Verification of the line and phase relationship in star and delta connections.
38. Study of 3-Phase, 4-wire distribution network.
39. Measurement of power of a 3-phase load by 3-wattmeter method.
40. Measurement of power of a 3-phase load by 2-wattmeter method.
41. Measurement of 3-phase power by one watt meter method.
42. Determination of phase sequence by phase sequence meter.
43. Measurement of reactive power, in a 3-phase balanced circuit.
44. Measurement of power in 3 phase circuit using phase angle meter.
45. Measurements of 3-Phase load energy using C.T. & P.T.
46. Improvement of power factor of an inductive load using capacitors and its verification.
47. Determination of current in neutral wire in balanced & unbalanced load.
48. Visit to college sub-station.

Each student must conduct one practical for evaluation for final test.

** Students must prepare theory and practical note books and get it checked weekly by the concerned teacher. He should produce it to external examiner for sessional work/marking check up at the time of final exam.

**Books Recommended:**


1. New Electric Library Vol III by Frakd Graham.
2. Electrical Engineering by C.L Dawes.
3. Examples of Electrical Calculation Admiralty.
4. Electrical Technology by B.L Teraja.
5. Reeds Basic Electro-Technology for Marine Engineers by E.G. Krall.
6. Fundamentals of Electrical Engineering by M.Kuzmetsov Moscow.
7. Theory & Problems of Electrical Circuit by Schaum's out line series.
8. Electrical Technology by Edwerd Huges.
9. Practical Electricity by T.Croft.
10. Industrial Electric Circuits by Herbart W.Jackson.

**ET-121 BASIC ELECTRICAL DRAWING**

| | T | P | C |
|---|---|---|---|
| **Total contact hours** | 0 | 3 | 1 |

Practical 96 Hrs.

**AIM** To provide basic skills in the use of drawing tools and to enable the students to prepare Orthographic, pictorial, free hand sketching for electrical drawings

**COURSE CONTENTS**

**(SHOP TALK ONLY)**

**1. USES AND APPLICATION OF TECHNICAL DRAWING**

1.1 Importance of Technical drawing and Techniques/Engineer's language.
1.2 Uses of technical drawing.
1.3 Types of drawings and their uses.

**2. DRAWING TOOLS AND MATERIALS**

2.1 Classification of drawing pencils and uses
2.2 Types of drawing papers and sizes
2.3 Drawing instruments and uses.
2.4 Types and use of erasers.
2.5 Care & maintenance of drawing tools.

**3. BASIC DIMENSIONING**

3.1 Definition of dimensioning.
3.2 Two types of dimensioning.
3.3 Elements in dimensioning.
3.4 Dimensioning pictorials.
3.5 Dimensioning Multi Views.
3.6 Dimensioning Holes and arcs.
3.7 Dimensioning Angles.

**4. MULTI VIEW DRAWING/ORTHOGRAPHIC DRAWING**

4.1 Definition and concept.
4.2 Six principle views.
4.3 Visualization glass box technique.
4.4 Principal planes of projections.
4.5 Projection lines.
4.6 Arrangement of views.
4.7 Multi view drawing, 1st angle and 3rd angle projection of simple objects.

**5. INTRODUCTION TO PICTORIAL DRAWING**

5.1 Three types of pictorials

5.2 Uses of pictorial views.
5.3 Isometric sketching of Rectangular Block and simple objects.
5.4 Oblique sketching of rectangular block and simple objects.
5.5 Proportions in pictorial drawing.

**6. SYMBOLS**

6.1 Building Material symbols.
6.2 Metal symbols.
6.3 Electrical symbols.
6.4 Importance and uses.

**7. ELECTRICAL DRAWING**

7.1 Drawing wiring circuits.
- 7.1.1 Single line diagram.
- 7.1.2 Wiring diagram.
- 7.1.3 Layout diagram.
- 7.1.4 Schematic diagram.
- 7.1.5 Circuit diagram.

**8. LINE SKETCHING**

8.1 Introduction to sketching techniques.
8.2 Sketching Horizontal, vertical, inclined lines.
8.3 Sketching of parallel (Horizontal, vertical, inclined lines).
8.4 Sketching arcs and circles.
8.5 Sketching squares, Rectangles, ellipses and simple objects.
8.6 Proportion in sketching.

**ET-121 BASIC ELECTRICAL DRAWING**

**INSTRUCTIONAL OBJECTIVES**

**UNIT-1:**

**1. A. UNDERSTAND THE IMPORTANCE OF TECHNICAL DRAWING AND CONSTRUCT GEOMETRICAL SHAPES.**

**B. APPRECIATE THE POWER OF DRAWING AS A TOOL OF COMMUNICATING IDEAS.**

1.1 Define importance of technical drawing/engineer's language.
1.2 Use drawing equipment, board, sheet, pencil, T-square, set square, compass, divider, protractor, French curves etc.
1.3 Draw different types of lines.
1.4 Show skill in lettering and dimension
1.5 Divide a line in two and more than two parts.
1.6 Draw different angles and bisect.
1.7 Draw square, rectangle, triangles, circle, hexagon, ellipses.

**UNIT-2:**

**2. UNDERSTAND ORTHOGRAPHIC DRAWING/MULTI-VIEW DRAWING AND PICTORIAL DRAWING**

2.1 Prepare 1st angle drawings.
2.2 Prepare drawings according to 3rd angle projection.
2.3 Draw surface development of simple objects.
2.4 Draw oblique and pictorial view of simple shapes and objects.

**UNIT-3:**

3. **UNDERSTAND ELECTRICAL SYMBOLS, RESIDENTIAL, AND POWER WIRING, AND DIFFERENT POWER CIRCUITS/DRAWINGS**

3.1 Draw electrical symbols.
3.2 Draw single phase wiring circuits.
3.3 Draw wiring circuit diagram of house wiring alongwith point position of single room and double room houses on given building layouts.
3.4 Draw wiring diagrams of motors.
3.5 Draw different industrial wiring circuits.
3.6 Draw three phase wiring circuits layout.

**UNIT-4:**

**4. SHOW SKILL IN FREE HAND SKETCHING**

4.1 Sketch free hand horizontal, vertical, and inclined lines.
4.2 Sketch free hand rectangles, triangles, circles, arcs, ellipse.
4.3 Sketch free hand, oblique and isometric views of simple regular objects.

**ET-121 BASIC ELECTRICAL DRAWING**

**LIST OF PRACTICALS**

1. Prepare the title block.
2. Draw the different lines according to rules (Horizontal and vertical lines) etc.
3. Draw square, rectangle, triangles, circle, hexagon, ellipse (atleast 3 sheets).
4. Practice of lettering and dimensioning.
5. Draw first and third angle drawing of single parts, i.e. prism, stepped block, V-block, gland etc. (at least 5 sheets).
6. Draw isometric projection and oblique projection of rectangular prism, stepped block, v-block, angle block etc. (at least 5 sheets).
7. Draw the surface development of prism, cylinder, cone, square, pyramid (at least 3 sheets).
8. Draw the section diagram of a bolt and nuts.
9. Draw building materials, metals and electrical symbols(3 sheets).
10. Draw the single line diagram of a grid-station switch-yard.
11. Draw the wiring circuit diagram of house wiring and house wiring layout alongwith point position on given house layout single/double room (2 sheets).
12. Wiring diagram of a single phase motor with starter.
13. Circuit diagram of 3-phase motor with magnetic contractor and star delta starters.
14. Draw layout of earthing for a simple house (Earth Wire, Earth lead, Earthing Electrode).
15. Draw layout of earthing circuit for a shop or a factory.
16. Draw Single line power wiring diagram of a shop of a factory.
17. Draw single line power wiring of power lab of a technical college.
18. Schematic diagram of power control panel of power lab of a technical college.
19. Study Drawing of a multi room house with electrical wiring.
20. Detailed drawing of a small house with front elevation.
21. Draw circuit diagram of six lines intercom-network.
22. Sketch free hand horizontal lines, vertical and inclined lines, rectangle, triangle, circle & ellipse (at least 3 sheets).
23. Sketch simple objects i.e. try square, switch plate, bulb holder, etc.
24. Sketch isometric view of a commutator.
25. Sketch sectional view of cable, single core cable, 3 core cable.
26. Sketch electrical tower.
27. Sketch insulators.
28. Draw a commutator.
29. Draw schematic diagram of a power supply/power house.

Note:- Students should prepare at least twenty drawings in college and thirty as home assignment.

They should get it checked weekly by the concerned teacher. They should also produce all

these drawings to the external examiner for marking/sectional work checkup at the time of final examination.

**RECOMMENDED BOOKS**

1. Interior Electrical Wiring & Estimating (Residential) by Uhl-Dunlap-Flynn.
2. Interior Electrical Wiring & Estimating by Graham.
3. Engineering Drawing by Muhammad Iqbal (Prescribed by S.B.T.E).
4. How to Read Electrical Blue Prints by Heine-Dunlap.
5. Power Wiring by Audels.
6. Elementary Engineering Drawing by N.D.Bhat.
7. Elementary Engineering Drawing by A.T. Parkinson.
8. Technical Drawing by Niaz. M. Mirza.

**ET-146 WORKSHOP PRACTICE-I**

| T | P | C |
|---|---|---|
| 1 | 15 | 6 |

**Total Contact Hours:**

Theory: 32
Practical: 480

**AIM** The course is aimed at providing skill in the use of tools and machines of common usage, to enable the student to develop simple projects related to wiring, welding, metal work and wood working. Related safety concerns while working on the job, forms an integrated part of the course. Necessary information about the types, materials, tools/machines may be provided as shop-talk. However, for wiring, separate theory classes will provide the essential background knowledge of electrical rules and regulations.

**1 ELECTRICAL WIRING**

**1.1 House Wiring. (10 Hrs.)**

1.1.1 Types and sizes of wiring cables according to voltage grade, core and strands, Insulation.
1.1.2 Wiring accessories and cables current carrying capacity.
1.1.3 Wiring system (cleat, batten, conduit)
1.1.4 Protection of house wiring.
1.1.4.1 Fuse (rewirable, cartridge, H.R.C).
1.1.4.2 Miniature circuit breaker.
1.1.4.3 Earthing.
1.1.5 Distribution board.
1.1.6 Testing of wiring.
1.1.7 Electricity rules about domestic wiring and earthing.
1.1.8 Voltage drop in cables and its simple calculation.

**1.2. Industrial and commercial wiring. (5 Hrs.)**

1.2.1 Power wiring system.
1.2.1.1 Steel conduit.
1.2.1.2 Trunking and Ducting system.
1.2.1.3 Catenary system.
1.2.1.4 Tough sheathed cable system.
1.2.1.5 Special purpose cable (heat resistant, fire retarding, welding cable etc).
1.2.2 Three phase power distribution board.
1.2.3 Multistory distribution board.
1.2.4 Cable and fuse size for motor.
1.2.5 Study and use of magnetic contractors, push button & thermal relay.

**2 ELECTRICITY RULES AND REGULATIONS. (5 Hrs.)**

**2.1 Pakistan electricity rules 1973.**

2.1.1 Condition of supply by license (rule no. 25, 28, 29, 32, 40, 46).
2.1.2 General precaution for safety of public (Rule 49,51,52,57,58).
2.1.3 Electrical supply line and apparatus (Rule 60, 61, 62, 64).

**2.2 I.E.E Regulation for Building installation. (5 Hrs.)**

(Institute of Electrical Engineers, London).
2.2.1 (Section-A).
Regulation No. and its brief description.
A-1 Control of supply to consumer's Installation.
A-3 Excess current protection.
A-26 Final Sub-circuits of rating exceeding 15 A
2.2.2 Section B.
B-4 Type of flexible cables and flexible cords.
B-12 Choice of types of insulation and protective covering of flexible conductor sizes.
2.2.3 Section C
C-4 Selection for situation.
C-6 Damp situation.
2.2.4 Section D
D-1 Methods of protection.
D-22 Protection by fuse and current circuit Breaker for excess current.

**3 FACTORY ACT. (2 Hrs.)**

**3.1 Workers compensation act.**

3.1.1 Report of Fatal Accidents.
3.1.2 Medical Exam.
3.1.3 Injury and diseases.
3.1.4 Amount of Compensation payable to workman.

**3.2 Safety. (5 Hrs.)**

3.2.1 Fire causes and its prevention, classes of fire.
3.2.2 Safety in electrical shops (Safety Belt, Gloves, clothing and shoes).
3.2.3 General safety precaution (Machine Guards, tools & ladders).
3.2.4 Electric shock its prevention and treatment.

**4 METAL WORK 96 Hrs**

**4.1. Shop orientation.**

4.1.1. Shop policy, rules and regulation.
4.1.2 Introduction to shop machines.

**4.2. Workshop safety practices.**

4.2.1 Measuring tools.
4.2.2 Cutting tools.
4.2.3 Marking tools.
4.2.4 Layout tools.
4.2.5 Grinding tools.
4.2.6 Stocking tools.
4.2.7 Stakes.

**4.3. Bench Work.**

4.3.1 Metal sawing.
4.3.2 Metal filing.
4.3.3 Metal fitting.
4.3.4. Metal drilling.
4.3.5 Pipe cutting/threading
4.3.6 Sheet metal work.
4.3.7 Riveting.

**List of Practical**

| | | |
|---|---|---|
| 1. | Preparation of name plate | 9 Hrs. |
| 2. | Sawing exercise | 9 Hrs. |
| 3. | Preparation of inside calliper | 9 Hrs. |
| 4. | Preparation of bottle opener | 9 Hrs. |
| 5. | Preparation of dove-tail joint | 12 Hrs. |
| 6. | Preparation of small size try-square | 6 Hrs. |
| 7. | Preparation of coat hook | 6 Hrs. |
| 8. | Preparation of funnel (sheet) | 6 Hrs. |
| 9. | Preparation of pin tray (sheet) | 6 Hrs. |
| 10. | Preparation of drawer handle | 6 Hrs. |
| 11. | Preparation of bevel square | 9 Hrs. |
| 12. | Preparation of spanner (small size) | 9 Hrs. |

**5 WOOD WORK** 96 Hrs

**5.1. Shop Orientation**

5.1.1 Shop policies, rules and regulation.
5.1.2 Introduction to shop machines.
5.1.3 Workshop Safety practice.

5.2. Introduction to wood working hand tools

5.2.1 Hand saws.
5.2.2 Planers.
5.2.3 Marking tools.
5.2.4 Chisels.
5.2.5 Boring tools.

5.2.6 Hammers.
5.2.7 Sharpening tools.

5.3. Miscellaneous.
5.3.1 Nails and screws.
5.3.2 Wood used in electrical work, seasoning of wood
5.3.3 Sand and Glass paper.

**List of Practicals (Wood Work)** 96 Hrs.

1. Safety precautions in wood working shop
2. Assembly and disassembly of jack-plane
3. Using of various wood working panes. (Tool exercise)
4. Planning and squaring to dimensions. (job-1)
5. Sharpening plane-iron
6. Introducing different wood working, layout and measuring tools.
7. Sawing exercise (job-2)
8. Identifying different types of `handsaws' and making sketches of all saws.
9. Sharpening `bandsaws'
10. Wood chiseling (chipping)
11. Making `mortise & tannon joint. (job-3)
12. Sharpening wood chisel
13. Making dado-joint (job-4)
14. Making cross-lap joint. (job-5)
15. Observing wood structure
16. Identifying and comparing soft and hard wood
17. Spirit polishing (preparing wood surface for polishing, staining and lacquering)
18. Boring process, making holes of different diameters in wood. (job-6)
19. Nailing and wood screwing process. (job-7+8)
20. Making middle half cross-lap joint. (job-9)
21. Making dove-tail joint. (job-10)

**6 WELDING.** 96 Hrs

6.1. Shop orientation.
6.1.1 Shop policies, shop rules and regulation.
6.1.2 Workshop safety practices.

6.2. Introduction to welding process and welding equipments.
6.2.1 Welding process.
6.2.2 Welding torches.
6.2.3 Gas cylinders.
6.2.4 Pressure gauges.
6.2.5 Welding flames.

6.2.6 Arc welding and related equipments.
6.2.7 Fluxes.
6.2.8 Soldering.

**List of Practicals**

**(Gas Welding)**

| | | |
|---|---|---|
| 1. | Flame making practice. | 3 Hrs. |
| 2. | Pool making. | 3 Hrs. |
| 3. | Bead making. | 3 Hrs. |
| 4. | Butt joint. | 6 Hrs. |
| 5. | Lab joint. | 6 Hrs. |
| 6. | Corner joint without filler rod. | 6 Hrs. |
| 7. | Corner joint with filler rod. | 6 Hrs. |
| 8. | T. joint. | 6 Hrs. |
| 9. | Edge joint. | 6 Hrs. |
| 10. | Brazing practice. | 6 Hrs. |

**(ARC Welding)**

| | | |
|---|---|---|
| 11. | ARC making/current setting/polarity selection | 6 Hrs. |
| 12. | Bead making | 3 Hrs. |
| 13. | Butt joint | 6 Hrs. |
| 14. | Lab joint | 3 Hrs. |
| 15. | Corner joint | 3 Hrs. |
| 16. | T. joint | 3 Hrs. |
| 17. | V. Butt joint | 3 Hrs. |
| 18. | Square corner joint | 3 Hrs. |
| 19. | Bevel butt joint | 3 Hrs. |
| 20. | Spot Welding | 3 Hrs. |

**BOOKS RECOMMENDED:**

1. Wiring Manual by Pakistan Cable.
2. Electrical Wiring-A.I.O.U Islamabad.
3. A.G.E wiring cables & Tables A.G.E ind. Ltd.
4. El. Wiring Guide by Audels.
5. Electricity Rules (Pakistan).
6. National electrical code 1985 USA.
7. I.E.E. Regulations London UK.

**ET-146 WORKSHOP PRACTICE-I**

**INSTRUCTIONAL OBJECTIVES**

**TIME SCHEDULE**

| S.NO. | MAJOR TOPICS | NO. OF PERIODS | NO. OF QUESTIONS IN Q. PAPER |
|---|---|---|---|
| 1. | House wiring | 10 | 2 |
| 2. | Industrial & commercial wiring | 5 | 1 |
| 3. | Pakistan electricity rules | 5 | ½ |
| 4. | I.E.E. regulations | 5 | ½ |
| 5. | Factory Act. | 2 | ¼ |
| 6. | Safety. | 5 | 1 |
| | TOTAL: | 32 | 5 |

**WIRING**

**1. UNDERSTAND ABOUT THE TYPES & SIZES OF COMMON CABLES USED IN DOMESTIC WIRING.**

1.1 Classify cables with respect to insulation, core, voltage grade & current carrying capacity.
1.2 Explain different systems for calculation of cable size.
1.3 Calculate size of cable for a given load

**2. UNDERSTAND THE WIRING SYSTEMS (CLEAT, BATTEN, CASING, CONDUIT).**

2.1 Distinguish between different wiring systems
2.2 Name the necessary materials for each type of wiring.
2.3 Explain the uses of each type of wiring.

**3. UNDERSTAND THE NEED FOR PROTECTION OF HOUSE WIRING AND KNOW DIFFERENT PROTECTIVE DEVICES FOR HOUSE WIRING.**

3.1 Define fuse, miniature circuit breaker.
3.2 Distinguish between fuse and miniature circuit breaker.
3.3 List the parts of fuse & M.C.B.
3.4 Compare the advantages & disadvantages of fuse & M.C.B.

**4. UNDERSTAND THE EARTHING SYSTEM USED IN HOUSE WIRING.**

4.1 Name components of earthing system.
4.2 Define earth electrode, earth continuity conductor & earthing lead.
4.3 Draw the earthing circuit.
4.4 Explain the earth fault current.

4.5 Calculate size of earth continuity conductor, earthing lead & earth electrodes.
4.6 Draw scheme of earthing system.

**5. UNDERSTAND THE CONSTRUCTION, NEED & APPLICATION OF DISTRIBUTION BOARDS.**

5.1 Define distribution board.
5.2 Name/Label parts of distribution board.
5.3 Prepare the distribution board.

**6. UNDERSTAND THE WIRING TESTS & TEST INSTRUMENT (CONTINUITY TESTERS, TEST LAMP, MEGGER)**.

6.1 Name different wiring tests.
6.2 Explain the procedure of test.
6.3 Enlist the results of test.

**7. KNOW ABOUT THE WIRING ACCESSORIES (SWITCHES, SOCKET OUTLETS, CEILING ROSE, LAMP HOLDERS ETC).**

7.1 Distinguish wiring accessories
7.2 Lists purpose of each accessory.
7.3 Connect accessories

**8. UNDERSTAND THE PROCEDURE OF JOINTING AND SOLDERING - MAKE A JOINT AND SOLDER IT.**

8.1 Make the cable joints (Britannia, straight, Tee) on single core single strand,single core multistrand and multicore cables
8.2 Solder the joint.
8.3 Describe the correct procedure of jointing & soldering.

**9. UNDERSTAND THE LIGHTING CIRCUITS - CONNECT DIFFERENT CIRCUITS.**

9.1 Connect one lamp with one way switch
9.2 Connect staircase circuit.
9.3 Connect lamps in series and parallel with switches.
9.4 Label parts of fluorescent lamp and its circuit.
9.5 Connect fluorescent lamp in different fashions.
9.6 Draw the circuit diagram of each circuit.
9.7 Discuss procedure to read the wiring circuit diagrams.

**10. INSTALL A DOMESTIC WIRING (BATTEN WIRING & P.V.C.CONDUIT WIRING).**

10.1 Select the material for wiring.
10.2 Design the layout.
10.3 Draw the circuit.

10.4 Select the tools.
10.5 Install the wiring.
10.6 Test the wiring.
10.7 Commission the wiring.
10.8 Locate & rectify the faults.

**11. CONSTRUCT ELECTRICIAN TEST BOARD & SWITCH BOARD.**

11.1 Select material & accessories
11.2 Fix the accessories on board.
11.3 Connect the accessories.
11.4 Test the performance of board.

**INDUSTRIAL & COMMERCIAL WIRING**

**1. UNDERSTAND POWER WIRING SYSTEMS (STEEL CONDUIT, TRUNKING & DUCTING, CATENARY, OVERHEAD BUSBAR, TOUGH SHEATHED SYSTEM).**

1.1 Describe procedure of each wiring system.
1.2 Identify the material used in each wiring.
1.3 Explain the uses of each of the wiring systems.

2. **UNDERSTAND L.T POWER CABLES - KNOW SPECIAL PURPOSE CABLES (HEAT RESISTANT, FIRE RETARDING, WELDING CABLES).**

2.1 Describe the construction of different types of L.T. power cables.
2.2 State the uses of special purpose cables.
2.3 Designate sizes of cables.
2.4 Give specifications of cables.

**3. UNDERSTAND MULTISTORY DISTRIBUTION SYSTEM.**

3.1 Describe electrical distribution system in multistory buildings.
3.2 Illustrate a typical distribution system in a multistory building.
3.3 Draw the wiring diagram of multistory building.

**4. APPLY THE TECHNIQUES OF JOINTING POWER CABLES.**

4.1 Identify the jointing tools.
4.2 Differentiate jointing material for copper conductors & aluminium conductors.
4.3 Narrate jointing technique & procedure for jointing copper & aluminum conductor power cables.

**5. ACQUIRE THE SKILL IN INSTALLING POWER WIRING.**

5.1 Install steel conduit wiring.
5.2 Install P.V.C.conduit wiring.
5.3 Install motor with D.O.L, 3 point & star-Delta starter.
5.4 Dismantle & assemble I-ph and 3-ph motors.

5.5 Construct & level motor foundation.
5.6 Locate & rectify faults in power wiring.

**SAFETY AND REGULATION:**

**1. UNDERSTAND THE HAZARDS TO LIFE AND EQUIPMENT FROM ELECTRICITY, ELECTRICAL & RELATED EQUIPMENTS - UNDERSTAND PRECAUTIONS WITH PREVENTIVE METHODS.**

1.1 State hazards to life from electric rotating machines.
1.2 Explain preventive methods.
1.3 Describe fire and its types.
1.4 Describe fire fighting equipments.
1.5 Describe the principles of fire fighting.

**2. UNDERSTAND I.E.E. REGULATION FOR ELECTRICAL EQUIPMENTS OF BUILDING AND ELECTRICITY RULES OF PAKISTAN, FACTORY COMPENSATION ACT**.

1.1 Define the following I.E.E. regulations (A1,A3,A-26,B-4,B-12, B-23, C-4,C-1,C-8, D-1,D-20)
1.2 Explain the regulations (relevant) electricity
1.3 Explain rules of Pakistan (R.No's 25, 28, 29, 32, 40, 49, 51, 52, 58, 60, 62, 64)
1.4 Describe Factory act (compensation only)

**3. UNDERSTAND THE PROCEDURE FOR CLAIMING COMPENSATION FOR WORKERS AFFECTED DUE TO ACCIDENT.**

3.1 Prepare report of fatal accidents on the relevant forms for the concerned authorities.
3.2 State the procedure for medical examination of the personnel affected due to accidents.
3.3 Describe the procedure for reporting injuries and acquired diseases due to nature of work.
3.4 Describe the method and amount of compensation payable to workmen due to accidents.

**METAL WORK (SHOP TALK ONLY)-NO THEORY PAPER**:

**1. BE FAMILIAR WITH THE SHOP AREA POLICIES AND DIFFERENT TOOLS & EQUIPMENT SUPPORTIVE TO BENCH WORK. SHOW CONCERN FOR SAFETY.**

1.1 Classify the tools and equipment which supports bench work.
1.2 Identify the different parts and functions of the support machines.
1.3 Follow proper operating procedure, care and maintenance of different tools and support machines.

1.4 Observe shop safety practice.

**2. APPLY THE VARIOUS KNOWLEDGE AND MANIPULATE SKILLS ACQUIRED IN BENCH WORK PROCESS.**

2.1 Identify various tools and equipment used in bench work.
2.2 Perform various bench work processes.
2.3 Demonstrate proper use, care and maintenance of various hand tools.
2.4 Select proper tools.
2.5 Identify parts and functions of hand tools.
2.6 Solve shop problems related to bench work.
2.7 Observe safety rules applied to bench work processes.

**WOOD WORK.(SHOP TALK ONLY)-NO THEORY PAPER**:

**1. KNOW AND USE WOOD WORKING HAND TOOLS.**

1.1 Identify wood working hand tools.
1.2 Classify wood working hand tools w.r.t. function.
1.3 Observe proper care and maintenance of hand tools.
1.4 Observe safety regulations.

**2. MAKE WOOD JOINTS AND PRACTICE DIFFERENT OPERATIONS**.

2.1 Perform the operation of sawing, planing, drilling and jointing.
2.2 Identify wood fastening devices.
2.3 Select correct fastening devices for a particular work.
2.4 Make different wood joints.
2.5 Finish the wood surface.

**3. KNOW SHARPENING TOOLS AND SHARPENING PROCEDURE.**

3.1 Identify different sharpening tools.
3.2 Use sharpening tools.
3.3 Practice of sharpening hand saw, chisel and plane blades.

**WELDING.(SHOP TALK ONLY)-NO THEORY PAPER:**

**1. UNDERSTAND TOOLS AND EQUIPMENT USED IN GAS WELDING, ARC WELDING AND SOLDERING - KNOW AND APPLY THE WELDING AND SOLDERING PROCESSES.**

1.1 Identify the tools and equipment used in basic welding (Gas, Arc) and soldering processes.
1.2 Select proper tools and material.
1.3 Weld common joints.
1.4 Solder joints.
1.5 Follow proper procedure.

1.6 Observe safety practice

## ET-146: WORKSHOP PRACTICE-I

## GUIDELINES FOR CONDUCT OF PRACTICALS

Following guidelines are suggested for the teachers before/while conducting or supervising lab/shop activities.

**The teacher should:**

1 Draw project circuit diagrams and explain the main concept(s).
2 Demonstrate/identify safety precautions to be taken while conducting practicals.
3 Discuss the procedure for the conduct of exercise by the students.
4 Identify key points to be specially observed/noted by the students while conducting the experiment.
5 Help students select tools, equipment and other material for the practical specially in the context of ratings & sizes.
6 Guide students in drawing conclusion/results.
7 Arrange a general discussion session at the end of practical to summarize the experiment.
8. Try to ensure and inculcate safety habits in the students

## LIST OF PRACTICALS (ELECTRICAL WIRING)

1. To study wiring accessories.
2. To study tools used in wiring.
3. To study types of cables.
4. Demonstration of treatment against electric shock.
5. To control one lamp with a single way switch.
6. To control Two lamps individually by 1-way switches.
7. To control Three lamps individually by 3 one way switches & install a fuse.
8. To control Two lamps individually by 2-way switch.
9. To control One lamp from 2 different places.(Stair case circuit).
10. To control One lamp from 3 different places.
11. To control Three lamps in series and measure voltage drop across each lamp.
12. To construct a test board.
13. To construct fuse indication circuit.
14. To control Two lamps by two 2-way switches both in series, both in parallel and individual control.
15. To control a bell through indicator by push button.
16. To prepare Bell-indicator circuit (Hotelling circuit).
17. To prepare Godown circuit.
18. Study of wiring boxes and sealing.
19. To prepare single twist joint.
20. To prepare married joint.
21. To prepare duplex joint.
22. To prepare rat-tail joint.
23. To prepare a Britannia joint.
24. Study of low power cables.

25. Study of medium power cables.
26. Jointing of low voltage cables.
27. Jointing of medium voltage cables.
28. Jointing of paper cables.
29. To prepare wiring switch board with 4 switches, one fan regulator, one socket and a lamp.
30. Study of various protective devices.
31. To control One lamp in batten wiring.
32. To control Two lamps in batten wiring.
33. To control Three lamps in batten wiring.
34. Bell indicator circuit in batten wiring.
35. Godown circuit in batten wiring.
36. To install 1-phase energy meter, main switch and distribution fuse board.
37. To Control One lamp in P.V.C. conduit wiring by making circuit at serial No.9.
38. To control Two lamps in P.V.C. conduit wiring by making circuit at serial No.10.
39. To control three lamps in P.V.C. conduit wiring by making circuit at serial No.14.
40. Stair case circuit in P.V.C. by making circuit at serial No.16.
41. Tunnel light circuit in P.V.C. wiring.
42. To control three lamps individually in steel conduit.
43. Stair case circuit in steel conduit.
44. Bell indicator circuit in steel conduit.
45. Flourescent lamp parts and its connection.
46. To study & connect starterless fluorescent lamp.
47. Wiring 3-phase motor contractor, push button starter and thermal relay.
48. Wiring 3-phase motor as above but controlled from more than one place.
49. Study of the various AC and DC motor starters.
50. Wiring 3-phase motor with 3 position starter. (forward, stop, reverse)
51. Typical commercial wiring in conduit, having distributed light and power circuit.
52. Demonstration of electric shock treatment.
53. Study of different fire extinguisher.
54. House wiring test (Short circuit, leakage current, polarity and continuity test).
55. Location of fault and rectification in wiring.
56. Measurement of earth resistance by earth tester.
57. Measurement of earth loop resistance by Ammeter and volt meter method.
58. Insulation test of 3-phase motors by megger.
59. Designing Protective Multiple Earth System for industrial installation.
60. Study of Pakistan Electricity Rules (R.No. 65,66,67,69,72,73,74).

**PROJECT: (ELECTRICAL WIRING)**

- Two room house wiring in P.V.C. conduit.
- Batten wiring for four rooms.
- Making motor foundation and its levelling.

Note: Students must prepare theory and practical note books and got it checked weekly by the concerned teacher. They should produce these to external examiner for sessional work/marking check up at the time of final exam.