**CURRICULUM**

For

**THREE YEARS’ DIPLOMA OF ASSOCIATE ENGINEER**

IN

**Electrical Automation Technology**

Entry Level: - Matriculation (Science) or Matric (Technical)-TSC

Duration of Course: - Three Years

Credit Hours: **70** (Annual System)

Methodology: Theory 40%

Practical 60%

Examination & Certification Body: Sindh Board of Technical Education (SBTE) Karachi.

Examination System: Annual System (The same as other DAEs programs)

Sindh Technical Education and Vocational Training Authority

**STEVTA**

**D.A.E Electrical Automation Technology**

**(3-Years’ Course)**

**Scheme of Studies**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **FIRST YEAR** | | | | | | |
| **Code** | **Subject Name** | | **T** | **P** | | **C** |
| **Gen 111** | **Islamist & Pakistan Studies** | | **1** | **0** | | **1** |
| **GenC 112** | **Chinese Ⅰ** | | **2** | **0** | | **2** |
| **Eng 112** | **English** | | **2** | **0** | | **2** |
| **Math 123** | **Applied Mathematics-I** | | **3** | **0** | | **3** |
| **Ch 132** | **Applied Chemistry** | | **1** | **3** | | **2** |
| **MGM-121** | **Business Management & Industrial Economics** | | **1** | **0** | | **1** |
| **Comp 162** | **Computer Applications** | | **1** | **3** | | **2** |
| **ET 115** | **Principles of Electrical Engineering** | | **3** | **6** | | **5** |
| **ET 121** | **Basic Electrical Drawing** | | **0** | **3** | | **1** |
| **ET-133** | **Basic Electronics-I** | | **2** | **3** | | **3** |
| **ET-143** | **Workshop Practice (Electrical)** | | **1** | **6** | **3** | |
|  | **Total** | | **17** | **24** | | **25** |
| **SECOND YEAR** | | | | | | |
| **Code** | | **Subject Name** | **T** | **P** | | **C** |
| **Gen-211** | | **Islamist & Pakistan Studies** | **1** | **0** | | **1** |
| **Math-233** | | **Applied Mathematics-II** | **3** | **0** | | **3** |
| **GenC-212** | | **Chinese Ⅱ** | **2** | **0** | | **2** |
| **GenC-222** | | **Understanding China** | **2** | **0** | | **2** |
| **Phy-232** | | **Applied Physics** | **1** | **3** | | **2** |
| **ET-203** | | **D.C. Machines & Batteries** | **2** | **3** | | **3** |
| **ET-273** | | **Electrical Instruments & Measurements** | **2** | **3** | | **3** |
| **ET-253** | | **AC Machine** | **4** | **6** | | **6** |
| **ET-261** | | **Applications of Computers in Electrical Tech.** | **0** | **3** | | **1** |
| **ET-282** | | **Digital Logic Design** | **1** | **3** | | **2** |
|  | | **Total** | **18** | **21** | | **25** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **THIRD YEAR** | | | | |
| **Code** | **Subject Name** | **T** | **P** | **C** |
| **Gen 311** | **Islamist & Pakistan Studies** | **1** | **0** | **1** |
| **GenC 312** | **Chinese Synthesis -1** | **1.5** | **1.5** | **2** |
| **GenC 311** | **Chinese Listening** | **0** | **1.5** | **0.5** |
| **GenC 321** | **Spoken Chinese** | **0** | **1.5** | **0.5** |
| **EAT-311** | **Electrical Chinese** | **1** | **0** | **1** |
| **EAT-322** | **Electronic skills training** | **1** | **3** | **2** |
| **EAT-332** | **Installation and maintenance of electrical control system** | **1** | **3** | **2** |
| **Gen-331** | **Introduction to Artificial Intelligence** | **0.5** | **1.5** | **1** |
| **GenC-342** | **Chinese Synthesis -2** | **1.5** | **1.5** | **2** |
| **GenC-352** | **Chinese Reading and Writing** | **0** | **1.5** | **0.5** |
| **EAT-342** | **Industrial Robot Technology** | **0.5** | **3** | **1.5** |
| **EAT-351** | **The Design of Intelligent Product Based on Arduino** | **0.5** | **1.5** | **1** |
| **EAT-362** | **Installation and Commissioning of PLC Control System** | **1** | **3** | **2** |
| **EAT-372** | **Frequency Conversion and Servo System** | **0.5** | **3** | **1.5** |
| **EAT-382** | **Power Supply and Distribution Technology** | **1** | **1.5** | **1.5** |
|  | **Total** | **11** | **27** | **20** |

**2. Curriculum Standards for Year 1**

**2.1 Islamist and Pakistan Studies**

### DAE Technology



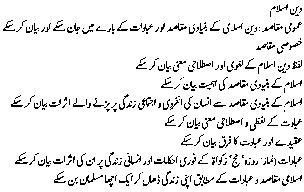
**DAE Technology**



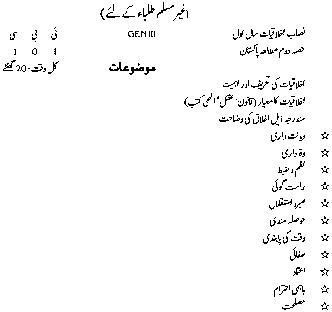
**DAE Technology**



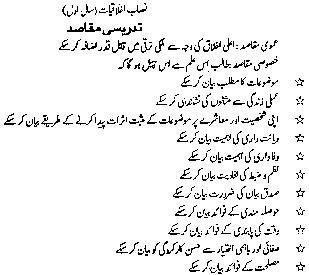
**DAE Technology**

-4

### DAE Technology



**DAE Technology**



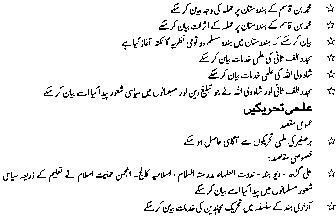
**DAE Technology**



**DAE Technology**



**DAE Technology**



**2.2 GenC-112 CHINESE COURSE Ⅰ**

**Total contact hours**

Theory 64 T P C

Practical 0 2 0 2

**PART ONE**

**AIMS** This course consists of 18 classes (including mid-term test and final test). After completing this part, students can master the primary Chinese language knowledge taught in the content of the course, and be able to achieve and exceed the **HSK level One**.

**INSTRUCTION OBJECTIVE** The course is mainly for zero-based learners. Through the study of this course, learners can lay a solid language foundation and have a preliminary understanding of Chinese language structure, including Pinyin, Chinese characters, words, grammar and other knowledge. After completing this course, learners can understand and use some basic words and sentences, and complete the most basic communication, such as greeting, asking, introducing, shopping and so on.

**COURSE CONTENTS**

1. **Lesson 1 Hello Vs Nǐhǎo 1 hour**

This lesson briefly introduces pinyin and spelling methods.

1. **Hello!**  **1 hour**

This lesson briefly introduces the sentence patterns used in greeting, such as dialogue, greeting farewell, and introducing one's own name.

1. **Lesson 3 I am Thai**  **2 hour**

Teach students to understand basic classroom language, learn to use "national + person" for simple communication dialogue, and introduce which country they come from.

1. **Lesson 4 What's the date today**  **2 hour**

This lesson introduces the expression of numbers, years, months, etc., and teaches students to ask about a date and answer it.

1. **Lesson 5 This is my brother 2 hours**

By introducing family members, students can understand the simple words when asking about family status and introduce them briefly.

1. **Lesson 6 I'm nineteen years old**  **2 hours**

This lesson expands quantifiers and animal names, and introduces the expression of age, so that students can ask and answer each other's age correctly.

1. **Lesson 7 What time is it** **2 hours**

This lesson introduces the usage of hours, minutes and seconds, so that students can describe their lives with time points.

1. **Lesson 8 What do you like to do on weekends** **2 hours**

This lesson introduces the expressions of hobbies, interests, activities and other related nouns, so as to help students communicate with each other by using simple linking sentences.

**Semi-MID-TERM REVIEW**  **2 hours**

Mid-term review is a summary of the knowledge learned in the past. The test paper uses the knowledge points learned in the past to design listening questions, answering questions by looking at pictures, connecting questions, filling in blanks, etc., which are illustrated with pictures and interesting, and can test students' learning effect.

1. **Lesson 9 Introduce yourself 2 hours**

Explain the related expressions related to self-introduction, and students can correctly introduce their names, families, ages, hobbies, school majors, etc. 2

1. **Lesson 10 My father is in Beijing** **2 hours**

This lesson introduces the names of major cities in China, Britain and Europe, and introduces the use of "person + place" in sentences.

1. **Lesson 11 I came to Beijing by plane 2 hours**

This lesson introduces the means of transportation and how to express long sentences in combination with the time and place learned before.

1. **Lesson 12 I eat at the company 2 hours** **2 hours**

This lesson introduces the polite expressions used in eating.

1. **Lesson 13 The weather is fine on Monday**  **2 hours**

It shows the conversations and topics that may appear when you want to date.

1. **Lesson 14 How much is it altogether** **2 hours**

This lesson introduces the vocabulary and sentences commonly used in shopping, and how to use Chinese for daily shopping.

1. **Lesson 15 What would you like to have 2 hours**

This lesson introduces the classic Chinese and Thai cuisine, the terms of treating guests, and the communicative terms of how to order food in restaurants.

1. **Lesson 16 The bathroom is next to the pantry** **2 hours**

This lesson introduces location and location words, and how to use location words to introduce the location of a place.

**Semi- FINAL REVIEW** **2 hours**

Similar to the mid-term test questions, it is a test of important knowledge points of the course to test students' learning effect. This lesson briefly introduces pinyin and spelling methods.

**PART TWO**

**AIMS** After completing this part, students can master the basic Chinese language knowledge taught in the content of the course, and be able to reach and exceed **HSK level TWO.**

**INSTRUCTION OBJECTIVE** Learners can master the language knowledge and use some basic grammar and sentence patterns in communication, learn to express personal feelings and attitudes in Chinese, and can complete communicative functions such as gratitude, apology, introduction and farewell, and begin to understand Chinese cultural knowledge and cultivate interest in learning.

**COURSE CONTENTS**

1. **Lesson 1 I was still sleeping at 7 o'clock 1 hour**

This lesson introduces the grammatical points of "still", so that students can correctly understand the meaning of sentences related to "still" and use this sentence pattern correctly for communication.

1. **Lesson 2 It will be cloudy tomorrow 1 hour**

By introducing the weather in several Chinese cities, Explain how to use temperature to answer weather questions.

1. **Lesson 3 That one is five hundred dollars cheaper than this one 1 hour**

This lesson Explain s comparative sentences, and compares them in terms of price, height and temperature, so that students can understand comparative sentences thoroughly.

1. **Lesson 4 This is a family photo 1 hour**

This lesson introduces family members in detail through appearance, clothing and occupation, so that students can master more detailed description methods.

1. **Lesson 5 It is forbidden to take pictures here 2 hours**

This lesson leads students to understand the relevant knowledge points of expressing commands, such as forbidden and forbidden, so that students can correctly understand the meaning of words in daily life.

1. **Lesson 6 I can't find something 2 hours**

This lesson introduces the use of language points in "V + should + result complement", so that students can correctly use relevant sentence patterns in communication.

1. **Lesson 7 I have been to Sichuan and seen pandas 2 hours**

This lesson introduces Chinese culture through "V + have been to", such as the Great Wall, the Forbidden City, national treasures, etc., so that students can use this sentence pattern correctly in communication.

1. **Lesson 8 I hope you can come to my wedding 2 hours**

By introducing Chinese weddings, this lesson enables students to master the verbal usage of banquet invitation, holiday blessing, emotional expression and euphemistic refusal.

**Semi-MID-TERM REVIEW 2 hours**

This section leads students to review the knowledge points they have learned in the past and conduct mid-term tests through reading pictures, listening questions and connecting questions to test students' learning effect.

1. **Lesson 9 Be ill, take more rest 2 hours**

This lesson introduces the vocabulary related to illness and the doctor's medication advice, so that students can correctly describe and understand the doctor's meaning in the process of seeing a doctor.

1. **Lesson 10 The station is just across the road 2 hours**

This lesson introduces the way of asking places and answers by asking directions, which helps students to use relevant sentence patterns for practical communication questions and answers.

1. **Lesson 11 She sings very well 2 hours**

This lesson focuses on hobbies and introduces the correct use of related words in sentences.

1. **Lesson 12 Did you do well in the exam 2 hours**

By describing the examination process and the situation of answering questions, students can correctly understand the instructions of the examination room, the distribution of questions and the analysis of test paper problems

1. **Lesson 13 Buy two and get one free 2 hours**

This lesson introduces the commodity names of supermarkets, as well as common terms such as promotional activities, discounts and price reductions.

1. **Lesson 14 We're a new restaurant 2 hours**

This lesson helps students understand how to understand the waiter's recommendation and put forward the food requirements for ordering.

1. **Lesson 15 The girl is dressed in white clothes 2 hours**

This lesson introduces others' clothes and how to use grammar points to describe the state of something through "V + be dressed in".

1. **Lesson 16 You can be discharged from hospital next week 2 hours**

This lesson introduces a variety of expressions, such as hospitalization, visiting patients and discharge, so that students can understand the language of hospital scenes and strengthen their multi-scene communication ability.

**Semi- FINAL REVIEW 2 hours**

This section is similar to the mid-term review, which leads students to review the knowledge points they have learned in the past and conduct final tests by looking at pictures, listening questions, connecting questions, etc., to test students' learning effect.

**Recommended Book**

*Tang Chinese Course 1 for PART TWO*

*Tang Chinese Course 2 for PART TWO*

**2.3 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. First eight essays of Intermediate English Book-II
2. **CLOZE TEST 4 hours**
   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"**

1. **GRAMMAR 26 hours**
   1. Sentence Structure.
   2. Tenses.
   3. Parts of speech.
   4. Punctuation.
   5. Change of Narration.
   6. One word for several
   7. Words often confused
2. **COMPOSITION 8 hours**
   1. Letters/Messages
   2. Job application letter
   3. For character certificate/for grant of scholarship
   4. Telegrams, Cablegrams and Radiograms, Telexes, Facsimiles
   5. Essay writing
   6. Technical Education, Science and Our life, Computers, Environmental Pollution, Duties of a Student.
3. **hours**
4. **TRANSLATION 6 hours**
   1. Translation from Urdu into English.

For Foreign Students: A paragraph or a dialogue.

**RECOMMENDED TEXT BOOK**

1. Technical English developed by Mr. Zia Sarwar, Mr. Habib-ur –Rehman, Evaluated by Mr.Zafar Iqbal Khokhar, Mr. Zahid Zahoor, Vol - I, National Book Foundation

**Eng-112 ENGLISH INSTRUCTIONAL OBJECTIVES PAPER-A**

1. **DEMONSTRATE BETTER READING, COMPREHENSION AND VOCABULARY**
   1. Manipulate, skimming and scanning of the text.
   2. Identify new ideas.
   3. Reproduce facts, characters in own words
   4. Write summary of stories
2. **UNDERSTAND FACTS OF THE TEXT**
   1. Rewrite words to fill in the blanks recalling the text.
   2. Use own words to fill in the blanks.

**PAPER-B**

1. **APPLY THE RULES OF GRAMMAR IN WRITING AND SPEAKING**
   1. Use rules of grammar to construct meaningful sentences containing a subject and a predicate.
   2. State classification of time, i. e present, past and future and use verb tense correctly in different forms to denote relevant time.
   3. Identify function words and content words.
   4. Use marks of punctuation to make sense clear.
   5. Relate what a person says in direct and indirect forms.
   6. Compose his writings.
   7. Distinguish between confusing words.
2. **APPLY THE CONCEPTS OF COMPOSITION WRITING TO PRACTICAL SITUATIONS**
   1. Use concept to construct applications for employment, for character certificate, for grant of scholarship.
   2. Define and write telegrams, cablegrams and radiograms, telexes, facsimiles
   3. Describe steps of a good composition writing.
   4. Describe features of a good composition.
   5. Describe methods of composition writing
   6. Use these concepts to organize facts and describe them systematically in practical situation.
3. **APPLIES RULES OF TRANSLATION**
   1. Describe confusion.
   2. Describe rules of translation.
   3. Use rules of translation from Urdu to English in simple paragraph and sentences.

**2.4 Math-123 APPLIED MATHEMATICS-I**

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

**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. Standard Form
   2. Solution
   3. Nature of roots
   4. Sum and product of roots
   5. Formation
   6. Problems
2. **BINOMIAL THEOREM 6 hours**
   1. Factorials
   2. Binomial expression
   3. Binomial co-efficient
   4. Statement
   5. The general term
   6. The binomial series
   7. Problems.
3. **PARTIAL FRACTIONS 6 hours**
   1. Introduction
   2. Linear distinct factors case I
   3. Linear repeated factors case II
   4. Quadratic distinct factors case III
   5. Quadratic repeated factors case IV
   6. Problems
4. **FUNDAMENTALS OF TRIGONOMETRY 6 hours**
   1. Angles
   2. Quadrants
   3. Measurements of angles
   4. Relation between sexagesimal and circular system
   5. Relation between length of a circular arc and the radian measure of its central angle
   6. Problems
5. **TRIGONOMETRIC FUNCTIONS AND RATIOS 6 hours**
   1. Trigonometric functions of any angle
   2. Signs of trigonometric functions
   3. Trigonometric ratios of particular angles
   4. Fundamental identities
   5. Problems
6. **GENERAL IDENTITIES 6 hours**
   1. The Fundamental Law
   2. Deductions
   3. Sum and difference formulae
   4. Double angle identities
   5. Half angle identities
   6. Conversion of sum or difference to products
   7. Problems
7. **SOLUTION OF TRIANGLES 6 hours**
   1. The law of Sines
   2. The law of Cosines
   3. Measurement of heights and distances
   4. Problems
8. **VECTORS AND PHASORS 12 hours**
   1. Scalars and Vectors
   2. The unit Vectors i, j, k
   3. Direction Cosines
   4. Dot product
   5. Cross product
   6. Analytic expressions for dot and cross products
   7. Phasors
   8. Significance of j operator
   9. Different forms
   10. Algebraic operations
   11. Problems
9. **COMPLEX NUMBERS 9 hours**
   1. Introduction and properties
   2. Basic operations
   3. Conjugate
   4. Modulus
   5. Different forms
   6. Problems
10. **BOOLEAN ALGEBRA AND GATE NETWORKS 15 hours**
    1. Concept and basic laws
    2. Sums of product and product of sums
    3. Binary, decimals and octals, presentation of decimal numbers in BCD
    4. Interconversion of numbers
    5. OR Gates and AND Gates
    6. Logical Expressions and their simplification
    7. Demorgan's theorems
    8. NAND Gates and NOR Gates
    9. Problems
11. **PLANE ANALYTIC GEOMETRY AND STRAIGHT LINE 6 hours**
    1. Coordinate system
    2. Distance formula.
    3. Ratio formulas.
    4. Inclination and slope of line.
    5. Slope formula.
    6. Problems.
12. **EQUATIONS OF THE STRAIGHT LINE 6 hours**
    1. Some important forms
    2. General form
    3. Angle formula.
    4. Parallelism and perpendicularity
    5. Problems
13. **EQUATIONS OF THE CIRCLE. 6 hours**
    1. Standard and Central forms of equation.
    2. General form of equation.
    3. Radius and coordinates of center.
    4. Problems

**RECOMMENDED TEXT BOOK**

1. Applied Mathematics: Math-123, Developed by Nasir -ud-Din Mahmood, Sana-ullah Khan, Tahir Hameed, Evaluated by Syed Tanvir Haider, Javed Iqbal, Vol - I, National Book Foundation

**2.4 Math-123 APPLIED MATHEMATICS-I INSTRUCTIONAL OBJECTIVES**

**1. USE DIFFERENT METHODS FOR THE SOLUTION OF QUADRATIC EQUATION**

* 1. Define a standard quadratic equation.
  2. Use methods of factorization and method of completing the square for solving the equations.
  3. Derive quadratic formula.
  4. Write expression for the discriminant.
  5. Explain nature of the roots of a quadratic equation.
  6. Calculate the sum and product of the roots.
  7. Form a quadratic equation from the given roots.
  8. Solve problems involving quadratic equations.

1. **APPLY BINOMIAL THEOREM FOR THE EXPANSION OF BINOMIAL AND EXTRACTION OF ROOTS.**
   1. State binomial theorem for positive integral index.
   2. Explain binomial coefficients: (n,0), (n,1)....(n, r)...(n, n)
   3. Derive expression for the general term.
   4. Calculate the specified terms.
   5. Expand a binomial of a given index.
   6. Extract the specified roots.
   7. Compute the approximate value to a given decimal place.
   8. Solve problems involving binomials.
2. **APPLY DIFFERENT METHODS FOR RESOLVING A SINGLE FRACTION INTO PARTIAL FRACTIONS USING DIFFERENT METHODS**
   1. Define a partial fraction, a proper and an improper fraction.
   2. Explain all the four types of partial fractions.
   3. Set up equivalent partial fractions for each type.
   4. Explain the methods for finding constants involved.
   5. Resolve a single fraction into partial fractions.
   6. Solve problems involving all the four types.
3. **UNDERSTAND THE SYSTEMS OF MEASUREMENT OF ANGLES.**
   1. Define angles and the related terms.
   2. Illustrate the generation of an angle.
   3. Explain sexagesimal and circular systems for the measurement of angles.
   4. Derive the relationship between radian and degree.
   5. Convert radians to degrees and vice versa.
   6. Derive a formula for the circular measure of a central angle.
   7. Use this formula for solving problems.
4. **UNDERSTAND BASIC CONCEPTS AND PRINCIPLES OF TRIGONOMETRIC FUNCTIONS.**
   1. Define the basic trigonometric functions/ratios of an angle as ratios of the sides of a right triangle.
   2. Derive fundamental identities.
   3. Find trigonometric ratios of particular angles.
   4. Draw the graph of trigonometric functions.
   5. Solve problems involving trigonometric functions.
5. **USE TRIGONOMETRIC IDENTITIES IN SOLVING TECHNOLOGICAL PROBLEMS**.
   1. List fundamental identities.
   2. Prove the fundamental law.
   3. Deduce important results.
   4. Derive sum and difference formulas.
   5. Establish half angle, double and triple angle formulas.
   6. Convert sum or difference into product and vice versa.
   7. Solve problems.
6. **USE CONCEPT, PROPERTIES AND LAWS OF TRIGONOMETRIC FUNCTIONS FOR SOLVING TRIANGLES.**
   1. Define angle of elevation and angle of depression.
   2. Prove the law of sines and the law of cosines.
   3. Explain elements of a triangle.
   4. Solve triangles and the problems involving heights and distances.
7. **UNDERSTAND PRINCIPLES OF VECTORS AND PHASORS**
   1. Define unit vectors i, j, k.
   2. Express a vector in the component form.
   3. Explain magnitude, unit vector, direction cosines of a vector.
   4. Explain dot product and cross product of two vector.
   5. Deduce important results from dot and cross product.
   6. Define phasor and operator j.
   7. Explain different forms of phasors.
   8. Perform basic Algebraic operation on phasors.
   9. Solve problems on phasors.
8. **USE PRINCIPLES OF COMPLEX NUMBERS IN SOLVING TECHNOLOGICAL PROBLEMS.**
   1. Define a complex number and its conjugate.
   2. State properties of complex numbers.
   3. Give different forms of complex numbers.
   4. Perform basic algebraic operations on complex numbers.
   5. Solve problem involving complex numbers.
9. **SOLVE TECHNICAL PROBLEMS USING PRINCIPLES OF BOOLEAN ALGEBRA**
   1. Explain fundamental concepts of Boolean algebra
   2. Explain binary numbers, octal numbers, decimal numbers and their interconversion.
   3. Explain digital addition and multiplication and its applications to OR gates and AND Gates
   4. Illustrate complimentation and inversion
   5. Evaluate logical expression
   6. List basic Laws of Boolean Algebra
   7. Explain De-Morgan's theorem
   8. Explain basic duality of Boolean algebra
   9. Derive Boolean expression
   10. Explain combination of GATES
   11. Illustrate sum of products and product of sum
   12. Derive product of sum expression
   13. Explain NAND Gates and NOR Gates
   14. Use the map methods for simplifying expressions
   15. Explain sub-cubes and covering
10. **UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY** 11.1 Explain the rectangular coordinate system.
    1. Locate points in different quadrants.
    2. Derive distance formula.
    3. Describe the ratio formula
    4. Derive slope formula
    5. Solve problems using the above formulae.
11. **USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.**
    1. Define equation of a straight line.
    2. Derive slope intercept and intercept forms of equations of a straight line.
    3. Write general form of equations of a straight line.
    4. Derive an expression for angle between two straight lines.
    5. Derive conditions of perpendicularity and parallelism of two straight lines.
    6. Solve problems using these equations/formulae.
12. **SOLVE TECHNOLOGICAL PROBLEMS USING EQUATIONS OF CIRCLE**
    1. Define a circle.
    2. Describe standard, central and general forms of the equation of a circle.
    3. Convert general form to the central form of equation of a circle.
    4. Deduce formula for radius and coordinates of the center of a circle.
    5. Derive equation of the circle passing through three points.
    6. Solve problems involving these equations.

**2.5 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 practical in a chemistry lab.
5. **INTRODUCTION 2 Hours**
   1. The scope and significance of the subject.
   2. Orientation with reference to Technology.
   3. Terms used & units of measurements in the study of chemistry.
6. **FUNDAMENTAL CONCEPTS OF CHEMISTRY 2 Hours**
   1. Symbols, Valency, Radicals, formulas.
   2. Chemical Reactions & their types.
   3. Balancing of equations by ionic method.
7. **ATOMIC STRUCTURE 2 Hours**
   1. Sub-atomic particles.
   2. Bohr Atomic Model.
   3. The periodic classification of elements and periodic law
   4. General characteristics of a period and group.
8. **CHEMICAL BOND 2 Hours**
   1. Nature of chemical Bond.
   2. Electrovalent bond with examples.
   3. Covalent Bond(Polar and Non-polar, sigma & Pi Bonds with examples.
   4. Co-ordinate Bond with examples.
9. **SOLIDS AND LIQUIDS 3 Hours**
   1. The liquid and Solids state.
   2. The liquids and their general properties (Density, viscosity, surface tension capillary action etc).
   3. Solids and their general properties.
   4. Crystal structure of solids
   5. Crystals of Si and Ge.
10. **WATER 3 Hours**
    1. Chemical nature and properties.
    2. Impurities.
    3. Hardness of water (types, causes & removal)
    4. Scales of measuring hardness (Degress Clark, French, PPM, MGM per Litre).
    5. Boiler feed water, scales and treatment.
    6. Sea-water desalination, sewage treatment.
11. **ACIDS, BASES AND SALTS 2 Hours**
    1. Definitions with examples.
    2. Properties, their strength, basicity & Acidity.
    3. Salts and their classification with examples.
    4. pH-value and scale.
12. **OXIDATION & REDUCTION 2 Hours**
    1. The process with examples.
    2. Oxidizing and Reducing agents.
    3. Oxides and their classifications.
13. **NUCLEAR CHEMISTRY 2 Hours**
    1. Introduction.
    2. Radioactivity (Alpha, beta and gamma rays).
    3. Half life process.
    4. Nuclear reaction & transformation of elements.
    5. Isotopes and their uses.
14. **ALLOYS 2 Hours**
    1. Introduction with need.
    2. Preparation and properties.
    3. Some important alloys and their composition.
15. **CORROSION 2 Hours**
    1. Introduction with causes.
    2. Types of corrosion.
    3. Rusting of Iron
    4. Protective measures against corrosion.
16. **ELECTRO CHEMISTRY 2 Hours**
    1. Ionization and Arrhenius theory of Ionization.
    2. Electrolytes and Electrolysis.
    3. Faraday's Laws and numericals related to them.
    4. Application of Electrolysis (Electron, lathing etc).
    5. Electro Chemical cells.
17. **ELECTRICAL INSULATING MATERIALS. 2 Hours**
    1. Introduction.
    2. Solid insulators with chemical nature.
    3. Liquid insulators with chemical nature.
    4. Gaseous insulators with chemical nature.
    5. Uses and their classification.
18. **SEMI CONDUCTORS. 2 Hours**
    1. Introduction
    2. Atomic structure of silicon and germanium.
    3. Bonding & Conductivity.
    4. Energy bands in a semiconductor.
19. **ETCHING PROCESS. 2 Hours**
    1. The process and its aims.
    2. Etching reagents.
    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. Define chemistry and its terms.
   2. Define the units of measurements in the study of chemistry.
   3. Explain the importance of chemistry in various fields of specialization.
   4. Explain the role of chemistry in this technology.
2. **UNDERSTAND LANGUAGE OF CHEMISTRY AND CHEMICAL REACTIONS.**
   1. Define symbol, valency, radical, formula with examples of each.
   2. Write chemical formula of common compounds.
   3. Define chemical reaction and equations.
   4. Describe types of chemical reactions with examples.
   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.**
   1. Define atom.
   2. Describe the fundamental sub atomic particles
   3. Distinguish between atomic no. mass no. and between isotope and isobars.
   4. Explain the arrangements of electrons in different shells and sub energy levels and understand Bohr's atomic model.
   5. Explain the grouping and placing of elements in the periodic table especially Si & germanium.
   6. State the periodic law of elements.
   7. Explain the trend of properties of elements based on their position in the periodic table.
   8. Explain general characteristics of a period and a group.
4. **UNDERSTAND THE NATURE OF CHEMICAL BONDS.**
   1. Define chemical Bond.
   2. State the nature of chemical bond.
   3. Differentiate between electrovalent and covalent bonding.
   4. Explain the formation of polar and non polar, sigma and pi-bond with examples.
   5. Describe the nature of coordinate bond with examples.
5. **UNDERSTAND THE STATES OF MATTER AND DISTINGUISHES SOLIDS FROM GASES.**
   1. Describe the liquid and solid states of matter.
   2. State the general properties of liquid.
   3. State the general properties of solid.
   4. Explain the formation of crystals and their types.
   5. Describe the crystal structure of Si and Ge.
6. **UNDERSTAND THE CHEMICAL NATURE OF WATER.**
   1. Describe the chemical nature of water with its formula.
   2. Describe the general impurities present in water.
   3. Explain the causes and methods to remove hardness of water.
   4. Express hardness in different units like mg/litre. p.p.m, degrees Clark and degrees French.
   5. Describe the formation and nature of scales in boiler feed water.
   6. Explain the method for the treatment of scales.
   7. Explain the sewage treatment and desalination of sea water.
7. **UNDERSTAND THE NATURE OF ACIDS, BASES AND SALTS.**
   1. Define acids, bases and salts with examples.
   2. State general properties of acids and bases.
   3. Differentiate between acidity and basicity.
   4. Define salts, give their classification with examples.
   5. Explain pH value of solution and pH scale.
8. **UNDERSTAND THE PROCESS OF OXIDATION AND REDUCTION.**
   1. Define oxidation.
   2. Illustrate the oxidation process with examples.
   3. Define reduction.
   4. Explain reduction process with examples.
   5. Define oxidizing and reducing agents and give at least six examples of each.
   6. Define oxides.
   7. Classify the oxides and give examples.
9. **UNDERSTAND THE FUNDAMENTALS OF NUCLEAR CHEMISTRY.**
   1. Define nuclear chemistry and radio activity.
   2. Differentiate between alpha, beta and gamma particles.
   3. Explain half life process.
   4. Explain at least six nuclear reactions resulting in the transformation of some elements.
   5. State the uses of isotopes.
10. **UNDERSTAND THE NATURE OF ALLOYS USED IN THE RESPECTIVE TECHNOLOGY.**
    1. Define alloy.
    2. Explain different methods for the preparation of alloys.
    3. Explain important properties of alloys.
    4. Explain the composition, properties and uses of alloys.
11. **UNDERSTAND THE PROCESS OF CORROSION**.
    1. Define corrosion.
    2. Describe different types of corrosion.
    3. State the causes of corrosion.
    4. Explain the process of rusting of iron.
    5. Describe methods to prevent/control corrosion.
12. **UNDERSTAND THE APPLICATION OF ELECTROCHEMISTRY IN DIFFERENT FIELDS OF INDUSTRIES.**
    1. Define ionization, electrolyte and electrolysis.
    2. Describe Arrhenius theory of ionization.
    3. State Faraday's laws of electrolysis.
    4. Apply Faraday's laws of different fields of industry.
    5. Solves numerical problem on Faraday's Laws.
    6. Explain the construction and working of Daniel cell and lead accumulator.
13. **KNOW THE USE OF INSULATING MATERIALS.**
    1. Define insulator, conductor.
    2. Classify solid, liquid and gaseous insulators with their chemical nature.
    3. Describe their uses.
14. **UNDERSTAND THE NATURE AND CHEMISTRY OF SEMI CONDUCTORS.**
    1. Define semi conductors.
    2. Draw the atomic structure of silicon and germanium.
    3. Describe the process of bonding and conductivity in conductors and semi conductors.
    4. Explain energy bands in semi conductors.
15. **USE ETCHING PROCESS IN DIFFERENT FIELDS OF TECHNOLOGY.**
    1. Define etching process and its aims.
    2. Enlist the chemicals/reagents used in the process.
    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 analyses 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 KNO3 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.

## MGM-121 BUSINESS MANAGEMENT AND INDUSTRIAL ECONOMICS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Total Contact Hours** |  | | | |
| Theory | 32 | **T** | **P** | **C** |
| Practical | 0 | 1 | 0 | 1 |

**AIMS** The students will be able to develop management skills, get acquainted the learner with the principles of management and economic relations and develop commercial/economic approach to solve the problems in the industrial set-up.

## COURSE CONTENTS

1. **ECONOMICS 2 Hours**
   1. Definition: Adam Smith, Alfred Marshall, Prof. Robins.
   2. Nature and scope
   3. Importance for technicians
   4. Micro and Macro Economics.

## BASIC CONCEPTS OF ECONOMICS 1 Hour

* 1. Utility
  2. Income
  3. Wealth
  4. Saving
  5. Investment
  6. Value.

## DEMAND AND SUPPLY. 2 Hours

* 1. Definition of demand.
  2. Law of demand.
  3. Definition of supply.
  4. Law of supply.

## FACTORS OF PRODUCTION. 2 Hours

* 1. Land
  2. Labour
  3. Capital
  4. Organization.

## BUSINESS ORGANIZATION. 3 Hours

* 1. Sole proprietorship.
  2. Partnership
  3. Joint stock company.

## ENTERPRENEURIAL SKILLS 4 Hours

* 1. Preparing, planning, establishing, managing, operating and evaluating relevant resources in small business.
  2. Business opportunities, goal setting.
  3. Organizing, evaluating and analyzing opportunity and risk tasks.

## SCALE OF PRODUCTION. 2 Hours

* 1. Meaning and its determination.
  2. Large scale production.
  3. Small scale production.

## ECONOMIC SYSTEM 3 Hours

* 1. Free economic system.
  2. Centrally planned economy.
  3. Mixed economic system.

## MONEY. 1 Hour

* 1. Barter system and its inconveniences.
  2. Definition of money and its functions.

## BANK. 1 Hour

* 1. Definition
  2. Functions of a commercial bank.
  3. Central bank and its functions.

## CHEQUE 1 Hour

* 1. Definition
  2. Characteristics and kinds of cheque.
  3. Dishonour of cheque.

## FINANCIAL INSTITUTIONS 2 Hours

* 1. IMF
  2. IDBP
  3. PIDC

## TRADE UNION 2 Hours

* 1. Introduction and brief history.
  2. Objectives, merits and demerits.
  3. Problems of industrial labour.

## INTERNATIONAL TRADE. 2 Hours

* 1. Introduction
  2. Advantages and disadvantages.

## MANAGEMENT 1 Hour

* 1. Meaning
  2. Functions

## ADVERTISEMENT 2 Hour

* 1. The concept, benefits and draw-backs.
  2. Principal media used in business world.

## ECONOMY OF PAKISTAN 1 Hour

* 1. Introduction
  2. Economic problems and remedies.

## BOOKS RECOMMENDED

1. Nisar-ud-Din, Business Organization, Aziz Publisher, Lahore
2. M. Saeed Nasir,Introduction to Business, Ilmi Kitab Khana, Lahore.
3. S.M. Akhtar, An Introduction to Modern Economics, United Limited, Lahore.

## MGM-121 BUSINESS MANAGEMENT AND INDUSTRIAL ECONOMICS. INSTRUCTIONAL OBJECTIVES

1. **UNDERSTAND THE IMPORTANCE OF ECONOMICS**.
   1. State definition of economics given by Adam Smith, Alfred Marshall and Professor Robins.
   2. Explain nature and scope of economics.
   3. Describe importance of study of economics for technicians.
   4. Distinguish between Micro and Macro Economics

## UNDERSTAND BASIC TERMS USED IN ECONOMICS.

* 1. Define basic terms, utility, income, wealth, saving, investment and value.
  2. Explain the basic terms with examples

## UNDERSTAND LAW OF DEMAND AND LAW OF SUPPLY.

* 1. Define Demand.
  2. Explain law of demand with the help of schedule and diagram.
  3. State assumptions and limitation of law of demand.
  4. Define Supply.
  5. Explain law of Supply with the help of schedule and diagram.
  6. State assumptions and limitation of law of supply.

## UNDERSTAND THE FACTORS OF PRODUCTION

* 1. Define the four factors of production.
  2. Explain labour and its features.
  3. Describe capital and its peculiarities.

## UNDERSTAND FORMS OF BUSINESS ORGANIZATION.

* 1. Describe sole proprietorship, its merits and demerits.
  2. Explain partnership, its advantages and disadvantages.
  3. Describe joint stock company, its merits and demerits.
  4. Distinguish public limited company and private limited company.
  5. Difference between proprietorship, partnership and joint stock company

## UNDERSTAND ENTERPRENEURIAL SKILLS

* 1. Explain preparing, planning, establishing and managing small business set up
  2. Explain evaluating all relevant resources
  3. Describe organizing analyzing and innovation of risk of task

## UNDERSTAND SCALE OF PRODUCTION.

* 1. Explain scale of production and its determination.
  2. Describe large scale production and it merits.
  3. Explain small scale of production and its advantages and disadvantages.

## UNDERSTAND DIFFERENT ECONOMIC SYSTEMS.

* 1. Describe free and centrally planned economic system and its characteristics.
  2. Merits and demerits of economic system.

## UNDERSTAND WHAT IS MONEY

* 1. Define money
  2. Explain barter system and its inconveniences.
  3. Explain functions of money.

## UNDERSTAND BANK AND ITS FUNCTIONS.

* 1. Define bank.
  2. Describe commercial bank and its functions.
  3. State central bank and its functions.
  4. Kind of accounts which are opened into a bank.

## UNDERSTAND CHEQUE AND DISHONOR OF CHEQUE.

* 1. Define cheque.
  2. Enlist the characteristics of cheque.
  3. Identify the kinds of cheque.
  4. Describe the causes of dishonor of a cheque.

## UNDERSTAND FINANCIAL INSTITUTIONS.

* 1. Explain IMF and its objectives.
  2. Explain organisational set up and objectives of IDBP.
  3. Explain organisational set up and objectives of PIDC.
  4. Explain function of SBP.

## UNDERSTAND TRADE UNION, ITS BACKGROUND AND FUNCTIONS.

* 1. Describe brief history of trade union.
  2. State functions of trade union.
  3. Explain objectives, merits and demerits of trade unions.
  4. Enlist problems of industrial labour.

## UNDERSTAND INTERNATIONAL TRADE.

* 1. Explain international trade.
  2. Enlist its merits and demerits.

## UNDERSTAND MANAGEMENT

* 1. Explain meaning of management.
  2. Describe functions of management.
  3. Identify the problems of business management.

## UNDERSTAND ADVERTISEMENT.

* 1. Explain the concept of advertisement.
  2. Enlist benefits and drawbacks of advertisement.
  3. Describe principal media of advertisement used in business world.

## UNDERSTAND THE ECONOMIC PROBLEMS OF PAKISTAN.

* 1. Describe economy of Pakistan.
  2. Explain economic problems of Pakistan
  3. Explain remedial measures for economic problems of Pakistan.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **COMP-162** |  | **COMPUTER APPLICATIONS** |  | |
| **Total Contact Hours Theory:** | **32 Hrs** | **T 1** | **P 3** | **C 2** |
| **Practical:** | **96 Hrs** |  |  |  |

## Pre-requisites: None

**AIMS**: This subject will enable the student to be familiar with the basic daily life applications of computer. Trainee will also learn computer applications and other information according to profession at elementary level. Trainee will learn the knowledge and skills regarding EDP, Windows OS, MS-Word, C++, Spread Sheets (Excel), Power Point & Internet.

## COURSE CONTENTS:

* 1. **ELECTRONIC DATA PROCESSING (E.D.P.) 4 Hours**
     1. Basic Terms of Computer Science Data & its, types, Information, Hardware, Software
     2. Computer & its types
     3. Generations of Computers
     4. Block diagram of a computer system
     5. BIT, Byte, RAM & ROM
     6. Input & Output devices
     7. Secondary storage devices
     8. Types of Software
     9. Programming Languages
     10. Applications of computer in different fields
     11. Applications in Engineering, Education & Business

## MS-WINDOWS 2010 6 Hours

* + 1. Introduction to Windows
    2. How to install Drivers & Windows
    3. Loading & Shut down process
    4. Introduction to Desktop items (Creation of Icons, Shortcut, Folder & modify Taskbar)
    5. Desktop properties
    6. Use of Control Panel
    7. Searching a document

## MS-OFFICE (MS-WORD 2016) 7 Hours

* + 1. Introduction to MS-Office
    2. Introduction to MS-Word & its Screen
    3. Create a new document
    4. Editing & formatting the text
    5. Saving & Opening a document
    6. Page setup (Set the Margins & Paper)
    7. Spell Check & Grammar
    8. Paragraph Alignment
    9. Inserting Page numbers, Symbols, Text box & Picture in the document
    10. Use the different Format menu drop down commands(Drop Cap, Change Case, Bullet

& Numbering and Border & Shading)

* + 1. Insert the 'Table and it's Editing
    2. Printing the document
    3. Saving a document file as PDF format

## MS-OFFICE (MS-EXCEL 2016) 4 Hours

* + 1. Introduction to MS-Excel & its Screen
    2. Entering data & apply formulas in worksheet
    3. Editing & Formatting the Cells, Row & Column
    4. Insert Graphs in sheet
    5. Page setup, Print Preview & Printing
    6. Types & Categories of Charts

## MS-OFFICE (MS-POWER POINT 2016) 4 Hours

* + 1. Introduction to MS-Power point
    2. Creating a, presentation
    3. Editing & formatting a text box
    4. Adding pictures & colors to a slide
    5. Making slide shows
    6. Slide Transition

## INTRODUCTION TO PROGRAMMING 4 Hours

* + 1. Introduction to computer programming and languages
    2. Introduction to C++
    3. Arithmetical operations
    4. Logical operations
    5. Looping
    6. Flow chart

## INTERNET & E-MAIL 3 Hours

* + 1. Introduction to Internet & browser window
    2. Searching, Saving and Print a page from internet
    3. Creating, Reading & Sending E-Mail
    4. File Attachment
    5. Uploading and downloading file(s) and software(s)
    6. Explain some advance features over the internet and search engines
    7. Difference between Internet, Intranet and Extranet

## COMP-162 COMPUTER APPLICATIONS INSTRUCTIONAL OBJECTIVES:

1. **UNDERSTAND ELECTRONIC DATA PROCESSING (E.D.P)**
   1. Describe Basic Terms of Computer Science. Data & its Types, Information, Hardware, Software
   2. Explain Computer & its types
   3. Generations of Computers
   4. Explain Block diagram of a computer system
   5. State the terms such as BIT, Byte, RAM & ROM
   6. Identify Input & Output devices
   7. Describe Secondary Storage devices
   8. Explain Types of Software
   9. Introduction to Programming Language
   10. Explain Applications of computer in different fields
   11. Application in Engineering, Education & Business

## UNDERSTAND MS-WINDOWS 2010

* 1. Explain Introduction to Windows
  2. How to install Drivers & Windows
  3. Describe Loading & Shut down process
  4. Explain Introduction to Desktop items(Creation of Icons, Shortcut, Folder & modify Taskbar)
  5. Explain Desktop properties
  6. Describe Use' of Control Panel (add/remove program, time & date, mouse and create user account)
  7. Explain the method of searching a document

## UNDERSTAND MS-OFFICE (MS-WORD 2016)

* 1. Explain Introduction to MS-Office
  2. Describe -Introduction to MS-Word & its Screen
  3. Describe create a new document
  4. Explain Editing & formatting the text
  5. Describe saving & Opening a document
  6. Explain Page setup, (Set the Margins & Paper)
  7. Describe Spell Check & Grammar
  8. Explain Paragraph Alignment
  9. Explain Inserting Page numbers, Symbols, Text box & Picture in the document
  10. Describe Use the different Format menu drop down commands(Drop Cap, Change Case, Bullet &Numbering and Border & Shading)
  11. Explain Insert the Table and its Editing and modifying
  12. Describe printing the document
  13. Describe the method of file saving as a PDF Format

## UNDERSTAND MS-OFFICE (MS-EXCEL 2016)

* 1. Explain Introduction to MS-Excel & its Screen
  2. Describe Entering data & apply formulas in worksheet
  3. Describe Editing &Formatting the, Cells, Row & Column
  4. Explain Insert Graphs in sheet
  5. Describe Page setup, Print preview & Printing
  6. Explain in details formulas for sum, subtract, multiply, divide, average
  7. Explain in details the types of charts e.g pie chart, bar chart

## UNDERSTAND MS-OFFICE (MS-POWER POINT 2016)

* 1. Describe Introduction to MS-Power point
  2. Explain creating a presentation
  3. Describe Editing & formatting a text box
  4. Explain Adding pictures & colors to a slide
  5. Describe Making slide shows
  6. Explain Slide Transitions

## UNDERSTAND LANGUAGE

* 1. Define program, programming, programmer , and programming languages.
  2. Classify computer programming languages.
  3. Describe briefly computer languages.
  4. Describe C++ programming language and its advantages.
  5. Explain arithmetic operations (addition, multiplication, subtraction, division etc.)
  6. Explain logical operations (AND, OR, NOT, Equal to, etc.)
  7. Explain the basics of loops for repetitive operations.
  8. Explain the components of Flow-Charts for simple computer program.

## UNDERSTAND INTERNET & E-MAIL

* 1. Explain Introduction to Internet and browser window
  2. Explain Introduction to Internet and browser window
  3. Explain Searching, Saving and Print a page from internet
  4. Describe Creating, Reading & Sending E-Mail
  5. File attachment.
  6. Uploading and downloading file(s) and software(s)
  7. Explain some advance features over the internet and how to search topics on different search engines
  8. Difference between Internet, Intranet and Extranet

## COMP-162 COMPUTER APPLICATIONS

**List of Practical: 96 Hours**

1. Identify key board, mouse, CPU, disk drives, disks, monitor, and printer, **3 Hours**

Speakers, microphone, scanner, digital camera, card reader, DSL Modem and other magnetic elements.

## MS WINDOWS 2010 18 Hours

* 1. Practice of loading and shutdown of operating system
  2. How to install Drivers & Windows
  3. Creating items (icons, shortcut, folders etc) and modifying taskbar
  4. Changing of wallpaper, screensaver, and resolution
  5. Practice of control panel items (add/remove, time and date, mouse, and create user account)

## MS OFFICE (MS-WORD 2016) 27 Hours

* 1. Identifying the MS Word Screen and its menu
  2. Practice of create a new document, saving and re-opening it from the location and spell check & grammar
  3. Practice of Page Formatting (Borders, Character Spacing, Paragraph, Bullets & Numberings and Fonts)
  4. Practice of different tool bars like standard, format& drawing tool bars
  5. Practice of Insert pictures, clipart, and shapes
  6. Practice of header and footer
  7. Practice of insert table and also format of table
  8. Practice of page setup, set the page margins, and printing documents

## MS OFFICE (MS-EXCEL 2016) 18 Hours

* 1. Identifying the MS EXCEL Screen and its menu
  2. Practice of create a new sheet, saving and re-opening it from the location and spell check
  3. Practice of insert and delete of row and columns (format of cell)
  4. Practice of entering data and formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)
  5. Repeating practical serial number04
  6. Practice of insert chart and its types
  7. Practice of page setup, set the page margins, and printing

## MS OFFICE (MS-POWER POINT 2016) 09 Hours

* 1. Identifying the MS POWER POINT Screen and its menu
  2. Practice of create a new presentation and save
  3. Practice of open saves presentations
  4. Practice of inset picture and videos

## INTRODUCTION TO PROGRAMMING LANGUAGE 12 Hours

* 1. Practice on C++ for addition, multiplication, subtraction, division etc.
  2. Practice on C++ using loop statements.
  3. Practice on C++ using logical operations ( AND, OR, NOT, Shift, Equal to etc)
  4. Practice on C++ using incremental statement.
  5. Practice of making flow chart(Prepare a flow chart to find the sum of 529 and 256)

## INTERNET & E-MAIL 09 Hours

* 1. Identifying internet explorer
  2. Practice of searching data from any search engine
  3. Practice of create an E-Mail account and how to send and receive mails, download attachments
  4. File attachment.
  5. Uploading and downloading file(s) and software(s)

**COMP-162 COMPUTER APPLICATIONS**

# PRACTICAL OBJECTIVES:

## Identify key board, mouse, CPU, disk drives, disks, monitor, and printer

* + Understand use and features of keyboard, CPU, disk drives, disks, monitor, and printer

# MS WINDOWS 2010

## Practice of loading and shutdown of operating system

* + - Students will be able to load and shutdown of operating system (MS Windows 2010)
    - Students will be able to Install the operating system(MS Windows 2010) & its Drivers

## Creating items (icons, shortcut, folders etc) and modifying taskbar

* + - Student will be able to create, modify & delete icons, shortcuts, & folders in MS Windows 2010

## Changing of wallpaper, screensaver, and resolution

* + - Student will be able to change wallpapers, screensavers, & resolution size in MS Windows 2010

## Practice of control panel items (add/remove, time and date, mouse, and create user account)

* + - Student will be able to adjust control panel items (add/remove, time & date, Mouse, and configure the user account) in MS Windows 2010

# MS OFFICE (MS-WORD 2016)

## Identifying the MS Word Screen and its menu

* + - Student will be able to identify the MS Word screen and its menus in MS Word 2016

## Practice of create a new document, saving and re-opening it from the location and spell check & grammar

* + - Student will be able to create new documents, save documents and reopen the saved documents and spell check and grammar

## Practice of Page Formatting (Borders, Character Spacing, Paragraph, Bullets & Numberings and Fonts)

* + - Student will be able to change the format of documents (Borders, Character Spacing, Paragraph, Bullets & Numberings and Fonts)

## Practice of different tool bars like standard, format & drawing tool bars

* + - Student will be able to use the standard, format and drawing tools

## Practice of Insert pictures, clipart, and shapes

* + - Student will be able to add pictures, clipart and different shapes into document in MS Word 2016

## Practice of header and footer

* + - Student will be able to make and adjust header & footer in MS Word 2016

## Practice of insert table and also format of table

* + - Student will be able to insert and format the table in MS Word 2016

## Practice of page setup, set the page margins, and printing documents

* + - Student will be able to adjust page setup, margin and print documents in MS Word 2016

# MS OFFICE (MS-EXCEL 2016)

## Identifying the MS EXCEL Screen and its menu

* + - Student will be able to identify the MS EXCEL screen and its menus

## Practice of creating a new sheet, saving and re-opening it from the location and spell check

* + - Student will be able to create new documents, save documents and reopen the saved documents and spell check and grammar

## Practice of insert and delete of row and columns (format of cell)

* + - Student will be able to insert and delete row and columns

## Practice of entering data and formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)

* + - Student will be able to use different formulas in worksheet(Add, Subtract, Multiplying, and Divide & Average)

## Repeating practical serial number04

* 1. **Practice of insert chart and its types**
     + Student will be able to insert different types of chart into worksheet

## Practice of page setup, set the page margins, and printing

* + - Student will be able to adjust page setup, margin and print worksheets

# MS OFFICE (MS-POWER POINT 2016)

## Identifying the MS POWER POINT Screen and its menu

* + - Student will be able to identify the MS POWER POINT screen and its components.

## Practice of create a new presentation and save

* + - Student will be able to create a presentation and save it

## Practice of open saves presentations

* + - Student will be able to open the saves presentations

## Practice of inset picture and videos

* + - Students will be able to insert picture and video clips

## PROGRAMMING LANGUAGE

* 1. **Practice on C++ for addition, multiplication, subtraction, division etc.**

By the end of this practical, Students will be able to

* + - Add two numbers using C++ program
    - Subtract one value from other value using C++ program
    - Multiplies two values using C++ program
    - Divide one value by another value using C++ program

## Practice on C++ using loop statements.

By the end of this practical, Students will be able to

* + - Student will be able to use Loop constructs (for-Loop, While-Loop, do-while Loop).

## Practice on C++ using logical operations ( AND, OR, NOT, Shift, Equal to etc).

By the end of this practical, Students will be able to

* + - Use logical operators ( AND, OR, NOT, Shift, Equal to etc).
  1. Practice on C++ using incremental statement.

By the end of this practical, Students will be able to

* + - Student will be able to program increment (*postfix & prefix*) and decrement (*postfix & prefix*)operator

# INTERNET & E-MAIL

## Recognize MS Edge Browser screen

* + - Students will be able to identify the components of MS Edge browser screen and their function.

## Practice of searching data from any search engine

* + - Students will be able to search information catalog, e-books etc from different search engine

## Practice of creating an E-Mail account, send and receive E-mails and download attachments

By the end of this practical, students will be able to

* + - Create a new E-mail account.
    - Send and receive e-mails.
    - download & upload files and attachments

## RECOMMENDED BOOKS:

1. Bible Microsoft Office 2016 by John Walkenbach
2. Let us C++ by yashwant kanetkar
3. Bible Microsoft Excel 2016 by John Walkenbach
4. Bible Microsoft PowerPoint 2016 by John Walkenbach
5. C++ how to program by deitel & deitel
6. User Guides for Windows 2010 and MS Office 2016 by Microsoft Corporation

**2.7 ET 115 PRINCIPLES OF ELECTRICAL ENGINEERING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Total Contact Hours:** | **T** | **P** | **C** |
| Theory: 96 | 3 | 6 | 5 |
| Practical: 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, along with 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. Electron Theory.
   2. Conductor, Insulator, semiconductor.
   3. Resistance, conductance, electrical current, potential difference.
   4. Ohm's Law.
   5. Laws of Resistance
   6. Effect of temperature on Resistance.
   7. Temperature coefficient of resistance.
   8. Series and parallel circuits
   9. Resistances in series and parallel.
   10. Division of voltage in series circuit.
   11. Division of current in parallel circuit.
   12. Equivalent resistance of complex network.
2. **NETWORK THEOREMS**
   1. Kirchhoff's law I - current law.
   2. Kirchhoff's law II-voltage law.
   3. Active & Passive circuits, node, branch, and loop in Electrical circuits.
   4. Application of Kirchhoff's laws.
   5. Problem solving with Kirchhoff's Laws in D.C. circuit. (Simple problems)
   6. Superposition theorem.
   7. Maximum power transfer theorem.
   8. Thevenin’s theorem.
3. **WORK, POWER AND ENERGY**
   1. Heating effect of current.
   2. Joule's Law.
   3. Thermal efficiency.
   4. Conversion of electrical energy into Mechanical energy.
   5. Energy billing.
   6. Problem solving on above
4. **MAGNETIC EFFECT OF ELECTRIC CURRENT**
   1. Laws of magnetic force.
   2. Absolute and relative permeability.
   3. Magnetic field due to a straight current carrying conductor.
   4. Magnetic field of coil
   5. Cork-Screw rule.
   6. Effect of iron core in a coil.
   7. Fleming's right and left hand rules.
   8. Mechanical force on a current carrying conductor in a magnetic field.
5. **ELECTROMAGNETIC INDUCTION**
   1. Faraday's Laws of electromagnetic Induction.
   2. Dynamically and statically induced EMF.
   3. Lenz's Law.
   4. Concept of self and mutual induction.
   5. Unit of Inductance
6. **ELECTROSTATICS**
   1. Static Electricity.
   2. Absolute and relative permeability of a medium.
   3. Laws of Electrostatic.
   4. Capacitor, capacitance.
   5. Types of capacitors.
   6. Capacitors in series and parallel.
   7. Charging of a capacitor.
   8. Equation of charging of a capacitor.
   9. Discharging of a capacitor and its equations.

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

1. **FUNDAMENTALS OF A.C**
   1. Definition of Alternating current & voltage.
   2. Working principle of Alternating current generator.
   3. Simple loop Alternator, Relationship between Speed, poles and frequency.
   4. Sinusoidal Emf Equation, other wave forms, triangular, square wave etc.
   5. Cycle, period, Frequency, amplitude, instantaneous value.
   6. Average value, Effective value. R.M.S value. Form factor. Peak factor.
   7. Representation of A.C. through vectors.
   8. Phasor Diagrams, Phase difference, Polar form of A.C quantities.
   9. j Notation
2. **SINGLE PHASE A.C. CIRCUIT (22 Hrs.)**
   1. A.C through pure Resistance and Vector Diagram.
   2. A.C through pure Inductance and Vector Diagram.
   3. A.C through pure Capacitance and Vector Diagram.
   4. A.C through pure Resistance & Inductance in series including wave forms and Phasor diagram.
   5. A.C through Resistance and Capacitance connected in series including wave forms and phaser diagram.
   6. Voltage, current and power relation in A.C. R/L and R/C Circuits.
   7. R.L.C series circuit.
   8. Impedance Triangle, Phase angle, power factor.
   9. Active and Reactive component. Actual power, Apparent Power, Reactive Power, relationship.
   10. Parallel A.C circuits.
   11. Solution of Parallel circuits by vector and admittance method.
   12. Solution of simple problems with Phasor Algebra.
   13. Power factor improvement with static capacitor.
   14. Solving problems involving power factor improvement.
   15. Resonance circuit.
   16. Series, parallel resonance circuit.
   17. Problems on resonant circuit.

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

1. **POLY-PHASE A.C. CIRCUIT**
   1. Generation of two Phase, three Phase emf.
   2. Advantages of Poly Phase system.
   3. Current in Neutral in a 3 Phase circuit.
   4. Power Equation.
   5. Star & Delta connection, Relation ship between line and Phase values.
   6. Comparison of Star and Delta connections, their uses, and conversion.
   7. Power in a three Phase Balanced load.
   8. Vector diagram of a Star and Delta connected load.
   9. Measurement of power with one watt meter without the use of Neutral wire.
   10. Measurement of power with two watt meters and its vector diagram.
   11. Measurement of Power with three watt meters and its vector diagram.
   12. Measurement of Reactive power in a three Phase circuit.
   13. Calculation of P.F. with Active and reactive power.
   14. Phase sequence.
   15. Power factor improvement and problems solving.
   16. Advantages of 3 Phase supply over single Phase supply.
   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, & rchhoff’s laws. |  | 1 |
|  | b. Work, Power & Energy. |  | 1 |
|  | c. Electromagnetic induction & ectrostatic. |  | 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. State Electron theory.
   2. Compare conductor, Insulator & semi-conductor.
   3. Define Resistance, conductance and state units.
   4. Define electrical current and state its unit.
   5. Define potential difference and state its unit.
   6. State Ohm`s law.
   7. Explain laws of resistance and calculations.
   8. State effects of temperature on Resistance.
   9. Calculate temperature co-efficient of Resistance.
   10. Define series and parallel circuits with their properties.
   11. Determine total resistances in series & parallel circuits.
   12. Calculate division of voltage in series circuits.
   13. Calculate division of current in parallel circuits.
   14. Draw equivalent circuits of complex networks.
2. **UNDERSTAND KIRCHHOFF'S LAWS**
   1. State Kirchhoff`s Ist Law - (current Law).
   2. State Kirchhoff`s 2nd Law - (voltage Law).
   3. Define active circuit, passive circuit, node, branch & loop circuit.
   4. Give examples for applications of Kirchhoff's Laws.
   5. Solve simple problems on Kirchhoff's Laws in D.C.circuits.
   6. State superposition theorem.
   7. State Maximum power transfer theorem.
   8. Solve circuits through Thevenin's Theorem.
3. **UNDERSTAND WORK, POWER & ENERGY**
   1. Define work, electrical power, mechanical power and energy with their units.
   2. State formula for conversion of Electrical Energy to Mechanical Energy.
   3. Calculate Energy billing of an installation.
   4. Explain heating effect of current.
   5. State Joule's Law of current.
   6. Define thermal efficiency.
   7. Solve problems on Thermal Efficiency.
4. **UNDERSTAND MAGNETIC EFFECTS OF ELECTRIC CURRENT**
   1. Explain Laws of Magnetic force.
   2. Define Absolute & Relative permeability.
   3. Describe Magnetic field of a straight current carrying conductor.
   4. Determine Magnetic field of a coil.
   5. State cork-screw rule.
   6. Describe effect of iron core in a coil.
   7. State Fleming's Right hand & Left hand rules.
   8. Explain mechanical force on a current carrying conductor in a magnetic field.
5. **UNDERSTAND ELECTROMAGNETIC INDUCTION**
   1. State Faraday's Laws of Electromagnetic Induction.
   2. Define Dynamically & statically induced e.m.f.
   3. Explain Lenz's Law
   4. Explain self & Mutual Inductances.
   5. State units of Inductance.
6. **UNDERSTAND FUNDAMENTALS OF ELECTROSTATICS**
   1. Define the term static-electricity.
   2. Describe Absolute & Relative Permeability of a Medium.
   3. State Laws of Electrostatics.
   4. Explain the term capacitance.
   5. List types of capacitors.
   6. Solve problems on capacitors in series & Parallel.
   7. Explain charging & Discharging of capacitors along with equations.

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

1. **UNDERSTAND A.C. FUNDAMENTALS**
   1. Define alternating current & voltage.
   2. Describe principle of working of A.C. Generator.
   3. Explain simple loop Alternator & relationship between speed, poles and frequency.
   4. State sinusoidal E.M.F. equation, triangular, square waves etc.
   5. Define terms cycle, period, frequency, amplitude, & Instantaneous value.
   6. Define the terms average value, Effective value, R.M.S. value, form factor & peak factor.
   7. Explain how AC quantities can be represented by vectors.
   8. Draw phasor diagrams.
   9. Explain the term phase difference.
   10. Describe polar forms of A.C. quantities.
   11. Conversion from R-P form and P-R form.
   12. Simple calculations of j-notation.
2. **UNDERSTAND A.C. CIRCUITS (SINGLE PHASE)**
   1. Explain the effects of A.C. supply through pure resistance, inductance & Capacitance with their vector diagrams.
   2. Describe the effects of A.C. supply through RL and RC Series circuits with the help of waveforms and vector diagrams.
   3. Derive voltage current & power relation in A.C. circuits.
   4. Solve examples on R.L.C. series circuit.
   5. Define terms Impedance triangle, phase angle & power factor
   6. Describe active & reactive component, Actual power, Apparent power & reactive power with relation ships.
   7. Explain parallel A.C circuits (R.L.C).
   8. Solve problems on parallel A.C. circuits
   9. Explain power factors improvement with static capacitor bank.
   10. Solve simple problems on power factor improving circuits.
   11. Write relationship for V.I.Z. for resonance circuit in series & parallel.
   12. Solve simple problem on resonance circuit.

**UNIT-III: POLYPHASE FUNDAMENTALS.**

1. **UNDERSTAND POLYPHASE A.C. CIRCUITS**
   1. Explain generation of two-phase & 3-phase e.m.f.
   2. Explain advantages of A.C. polyphase system.
   3. State value of current in neutral in a 3-phase balanced circuit.
   4. State power equation for 3-phase system.
   5. Draw & explain star & delta connections.
   6. Calculate relationship between line & phase values in star/delta.
   7. Compare star & delta connections with their uses.
   8. Draw vector diagrams of star & delta connected loads.
   9. Calculate power in 3-phase balanced load.
   10. Solve problems on 3-phase balanced load.
   11. Explain Measurements of power with one wattmeter without the use of neutral wire.
   12. Describe Measurement of power with two watt meters along with its vector diagram.
   13. Calculate power with three watt-meters along with vector diagrams.
   14. Describe Measurement of Reactive power in a three phase circuit.
   15. Solve problems on P.F with active & reactive power.
   16. Explain phase sequence meter.
   17. Explain power factor improvement methods.
   18. Solve problems on power factor improvements.
   19. Explain advantages of 3-phase supply over single phase supply.
   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
   1. Sliding Rheostat.
   2. Voltmeter.
   3. 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 practical 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.

1. Determination of resonance frequency of a series circuit using variable frequency oscillator.
2. Study of the effects of capacitors on the power of an inductive circuit.
3. Study of an elementary poly phase generator.
4. Verification of the line and phase relationship in star and delta connections.
5. Study of 3-Phase, 4-wire distribution network.
6. Measurement of power of a 3-phase load by 3-wattmeter method.
7. Measurement of power of a 3-phase load by 2-wattmeter method.
8. Measurement of 3-phase power by one watt meter method.
9. Determination of phase sequence by phase sequence meter.
10. Measurement of reactive power, in a 3-phase balanced circuit.
11. Measurement of power in 3 phase circuit using phase angle meter.
12. Measurements of 3-Phase load energy using C.T. & P.T.
13. Improvement of power factor of an inductive load using capacitors and its verification.
14. Determination of current in neutral wire in balanced & unbalanced load.
15. Visit to local / 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.

**2.8 ET-121 BASIC ELECTRICAL DRAWING**

**T P C**

**Total contact hours** 0 3 1

Theory: 0

Practical: 96

**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. Importance of Technical drawing and Techniques/Engineer's language.
   2. Uses of technical drawing, tools and equipments.
   3. Types of drawings and their uses.
2. **DRAWING TOOLS AND MATERIALS**
   1. Classification of drawing pencils and uses
   2. Types of drawing papers and sizes
   3. Drawing instruments and uses.
   4. Types and use of erasers.
   5. Care & maintenance of drawing tools.
3. **BASIC DIMENSIONING**
   1. Definition of dimensioning.
   2. Two types of dimensioning.
   3. Elements in dimensioning.
   4. Dimensioning pictorials.
   5. Dimensioning Multi Views.
   6. Dimensioning Holes and arcs.
   7. Dimensioning Angles.
4. **MULTI VIEW DRAWING/ORTHOGRAPHIC DRAWING**
   1. Definition and concept.
   2. Six principle views.
   3. Visualization glass box technique.
   4. Principal planes of projections.
   5. Projection lines.
   6. Arrangement of views.
   7. Multi view drawing, 1st angle and 3rd angle projection of simple objects.
5. **INTRODUCTION TO PICTORIAL DRAWING**
   1. Three types of pictorials
   2. Uses of pictorial views.
   3. Isometric sketching of Rectangular Block and simple objects.
   4. Oblique sketching of rectangular block and simple objects.
   5. Proportions in pictorial drawing.
6. **SYMBOLS**
   1. Building Material symbols.
   2. Metal symbols.
   3. Electrical symbols.
   4. Importance and uses.
7. **ELECTRICAL DRAWING**
   1. Drawing wiring circuits.
      1. Single line diagram.
      2. Wiring diagram.
      3. Layout diagram.
      4. Schematic diagram.
      5. Circuit diagram.
8. **LINE SKETCHING**
   1. Introduction to sketching techniques.
   2. Sketching Horizontal, vertical, inclined lines.
   3. Sketching of parallel (Horizontal, vertical, inclined lines).
   4. Sketching arcs and circles.
   5. Sketching squares, Rectangles, ellipses and simple objects.
   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. Define importance of technical drawing/engineer's language.
  2. Use drawing equipment, board, sheet, pencil, T-square, set square, compass, divider, protractor, French curves etc.
  3. Draw different types of lines.
  4. Show skill in lettering and dimension
  5. Divide a line in two and more than two parts.
  6. Draw different angles and bisect.
  7. Draw square, rectangle, triangles, circle, hexagon, ellipses.

**UNIT-2:**

1. **UNDERSTAND ORTHOGRAPHIC DRAWING/MULTI-VIEW DRAWING AND PICTORIAL DRAWING**
   1. Prepare 1st angle drawings.
   2. Prepare drawings according to 3rd angle projection.
   3. Draw surface development of simple objects.
   4. Draw oblique and pictorial view of simple shapes and objects.

**UNIT-3:**

1. **UNDERSTAND ELECTRICAL SYMBOLS, RESIDENTIAL, AND POWER WIRING, AND DIFFERENT POWER CIRCUITS/DRAWINGS**
   1. Draw electrical symbols.
   2. Draw single phase wiring circuits.
   3. Draw wiring circuit diagram of house wiring along with point position of single room and double room houses on given building layouts.
   4. Draw wiring diagrams of motors.
   5. Draw different industrial wiring circuits.
   6. Draw three phase wiring circuits layout.

**UNIT-4:**

1. **SHOW SKILL IN FREE HAND SKETCHING**
   1. Sketch free hand horizontal, vertical, and inclined lines.
   2. Sketch free hand rectangles, triangles, circles, arcs, ellipse.
   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-133 BASIC ELECTRONICS

**Total Contact Hours: T P C**

Theory: 60 2 3 3

Practical: 90

**AIMS** This course is designed to enable the students to understand the basic principles of semiconductor electronics devices. It also provides basic insight in the working and applications of power electronic devices in control circuits.

The course also includes simple problem solving.

## ELECTRON EMISSION AND BASIC SEMI CONDUCTOR THEORY. 4 Hrs.

* 1. Electronic emission and fundamentals of solid state electronics.
     1. Introduction to electronics.
     2. Introduction to various types of electron emission and their characteristics.
     3. Brief history of electron tubes and their uses.
     4. Semiconductors, intrinsic, extrinsic, doping.
     5. P type and N type materials, carriers.

## SEMICONDUCTOR DIODES. 6 Hrs.

* 1. PN Junction Diode
     1. Diode construction, operation and applications.
     2. Half-wave & full wave rectifiers.
  2. D.C Power supply.
     1. Circuit and block diagram of full-wave bridge rectifier with filter.
     2. Circuit and block diagram of center-tapped transformer rectifier circuit.
     3. Ripple factor and filtering.
     4. Effect of rectification on supply current.

## SPECIAL DIODES. 8 Hrs.

* 1. Zener Diode.
     1. Construction, operation and rating of zener diode.
     2. Zener diode as a voltage regulators, series & shunt.
  2. Photodiode and photo conductive cells.
     1. Construction and working of photodiode
     2. Photodiode as light sensor.
     3. Use of photo conductive cell.
  3. Varactor diodes

## FIELD EFFECT TRANSISTOR (FET) 12 Hrs.

* 1. FET construction and operation
     1. FET transistor types (JFET, MOSFET) & Construction
     2. MOSFET, operation.
     3. MOSFET Biasing
  2. MOSFET Application
     1. MOSFET as amplifier.
        1. Types of MOSFET amplifier and their
        2. Characteristics (CS, CG, CD).

1. CS as current and voltage amplifier.
2. Applications of MOSFET amplifiers.
   * 1. MOSFET & CMOS.
        1. MOSFET as a switch and its characteristics.
        2. CMOS as switch.

## BIPOLAR JUNCTION TRANSISTORS. 8 Hrs.

* 1. Bipolar Junction Transistor (BJT)
     1. Construction, Application of BJT
     2. BJT amplifiers.
     3. Characteristics of BJT amplifiers (Common Emitter, common Base, common collector).
     4. BJT as a voltage amplifier.
  2. BJT as a switch

1. Characteristics of a BJT switch.
2. Use of BJT as switch.

## SILICON CONTROLLED RECTIFIERS. 08 Hrs.

* 1. Silicon Controlled Rectifiers.
     1. Silicon controlled Rectifier (SCR)

1. SCR, construction, operation and triggering pulses.
2. SCR application, power control of AC and DC.
3. Phase control of SCR's on resistive loads

## THYRISTORS. 10 Hrs.

* 1. Other Thyristors.
     1. Construction and operation of TRIAC & DIAC.

7.1.2. DIAC/TRIAC power control circuits.

7.1.3 UJT, operation, working and applications.

* + 1. Photo transistor, operation, rating and application.
    2. Light activated SCR (LASCR), rating and application.
    3. Opto-coupler, ratings & application.

## INTEGRATED CIRCUITS. 8 Hrs.

* 1. Integrated Circuits (IC's) and Op-amps.
     1. Types of IC's
     2. Monolithic IC's, fabrication of components
     3. Types of integration.
     4. Operational amplifiers (op-amps), characteristics and applications.
     5. Basic op-amp circuits.

## ET- 133 BASIC ELECTRONICS INSTRUCTIONAL OBJECTIVES

1. **UNDERSTAND TYPES OF ELECTRON EMISSIONS AND BASIC SEMI- CONDUCTOR THEORY**
   1. Explain types of electron emission
   2. Explain the terms-semi-conductor, intrinsic and extrinsic
   3. Name types of electron tubes and their uses, brief history.
   4. Explain P and N type doping
   5. State majority and minority charge carriers in P & N type semi-conductors

## UNDERSTAND THE CONSTRUCTION AND APPLICATIONS OF PN DIODES AS RECTIFIER

* 1. Explain formation of PN-junction.
  2. Define potential barrier of PN junction.
  3. Compare forward bias and reverse bias.
  4. Discuss static volt ampere characteristics of diode (forward and reverse bias).
  5. State applications of diode.
  6. Draw and discuss half wave rectification circuit (with wave forms).
  7. Draw and discuss full wave rectification circuit (with waveforms) by using:
     1. Centre tapped transformer.
     2. Bridge rectifier.
  8. Explain the need of filters in DC power supply
  9. Draw circuit diagram of filtering network (T & Pi).
  10. Define term ripple factor.
  11. Describe use of diode as a switch.

## UNDERSTAND WORKING AND USES OF ZENER AND PHOTO DIODES

* 1. Explain the working and construction of Zener diode
  2. Explain the behaviour of Zener diode in Breakdown region
  3. Give ratings of zener diode.
  4. Explain the Zener diode in power supplies and voltage regulation circuits.
  5. Describe construction & working of photodiode.
  6. Draw photodiode control circuit.

## UNDERSTANDING CONSTRUCTION, WORKING AND USES OF BIPOLAR JUNCTION TRANSISTOR

* 1. Explain construction of transistors.
  2. Constructional details of PNP and NPN transistor.
  3. Draw PNP and NPN transistor circuits with proper biasing.
  4. Describe principle of working of transistor as amplifier.
  5. Describe current gain, voltage gain & power gain of a CE amplifier.
  6. List uses of transistors.
     1. As a switch.
     2. As voltage & current amplifier.

## UNDERSTAND THE WORKING AND USES OF FIELD EFFECT TRANSISTORS

* 1. Explain the construction & working of JFET.
  2. List types of FET and their uses.
  3. Describe use of JFET as an amplifier.
  4. Draw characteristics curves of JFET.
  5. Explain construction of MOSFET
  6. State types of MOSFET(depletion mode and enhancement mode)
  7. Draw symbols of IGFET and MOSFETS
  8. State special handling procedures of MOSFETS

## UNDERSTAND THE TYPES, WORKING AND USES OF THYRISTORS SPECIALLY SILICON CONTROLLED RECTIFIER, DIAC, TRIAC

* 1. Define a thyristor.
  2. Explain construction and working operation of SCR's.
  3. Draw equivalent model of SCR by two transistors analogy.
  4. Draw characteristics waveforms of SCR's.
  5. Explain phase control of SCR.
  6. Explain use of SCR's as AC & DC Power control circuits with the help of circuit diagrams.
  7. Explain the operation of Diac.
  8. Draw characteristics & waveforms of Diac.
  9. Explain the construction and working of TRAIAC
  10. Enlist applications of Diac & Triac.

## UNDERSTAND WORKING AND USES OF SPECIAL SOLID STATE DEVICES SUCH AS UNI-JUNCTION TRANSISTOR (UJT), PHOTO TRANSISTOR, LIGHT ACTIVATED SILICON CONTROLLED RECTIFIER (LASCR), OPTO COUPLER

* 1. Explain the construction and working of UJT
  2. Define Intrinsic stand off Ratio of UJT
  3. State the equation for Peak Firing Voltage
  4. Draw characteristic curve of UJT
  5. Enlist common applications of UJT
  6. Explain Saw-tooth oscillator using UJT, with the help of circuit diagram
  7. Explain the working of photo transistor
  8. State common uses of photo transistor with circuits
  9. Explain the working of LASCR with the help of circuit
  10. Explain the working of opto-coupler
  11. State the need of opto-coupling in electronic circuits

## UNDERSTAND BASIC WORKING AND APPLICATIONS OF IC'S AND OP-AMPS

* 1. Explain the term IC.
  2. Define SSI, MSI, LSI, VLSI
  3. Sketch a monolithic IC cross section.
  4. Explain the term op-amp.
  5. State the main characteristics of op-amp
  6. Draw a symbol of op-amp and label it
  7. Explain the working of a common op-amp with the help of block diagram (IC 741) especially, discussing “Offset null in 741 op amp”

## ET- 133 BASIC ELECTRONICS LIST OF PRACTICALS

1. To study vacuum tubes.
2. To construct a half wave rectifier circuit and to check its output on oscilloscope.
3. To construct a full wave rectifier circuit and measure the input & outputs wave forms.
4. Demonstrate the effects of filter capacitance on DC output voltage and ripple.
5. Measure and plot the forward and reverse characteristics of a typical Zener-diode using an Electronic VOM.
6. Measure and plot the line voltage regulation properties of a typical shunt-type Zener diode voltage regulator.
7. Assemble an alarm circuit using a photo conductive cell (Project).
8. Assemble a Regulated Power Supply Circuit (Project)
9. Identify base - emitter and collector terminals and connections of NPN and PNP transistors.
10. Demonstrate and measure the effects on base current of forward and Reverse bias in the emitter - base circuit.
11. Demonstrate and measure the effects on collector current of forward and reverse bias in the emitter - base circuit and change in collector voltage.
12. Assemble a simple transistor radio circuit (Project) on PCB or Vero Board
13. Assemble a Bird Bell (Project) on PCB OR Vero Board
14. Assemble water level alarm using transistors (Project) on PCB or Vero Board
15. Demonstrate and measure the effect of drain voltage on drain current with Zero gate bias, and determine the value of drain source (Pinch - off) voltage required to produce constant drain current.
16. Measure the DC operating voltages of a typical JFET voltage amplifier.
17. Demonstrate the operation and determine the voltage gain of a typical JFET voltage amplifier.
18. Demonstrate and measure the Zero bias characteristics of a metal oxide semiconductor field effect transistor (MOSFET).
19. Demonstrate and measure the depletion mode characteristics of a metal oxide semiconductor field effect transistor (MOSFET).
20. Measure the DC operating voltage of a MOSFET voltage amplifier.
21. Measure the DC operating voltages of a Dual gate MOSFET RF amplifier.
22. Test a silicon controlled rectifier (SCR) using an Ohmmeter.
23. Demonstrate the effect of Negative gate current in an SCR.
24. Verify that an SCR operates as a semiconductor switch by using it to control DC voltage applied to a load.
25. Familiarize with the operations of a half wave variable resistor phase - control circuit of SCR.
26. Demonstrate bidirectional conduction of a gated TRIAC and DIAC.
27. Demonstrate the four triggering modes of a TRIAC.
28. Assemble a switching circuit using TRIAC-DIAC (Project)
29. Measure the inter-base resistance and determine the emitter base PN Junction diode characteristics of a uni-junction transistor.
30. Measure the peak emitter firing voltage of a uni-junction transistor.
31. Study various IC's and their pin configuration and packages.
32. Connect op-amps in functional circuits and observe their working and outputs.

## REFERENCE BOOKS:

1. Basic Electronics by B.Grob.
2. Electronic Devices & Circuits by Boylstd. 10th Edition.
3. Electronics (Vol.1) by Manzar Saeed.
4. Experiments in Electronic Devices by Berlin (2nd Edition).
5. Electronics for Today & Tomorrow by Tom Duncan.

## ET-143 WORKSHOP PRACTICE (ELECTRICAL)

**Total Contact Hours: T P C**

1 6 3

Theory: 32

Practical: 192

**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. 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. For wiring, separate theory classes will provide the essential background knowledge of electrical rules and regulations.

## ELECTRICAL WIRING 12 Hours.

* 1. **HOUSE WIRING.**
     1. Wiring Cables:
        1. Terms related to cables (cable, Wire, Core, Armouring, Conductor, Insulation, Sheath etc.)
        2. Types, systems and sizes of wiring cables and their current carrying capacity
        3. Flexible cables and cords.
        4. L.T and H.T power cables., Special purpose cables (heat resistant, fire resistant/proof and fire retarding, welding cable etc).
        5. Selection of electrical cables for a particular application
        6. Voltage drops in cables and simple calculation.
        7. Cable jointing
     2. Electrical Wiring accessories and their ratings.
     3. Domestic Wiring systems (PVC conduit and PVC channel/duct wiring)
     4. Protection of house wiring.
        1. Fuses and circuit breakers.
        2. Earthing.
     5. Distribution of supply and distribution boxes. (Single and three phase)
     6. Testing of wiring.
     7. Electricity rules about domestic wiring and earthing.

## INDUSTRIAL AND COMMERCIAL WIRING. 5 Hours.

* + 1. Power wiring systems (Steel conduit, Trunking, Ducting, Centenary, Overhead bus bar, cable tray and Tough sheathed cable system)
    2. Single & three phase supply for multi storey buildings.
    3. Power wiring for motors, Cable and fuse / circuit breaker size for motor.
    4. Study and use of magnetic contactors, push buttons, thermal overload relay and EOR(electronic over current relay).

## ELECTRICITY RULES AND REGULATIONS.

* 1. **Pakistan electricity rules 1973. 5 Hours.**
     1. Condition of supply by license (rule no. 25, 28, 29, 32, 40, 46).
     2. General precaution for safety of public (Rule 49,51,52,57,58).
     3. Electrical supply line and apparatus (Rule 60, 61, 62, 64).

## I.E.E Regulation for Building installation. 5 Hours.

(Institute of Electrical Engineers, London).

* + 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

* + 1. 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.

* + 1. Section C

C-4 Selection for situation. C-6 Damp situation.

* + 1. Section D

D-1 Methods of protection.

D-22 Protection by fuse and current circuit Breaker for excess current.

## FIRE PROTECTION AND SAFETY 5 Hours.

* 1. Fire
     1. Fire
     2. Classes of fire.
     3. Causes of fire and its prevention,
  2. Safety from electricity.
     1. Safety in electrical shops (Safety Belt, Gloves, clothing and shoes).2
     2. General safety precaution (Machine Guards, tools & ladders).

3.3.3 Electric shock its prevention and treatment.

## ET-143 WORKSHOP PRACTICE-I (ELECTRICAL)

## INSTRUCTIONAL OBJECTIVES

**HOUSE WIRING**

## UNDERSTAND ABOUT THE TYPES & SIZES OF ELECTRIC CABLES USED IN DOMESTIC WIRING.

* 1. Define cable, Wire, Core, Conductor, Insulation, Sheath and Armouring
  2. Name types of electrical cable (Wiring, power and control cables)
  3. Classify Wiring Cables with respect to insulation, core, voltage grade & strands of conductor etc.
  4. Define and distinguish between flexible cables and cords.
  5. Describe types of flexible cords.
  6. Define H.T and L.T power cables, Distinguish between L.T and H.T power cables; describe construction and applications of L.T and H.T Power cables
  7. Define special cables and describe construction and application of special purpose cables (heat resistant, fire resistant/proof fire retarding and welding cables)
  8. Explain different systems for describing the size of wiring cables in Pakistan.
  9. Describe points to be consider for the selection of cable for a particular application
  10. Calculate proper size of cable for a given load and conditions for both systems (Imperial and Metric)
  11. Define cable joint, distinguish between cable joint and cable termination.
  12. Describe the necessity and drawbacks of cable joints.
  13. Make list of tools and material required for making joints on wiring cables.
  14. Describe the steps of making joints on wiring cables (skinning, scrapping, jointing, soldering and tapping)
  15. Describe the correct procedure of making different wiring cable joints (Britannia, straight, Tee) on single core single stranded, single core multi stranded and multi core cables
  16. Enlist tools required for power cable jointing
  17. Describe the method of making joints of L.T & H.T power cables.

## UNDERSTAND THE WIRING ACCESSORIES AND WIRING SYSTEMS (PVC CONDUIT, AND CHANNEL WIRING SYSTEM).

* 1. Name electrical wiring accessories and their rating
  2. State purpose of each accessory.
  3. Name all domestic wiring systems.
  4. Describe procedure of installing wiring systems currently in practice (PVC conduit, and PVC Channel (PVC duct) wiring system).
  5. Compare PVC and metal conduit wiring system
  6. Compare surface and concealed conduit wiring system
  7. Enlist accessories and material used in both (PVC conduit, and PVC duct) wiring systems.
  8. Explain the advantages, disadvantages and uses of both the wiring systems,

## UNDERSTAND THE NEED FOR PROTECTION OF HOUSE WIRING AND KNOW

**DIFFERENT PROTECTIVE DEVICES FOR HOUSE WIRING.**

* 1. Enlist types of protective devices for the protection of house wiring (fuses, MCB, MCCB and ELCB).
  2. Define and distinguish between fuse MCB, MCCB and ELCB.
  3. Describe construction of fuses, MCB, MCCB and ELCB.
  4. Compare the advantages & disadvantages of fuse & MCB.

## UNDERSTAND THE EARTHING SYSTEM USED IN HOUSE WIRING.

* 1. Name components of equipment earthing system.
  2. Define earth electrode, earth continuity conductor & earthing lead.
  3. Draw the earthing circuit.
  4. Explain the earth fault current.
  5. Describe electricity rules about domestic wiring and Earthing

## UNDERSTAND THE CONSTRUCTION, NEED & APPLICATION OF DISTRIBUTION BOXES.

* 1. Define distribution box.
  2. Describe need and proper location of distribution box.
  3. Name Types of D.Bs. w.r.t. size, current rating, voltage, No. of C.Bs and phases etc.
  4. Describe parts of a typical distribution Box.
  5. Describe distribution of single phase supply in small and multi storey buildings.

## UNDERSTAND THE WIRING TESTS & TEST INSTRUMENT (CONTINUITY TESTERS, TEST LAMP, and MEGGER).

* 1. Name different wiring tests.
  2. Explain the procedure of each test and its result.

**INDUSTRIAL & COMMERCIAL WIRING**

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

* 1. Describe procedure of each power wiring system mentioned above.
  2. Identify the material used in each wiring system.
  3. Enlist uses of each wiring system.

## UNDERSTAND MULTISTORY DISTRIBUTION SYSTEM.

* 1. Describe three phase electrical supply distribution system in large commercial and multistory buildings.
  2. Illustrate a typical distribution system in a multistory building.
  3. Draw block diagram of three phase distribution in block of flats, large industrial building and multistory building.

## ACQUIRE THE SKILL IN INSTALLING POWER WIRING.

* 1. Describe procedure to install steel conduit wiring.
  2. Describe procedure to install motor with DOL, 3 point & star-Delta starter.
  3. Describe procedure to Dismantle & assemble I-ph and 3-ph motors.
  4. Describe shortly the design of concrete foundation for motors
  5. Describe steps to construct & level concrete motor foundation.

3.6 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. Describe general safety precautions to be observed in electrical labs/workshops
   2. State hazards to life from electric rotating machines.
   3. Explain preventive methods.
   4. Describe electric shock its prevention and treatment
   5. Describe fire and its types.
   6. Describe fire fighting equipments.
   7. Describe the principles of fire fighting.

## UNDERSTAND I.E.E. REGULATION FOR ELECTRICAL EQUIPMENTS OF BUILDING AND ELECTRICITY RULES OF PAKISTAN,

* 1. Describe the following I.E.E. regulations (A1,A3, A-26,B-4,B-12, C-4,C-6, D-1,D-20) 2.2

2.3 Explain Pakistan Electricity rules.No's 25, 28, 29, 32, 40, 49, 51, 52, 58, 60, 61, 62, 64)

## BOOKS RECOMMENDED:

1. Electricity Rules (Pakistan).
2. I.E.E. Regulations London UK.
3. Modern wiring Practice By W.E Steward,
4. A Text book of Workshop Practice (Electrical Wiring) ET 146 By TEVTA Punjab, published by NBF

## ET-143 WORKSHOP PRACTICE-I (ELECTRICAL)

**LIST OF PRACTICALS (ELECTRICAL WIRING) 192 Hrs.**

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 Go down 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 channel wiring.
32. To control two lamps in channel wiring.
33. To control three lamps in channel wiring.
34. Bell indicator circuit in channel wiring.
35. Go down circuit in channel 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. Fluorescent lamp parts and its connection.
46. To study & connect starter-less 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.

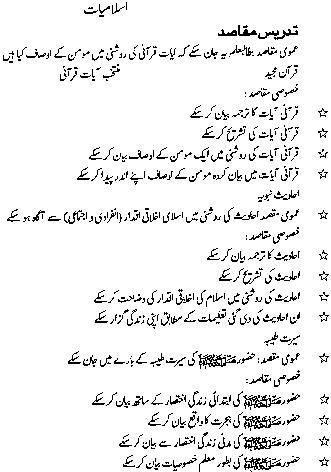
**3. Curriculum Standards for Year 2**

**3.1 Islamist and Pakistan Studies**

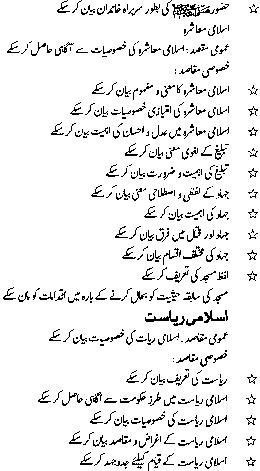
### DAE Technology



**DAE Technology**



**DAE Technology**



**DAE Technology**

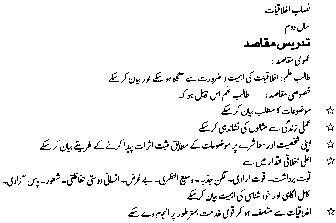


**DAE Technology**



**DAE Technology**



**DAE Technology**

**3.2 Math-233 APPLIED MATHEMATICS-II**

**Total Contact Hours**

Theory: 96 **T P C**

Practical: 0 3 0 3

**Pre-requisite:** Must have completed Mathematics-I.

**AIMS** At the end of the course, the students will be able to:

Solve problems of Calculus, Laplace Transformation and Fourier Series, and develop mathematical skills and logical perceptions in the use of mathematical instruments.

### COURSE CONTENTS

1. **FUNCTIONS & LIMITS. 6 hours**
   1. Constant & Variable Quantities
   2. Functions & their classification
   3. The concept of Limit
   4. Limit of a Function
   5. Fundamental Theorems on Limit
   6. Some important Limits
   7. Problems

### DIFFERENTIATION 6 hours

* 1. Increments
  2. Differential Coefficient or Derivative
  3. Differentiation ab-initio or by first Principle
  4. Geometrical Interpretation of Differential Coefficient
  5. Differential Coefficient of Xn and (ax + b)n
  6. Three important rules
  7. Problems

### DIFFERENTIATION OF ALGEBRAIC FUNCTIONS 9 hours

* 1. Explicit Functions
  2. Implicit Functions
  3. Parametric forms
  4. Problems

### DIFFERENTIATION OF TRIGONOMETRIC FUNCTIONS 6 hours

* 1. Differential Coefficient of Sin x, Cos x, Tan x from first principle.
  2. Differential Coefficient of Cosec x, Sec x, Cot x
  3. Differential Coefficient of Inverse trigonometric functions.
  4. Problems.

### DIFFERENTIATION OF LOGARITHMIC & EXPONENTIAL FUNCTIONS 6 hours

* 1. Differentiation of ln x
  2. Differentiation of Log ax
  3. Differentiation of ax
  4. Differentiation of ex
  5. Problems

### RATE OF CHANGE OF VARIABLES 6 hours

* 1. Increasing and decreasing functions
  2. Maxima and Minima
  3. Criteria for maximum & minimum values
  4. Methods of finding maximum & minimum
  5. Rate measure
  6. Slope of a line
  7. Velocity and acceleration
  8. Problems

### INTEGRATION(SIMPLE BASIC RULES) 9 hours

* 1. Concept
  2. Fundamental Formulas
  3. Important Rules
  4. Problems

### METHODS OF INTEGRATION 9 hours

* 1. Integration by substitution
  2. Integration by parts
  3. Problems

### DEFINITE INTEGRALS 6 hours

* 1. Properties
  2. Application to area
  3. Problems

### DIFFERENTIAL EQUATIONS 6 hours

* 1. Introduction
  2. Order and Degree
  3. First order Differential Equation of Ist degree.
  4. Solution of problems
  5. Problems

### LAPLACE TRANSFORMATIONS 9 hours

* 1. Laplace Transformations
  2. Inverse Laplace Transformations
  3. Problems.

### FOURIER SERIES. 9 hours

* 1. Introduction
  2. Periodic Functions
  3. Even and Odd Functions
  4. Problems

### STATISTICS 9 hours

* 1. Concept of mean, median and mode
  2. Standard Deviation
  3. Laws of probability
  4. Problems

### RECOMMENDED BOOKS

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

### Math-233 APPLIED MATHEMATICS-II INSTRUCTIONAL OBJECTIVES

1. **USE THE CONCEPT OF FUNCTIONS AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS.**
   1. Define a function.
   2. List all types of functions.
   3. Explain the concept of limit and limit of a function.
   4. Explain fundamental theorems on limits.
   5. Derive some important limits.
   6. Solve simple problems on limits.

### UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT.

* 1. Define differential coefficient.
  2. Derive mathematical expression of a derivative.
  3. Explain geometrically the meaning of differential coefficient.
  4. Differentiate ab-initio xn and (ax+b)n.
  5. Solve problems of these formulas.

### USE RULES OF DIFFERENTIATION FOR SOLVING PROBLEMS OF ALGEBRAIC FUNCTIONS.

* 1. Derive product rule, quotient rule and chain rule.
  2. Interpret the chain rule.
  3. Differentiate explicit and implicit functions.
  4. Find derivatives of parametric forms of a function w.r.t another function, by rationalization.
  5. Use these important rules to find derivatives of relevant functions.

### USE RULES OF DIFFERENTIATION TO SOLVE TRIGONOMETRIC FUNCTIONS.

* 1. Differentiate from first principle sin x, Cos x, tan x.
  2. Derive formulas for derivatives of Sec x, Cosec x, Cot x.
  3. Find derivatives of inverse trignometric functions.
  4. Solve problems based on these formulas.

### USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.

* 1. Derive formulas for differential coefficients of logarithmic and exponential functions.
  2. Solve problems using these formulae.

### UNDERSTAND RATE OF CHANGE OF ONE VARIABLE WITH ANOTHER

* 1. Derive formulas for velocity, acceleration and slope of a line
  2. Use derivative as a measure of rate of change.
  3. Explain an increasing and a decreasing function.
  4. Show graphically maxima and minima values and point of inflexion.
  5. Explain criteria for finding maxima and minima.
  6. Solve problems based upon these topics.

### USE PRINCIPLES OF INTEGRATION IN SOLVING RELEVANT PROBLEMS.

* 1. Explain concept of integration.
  2. Write basic theorems of integration.
  3. Define fundamental formulas of integration.
  4. List some important rules of integration.
  5. Solve problems based on these rules.

### UNDERSTAND VARIOUS METHODS OF INTEGRATION

* 1. List standard formulas of integration.
  2. Integrate a function by substitution method.
  3. Use method of integration by parts for finding integrals.
  4. Employ these methods to solve problems.

### UNDERSTAND THE METHODS OF SOLVING DEFINITE INTEGRALS.

* 1. Define definite integral.
  2. List properties of definite integrals.
  3. Use definite integral in the computation of areas.
  4. Solve problems involving definite integrals.

### USE DIFFERENT METHODS OF INTEGRATION TO SOLVE DIFFERENTIAL EQUATIONS.

* 1. Define a differential equation, its degree and order.
  2. Explain method of separation of variables for solving differential equations of first order and first degree.
  3. Solve differential equations of first order and first degree.

### USE LAPLACE AND INVERSE LAPLACE TRANSFORMATION FOR SOLVING PROBLEMS.

* 1. Define Laplace and Inverse Laplace Transformation
  2. List properties of Laplace Transformation
  3. Solve problems using Laplace Transformations

### EXPAND FUNCTIONS USING FOURIER SERIES

* 1. Define a Fourier series.
  2. Write extended rule of integration by parts.
  3. Illustrate periodic functions, even and odd functions.
  4. Explain Fourier expansion and Fourier constants.
  5. Expand the given functions of Fourier series.

### UNDERSTAND THE BASIC CONCEPTS OF STATISTICS

* 1. Define mean, median and mode
  2. Explain standard deviation
  3. State laws of probability
  4. Calculate the above mentioned quantities using the proper formula

**3.3 GenC-212 CHINESE COURSE Ⅱ**

**Total contact hours**

Theory : 64 **T P C**

Practical: 0 2 0 2

**AIMS** There are 20 lessons (including 4-unit reviews) in this course. It is recommended to complete 8 lessons and the unit reviews in 32 class hours. After completing this course, students can master the advanced-basic Chinese language knowledge in the content of the course, and be able to reach and exceed **HSK level THREE**.

**INSTRUCTION OBJECTIVE** Through this course, learners can systematically learn the language knowledge at this stage and cope with general communication, and can communicate on familiar topics and meet the basic communication needs of daily life and study, and gradually understand and be familiar with Chinese communication etiquette, cultural customs, etc.

**COURSE CONTENTS**

1. **Lesson 1 Pick up international students at the airport 4 hours**

This lesson introduces grammatical knowledge such as "flexible use of interrogative pronouns" and "basic forms of clutch words", which requires students to use sequential words correctly and understand the contextual meaning of some special words.

1. **Lesson 2 What would you like to drink 4 hours**

This lesson introduces the rhetorical question form "can…?" and the related words "not only… but also...", and learn to express your needs correctly in communication.

1. **Lesson 3 I'm kidding you 4 hours**

This lesson explains the fixed structures "more and more", "more A, more B", etc., and understands how to praise in Chinese and how to deal with others' praise.

1. **Lesson 4 I like winter best 4 hours**

Through the description of weather, students can learn the usage of adverbs such as "often" and "always", which express frequency, and compare and describe similar phenomena.

**UNIT REVIEW 1 (INCLUDING TESTS) 2 hours**

Summarize the contents of Lesson 1-4, review key words and grammar knowledge, and help learners really consolidate their mastery. There are tests designed, which can detect what has been learned before, so as to check for leaks and fill gaps.

1. **Lesson 5 I caught a cold 3 hours**

This lesson learns the basic usage of "active" sentence, understands the expressions related to illness and medical treatment, and learns the language communication in hospital scenes.

1. **Lesson 6 You are really careless**  **3 hours**

Learn and summarize the usage of simple directional complements "V come" and "V leave", and master the basic expression of request and evaluation functions in daily communication.

1. **Lesson 7 English black tea is healthy and delicious 4 hours**

Understand how to express approximate numbers in Chinese, how to persuade others and how to express their basic attitude.

1. **Lesson 8 I'm not a shopaholic 4 hours**

This lesson is related to online shopping. Learn the expression "A is A, that is" and learn how to express your views from different angles.

**UNIT REVIEW 2 (INCLUDING TESTS) 2 hours**

This section leads students to review the knowledge points they have learned in the past, and conduct mid-term tests to test students' learning effect.

1. **Lesson 9 Why did grandparents move 3 hours**

This lesson introduces a life event related to "moving house", the expression of learning conditions and the extended meaning of directional complement through events.

1. **Lesson 10 Eat hot pot for the first time 4 hours**

This lesson introduces the way of having dinner in China through "hot pot" and some basic situations of Chinese restaurants, so as to help learners get a preliminary understanding of Chinese dining customs.

1. **Lesson 11 Teacher Wang is going to change the house 4 hours**

This lesson is related to "housing" in "food, clothing, housing and transportation". While understanding the story, students can learn language knowledge such as hypothetical relationship and overlapping of disyllabic verbs.

1. **Lesson 12 Single Li Wenchao 4 hours**

This lesson introduces emotional problems, learn about young people's concepts of marriage and love, and learn how to compare them in Chinese.

**UNIT REVIEW 3 (INCLUDING TESTS) 2 hours**

Review the previous knowledge, students answer questions through the platform, check the learning situation, and help teachers and students analyze their learning situation.

1. **Lesson 13 This is her new home 3 hours**

This lesson introduces the living conditions of young people at present, and understands how to describe the living environment, learn the Chinese expression of concepts such as location and existence.

1. **Lesson14 Allen's weekend 3 hours**

This lesson introduces school life, understand the sentence structure expressing complete negation, and summarize the usage of three auxiliary words "adjective", "adverb" and "should".

1. **Lesson 15 Fall in love with public square dancing 4 hours**

By introducing the living conditions of the elderly in China, students can learn Chinese comparative structure, enumerating relations and various usages of complements.

1. **Lesson 16 Taste English afternoon tea 4 hours**

This lesson introduces grammatical knowledge such as "passive" sentence and "adjective reduplication". Through the study of this lesson, students can understand the dining habits of restaurant ordering and national dishes.

**UNIT REVIEW 4 (INCLUDING TESTS) 2 hours**

This section is a review test class, leading students to review the knowledge points learned in the past for final tests to test students' learning effect.

**3.4. GenC-222 Understanding China**

**Total contact hours**

Theory 64 T P C

Practical 0 2 0 2

**AIMS** Understanding China is a compulsory course designed for international

students who study on a Chinese education program. This course is jointly

created by experts and scholars from a dozen top Chinese universities, providing

international students with a more comfortable way for learning about China. It

aims to display China in a panoramic way and reflect “Chinese thought”, “Chinese

experience”, and the great achievement in contemporary China’s economic and

social development.

**COURSE CONTENTS**

**1.The Geography of China 6 hours**

1.1 A Look at China from the World

1.2 China's Natural Environment

1.3 Mountains and Rivers I

1.4 Mountains and Rivers II

1.5 Famous Chinese Cities——Beijing

1.6 Famous Chinese Cities——Shanghai

1.7 Famous Chinese Cities——Hong Kong

1.8 A Natural Journey——Wuyue, Zhangjiajie, Jiuzhaigou

1.9 A Natural Journey——Xizang

1.10 A Natural Journey——Xinjiang

1.11 A Cultural Journey

**2.History 6 hours**

2.1 The Ancestors of Chinese People

2.2 Emperor Qin Shihuang

2.3 Emperor Wu

2.4 Western Han Silk Road

2.5 Tang Dynasty and Age of Prosperity

2.6 Ascending the River at Qingming Festival

2.7 Genghis Khan and Kublai Khan

2.8 Ming Taizu

2.9 The Seven Voyages

2.10 The Prosperity of the Kangxi and Qianlong per

2.11 The Opium War

2.12 Sun Yat-sen and Kuomintang

2.13 The Communist Party of China

2.14 September 18th Incident

2.15 Mao Zedong and the Establishment of New China

2.16 Diplomacy of New China

2.17 Deng Xiaoping and China’s Reform and Opening

2.18 Entering a New Era

**3.Philosophy 6 hours**

3.1 Key Figures in Confucianism-Confucius

3.2 Key Figures in Confucianism-Mencius

3.3 The Core Teachings of Confucianism-Rites (Li)

3.4 The Core Teachings of Confucianism-Benevolence (Ren) and Benevolent Rule (Ren Zheng)

3.5 The Core Teachings of Confucianism-Dao, Li and the Investigation of Things for the Extension of Knowledge

3.6 Zhou Yi, Yin & Yang and the Five Elements

3.7 Daoism-Laozi

3.8 Daoism-Zhuangzi

3.9 Other Schools of Thought-Militarists

3.10 Other Schools of Thought-Legalism

**4.Religion 2 hours**

4.1 Native Beliefs and Religions in China

4.2 Taoism

4.3 Introduction of Buddhism into China

4.4 Buddhist Doctrines, Chan (Zen) School of Buddhism, and Buddhist Attractions.

4.5 Other Non-Native Religions&Current Situation of Religions in China

**5.China’s Political System 2 hours**

5.1 The National Flag, National Emblem and National Anthem

5.2 China’s Administrative Divisions

5.3 The National Institutions I

5.4 The National Institutions II

5.5 The Political Parties I

5.6 The Political Parties II

5.7 The Foreign Policy of the People’s Republic of China

**6.Literature and Art 6 hours**

6.1 Different Phases and Genres of China’s Literature

6.2 Ancient Chinese Literature--Pre-Qin Literature

6.3 Ancient Chinese Literature--Tang Poetry

6.4 Ancient Chinese Literature--Song Poetry

6.5 Ancient Chinese Literature--The Four Classical Novels

6.6 Modern and Contemporary Literature I

6.7 Modern and Contemporary Literature II

6.8 Chinese Operas I

6.9 Chinese Operas II

6.10 Chinese Operas III

6.11 Traditional Chinese Musical Concepts

6.12 Traditional Chinese Musical Instruments and Classic Works

6.13 Colorful Modern Music

**7.The Chinese Language and the Chinese Characters 2 hours**

7.1 Putonghua and Dialects

7.2 Ancient Chinese and Modern Chinese

7.3 Idiomatic Phrases

7.4 The Interesting Origins of the Chinese Characters &The Development of the Chinese Characters

7.5 The Six Categories of Chinese Characters

7.6 Traditional and Simplified Chinese

**8.Calligraphy and Painting 6 hours**

8.1 What is Calligraphy?

8.2 The Evolution of Chinese Calligraphy-The oracle bone inscriptions and the bronze inscription.

8.3 The Evolution of Chinese Calligraphy-The small seal and The clerical script

8.4 The Evolution of Chinese Calligraphy-The regular script

8.5 The Evolution of Chinese Calligraphy-The cursive script

8.6 The Evolution of Chinese Calligraphy-The running script

8.7 The beauty of calligraphy

8.8 The four treasures of the study

8.9 The connection between calligraphy and other arts

8.10 Basic Knowledge of Chinese Painting

8.11 Artistic Features of Chinese Painting

8.12 Three Major themes of Chinese Painting and the Representative Works

**9.Economics 2 hours**

9.1 China’s Agriculture

9.2 China’s Industry

9.3 China’s The Tertiary Industry

9.4 The New Normal of China’s Economy

9.5 The Digital Economy 2.0

9.6 The Belt and Road Initiative

**10.Science and Technology 4 hours**

10.1 Four Great Inventions

10.2 Bronze Ware

10.3 Di Dong Yi

10.4 Ceramics

10.5 Hybrid Rice

10.6 China Sky Eye

10.7 China High-speed Railway

10.8 Jiaolong’s Ocean Explorations

10.9 “Sunway – Taihu Light” Supercomputer

10.10 Aerospace Science and Technology

10.11 Internet Payment.

**11.Education 2 hours**

11.1 Imperial Examination System

11.2 Chinese Universities and Colleges

11.3 Chinese Examinations

11.4 Chinese International Education

**12.Healthcare 4 hours**

12.1 Chinese Healthcare System

12.2 Traditional Chinese medicine

12.3 The Development of Traditional Chinese Medicine

12.4 The Core Concepts in Traditional Chinese Medicine

12.5 Acupuncture and Massage

12.6 Traditional Chinese Medicine and Life I

12.7 Traditional Chinese Medicine and Life II

12.8 Knowing Chinese Medicinal

12.9 The Mystique of Chinese Medicinal Treatment

12.10 Traditional Chinese Medicine in the World

**13.Sports and Wushu 2 hours**

13.1 Traditional Chinese Sports-Kite

13.2 The myth of the descendants shooting the sun

13.3 Chinese Women and the Olympics

13.4 Tai Chi

13.5 Martial Arts Film

13.6 Martial Arts Elements and Martial Arts Spirit in Wushu film

13.7 The Cultural Connotation of Chinese Martial Arts

**14.Traditional Festivals and Chinese Cuisine 2 hours**

14.1 Chinese Traditional Festivals

14.2 Chinese Traditional Festivals-The Spring Festival&The Lantern Festival

14.3 Chinese Traditional Festivals-The Dragon Boat Festivall&The Mid-Autumn Festival

14.4 Chinese Cuisine

**15.Material cultural heritage 6 hours**

15.1 Human Civilization: The Peking Man

15.2 Grottoes: Dunhuang Mogao Grottoes

15.3 Amazing Engineering: Dujiangyan

15.4 The Imperial Tombs: Ming Xiaoling and the Ming Tombs

15.5 The Largest Ritual Bronzes: The Houmuwu Ding

15.6 Musical Instruments from the Warring States Period: The Zenghouyi Bells

15.7 Chinese Ancient Architecture

15.8 Types of Ancient Chinese Architecture

15.9 Royal Architecture: The Former Imperial Palace in Beijing

15.10 Ancient Dwellings: Siheyuan

15.11 Chinese Ancient Gardens

**16.Intangible Cultural Heritage 6 hours**

16.1 China's Intangible Cultural Heritage

16.2 Intangible cultural heritage project-Epic of King Gesar

16.3 Intangible cultural heritage project-Guqin

16.4 Intangible cultural heritage project-Farmers’dance of China’s Korean ethnic group

16.5 Intangible cultural heritage project-shadow puppetry

16.6 Intangible cultural heritage project-Yueju opera

16.7 Intangible cultural heritage project-Seal engraving

16.8 Intangible cultural heritage project-Nanjing Yunjin

16.9 Intangible cultural heritage project-The 24 solar terms

16.10 Intangible cultural heritage project-Crosstalk

16.11 Intangible cultural heritage project-Acrobatic art

16.12 How does China protect ICH?

**Recommended book**

*Understanding China( Digital and Paper format), edited by Cheng Aimin, jointly developed by Peking University, Beijing Normal University, Zhejiang University, Tianjin University, Harbin Institute of Technology, Xi’an Jiaotong University, Wuhan University, Chongqing University, Shanghai International Studies University, Dalian Medical University, South China Normal University, Jiangsu Normal University and Tang International Education Group, published by Shanghai Foreign Language Education Press, recommended by China Association for International Education (CAFSA)*

### 3.5 Phy-232 APPLIED PHYSICS

**Total Contact Hours**

Theory: 32 **T P C**

Practical: 96 1 3 2

**AIMS** The students will be able to understand the fundamental principles and concept of physics, use these to solve problems in practical situations/technological courses and understand concepts to learn advance physics/technical courses.

### COURSE CONTENTS

1. **MEASUREMENTS. 2 Hours.**
   1. Fundamental units and derived units
   2. Systems of measurement and S.I. units
   3. Concept of dimensions, dimensional formula
   4. Conversion from one system to another
   5. Significant figures

### SCALARS AND VECTORS. 4 Hours.

* 1. Revision of head to tail rule
  2. Laws of parallelogram, triangle and polygon of forces
  3. Resolution of a vector
  4. Addition of vectors by rectangular components
  5. Multiplication of two vectors, dot product and cross product

### WAVE MOTION. 5 Hours

* 1. Review Hooke's law of elasticity
  2. Motion under an elastic restoring force
  3. Characteristics of simple harmonic motion
  4. S.H.M. and circular motion
  5. Simple pendulum
  6. Wave form of S.H.M.
  7. Resonance
  8. Transverse vibration of a stretched string

### SOUND. 5 Hours

* 1. Longitudinal waves
  2. Intensity, loudness, pitch and quality of sound
  3. Units of Intensity of level and frequency response of ear
  4. Interference of sound waves silence zones, beats
  5. Acoustics
  6. Doppler effect.

### LIGHT. 5 Hours

* 1. Review laws of reflection and refraction
  2. Image formation by mirrors and lenses
  3. Optical instruments
  4. Wave theory of light
  5. Interference, diffraction, polarization of light waves
  6. Applications of polarization in sunglasses, optical activity and stress analysis

### OPTICAL FIBER. 2 Hours

* 1. Optical communication and problems
  2. Review total internal reflection and critical angle
  3. Structure of optical fiber
  4. Fiber material and manufacture
  5. Optical fiber - uses.

### LASERS. 3 Hours

* 1. Corpuscular theory of light
  2. Emission and absorption of light
  3. Stimulated absorption and emission of light
  4. Laser principle
  5. Structure and working of lasers
  6. Types of lasers with brief description.
  7. Applications (basic concepts)
  8. Material processing
  9. Laser welding
  10. Laser assisted machining
  11. Micro machining
  12. Drilling, scribing and marking
  13. Printing
  14. Lasers in medicine

### HEAT. 4hours.

* 1. Review of calorimetry and gas laws
  2. Thermal expansion of solids, liquids and gases
  3. Heat of fusion, vaporization
  4. Humidity, absolute and relative
  5. Law of cooling
  6. Thermoelectricity
  7. Thermocouple.

### MAGNETIC MATERIALS. 2 Hours

* 1. Magnetism
  2. Domains theory
  3. Para, dia and ferromagnetism and magnetic materials
  4. B.H. curve and hysterisis loop.

### SEMI CONDUCTOR MATERIALS. 2 Hours

* 1. Crystalline structure of solids
  2. Conductors, semiconductors, insulators
  3. P-type and N-type materials
  4. P-N junction
  5. P-N junction as a diode
  6. Photovoltaic cell (solar cell)

### RECOMMENDED BOOKS

1. Tahir Hussain, Fundamentals of Physics Vol-I and II
2. Farid Khawaja, Fundamentals of Physics Vol-I and II
3. Wells and Slusher, Schaum's Series Physics .
4. Nelkon and Oyborn, Advanced Level Practical Physics
5. Mehboob Ilahi Malik and Inam-ul-Haq, Practical Physics
6. Wilson, Lasers - Principles and Applications
7. M. Aslam Khan and M. Akram Sandhu, Experimental Physics Note Book

### Phy-232 APPLIED PHYSICS INSTRUCTIONAL OBJECTIVES

1. **USE CONCEPTS OF MEASUREMENT TO PRACTICAL SITUATIONS AND TECHNOLOGICAL PROBLEMS**.
   1. Write dimensional formulae for physical quantities
   2. Derive units using dimensional equations
   3. Convert a measurement from one system to another
   4. Use concepts of measurement and Significant figures in problem solving.

### USE CONCEPTS OF SCALARS AND VECTORS IN SOLVING PROBLEMS INVOLVING THESE CONCEPTS.

* 1. Explain laws of parallelogram, triangle and polygon of forces
  2. Describe method of resolution of a vector into components
  3. Describe method of addition of vectors by rectangular components
  4. Differentiate between dot product and cross product of vectors
  5. Use the concepts in solving problems involving addition resolution and multiplication of vectors.

|  |  |  |
| --- | --- | --- |
| **3** | **USE** | **CONCEPTS OF WAVE MOTION IN SOLVING RELEVANT PROBLEMS.** |
|  | 3.1 | Explain Hooke's Law of Elasticity |
|  | 3.2 | Derive formula for Motion under an elastic restoring force |
|  | 3.3 | Derive formulae for simple harmonic motion and simple pendulum |
|  | 3.4 | Explain wave form with reference to S.H.M. and circular motion |
|  | 3.5 | Explain Resonance |
|  | 3.6 | Explain Transverse vibration of a stretched string |
|  | 3.7 | Use the above concepts and formulae of S.H.M. to solve relevant problems. |

### UNDERSTAND CONCEPTS OF SOUND.

* 1. Describe longitudinal wave and its propagation
  2. Explain the concepts: Intensity, loudness, pitch and quality of sound
  3. Explain units of Intensity of level and frequency response of ear
  4. Explain phenomena of silence zones, beats
  5. Explain Acoustics of buildings
  6. Explain Doppler effect giving mathematical expressions.

### USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS and LENSES.

* 1. Explain laws of reflection and refraction
  2. Use mirror formula to solve problems
  3. Use the concepts of image formation by mirrors and lenses to describe working of optical instruments,

e.g. microscopes, telescopes, camera and sextant.

### UNDERSTAND WAVE THEORY OF LIGHT

* 1. Explain wave theory of light
  2. Explain phenomena of interference, diffraction, polarization of light waves
  3. Describe uses of polarization given in the course contents.

### UNDERSTAND THE STRUCTURE, WORKING AND USES OF OPTICAL FIBER.

* 1. Explain the structure of the Optical Fiber
  2. Explain its principle of working
  3. Describe use of optical fiber in industry and medicine.

### UNDERSTAND THE STRUCTURE, WORKING AND USES OF LASERS.

* 1. Explain the stimulated emission of radiation
  2. Explain the laser principle
  3. Describe the structure and working of lasers
  4. Distinguish between types of lasers
  5. Describe the applications of lasers in the fields mentioned in the course contents.

### UNDERSTAND TYPES AND USES OF ARTIFICIAL SATELLITES.

* 1. Explain escape velocity
  2. Explain orbital velocity
  3. Distinguish between geosynchronous and geostationary satellites
  4. Describe uses of artificial satellites in data communication.

### UNDERSTAND BASIC CONCEPTS AND CLASSIFICATION OF MAGNETIC MATERIALS.

* 1. Explain domains theory of magnetism
  2. Distinguish between para, dia and ferromagnetism and magnetic materials
  3. Distinguish between B and H
  4. Describe B.H. Curve
  5. Describe hysterisis loop.

### UNDERSTAND BASIC CONCEPTS OF SEMI-CONDUCTOR MATERIALS AND THEIR USES.

* 1. Explain crystalline structure of solids
  2. Distinguish between conductors, semiconductors and insulators
  3. Describe semiconductors giving examples with reference to their structure
  4. Distinguish between P-type and N-type materials
  5. Explain working of P-N junction as a diode
  6. Explain working of solar cell.

### Phy-232 APPLIED PHYSICS LIST OF PRACTICALS.

1. Draw graphs representing the functions: a) y=mx for m=0, 0.5, 1, 2
   1. y=x2
   2. y=1/x
2. Find the volume of a given solid cylinder using vernier callipers.
3. Find the area of cross-section of the given wire using micrometer screw gauge.
4. Prove that force is directly proportional to (a) mass, (b) acceleration, using fletchers' trolley.
5. Verify law of parallelogram of forces using Grave-sands apparatus.
6. Verify law of triangle of forces and Lami's theorem
7. Determine the weight of a given body using
8. Law of parallelogram of forces
9. Law of triangle of forces
10. Lami's theorem
11. Verify law of polygon of forces using Grave-sands apparatus.
12. Locate the position and magnitude of resultant of like parallel forces.
13. Determine the resultant of two unlike parallel forces.
14. Find the weight of a given body using principle of moments.
15. Locate the centre of gravity of regular and irregular shaped bodies.
16. Find Young's Modules of Elasticity of a metallic wire.
17. Verify Hooke's Law using helical spring.
18. Study of frequency of stretched string with length.
19. Study of variation of frequency of stretched string with tension.
20. Study resonance of air column in resonance tube and find velocity of sound.
21. Find the frequency of the given tuning fork using resonance tube.
22. Find velocity of sound in rod by Kundt's tube.
23. Verify rectilinear propagation of light and study shadow formation.
24. Study effect of rotation of plane mirror on reflection.
25. Compare the refractive indices of given glass slabs.
26. Find focal length of concave mirror by locating centre of curvature.
27. Find focal length of concave mirror by object and image method
28. Find focal length of concave mirror with converging lens.
29. Find refractive index of glass by apparent depth.
30. Find refractive index of glass by spectrometer.
31. Find focal length of converging lens by plane mirror.
32. Find focal length of converging lens by displacement method.
33. Find focal length of diverging lense using converging lens.
34. Find focal length of diverging lens using concave mirror.
35. Find angular magnification of an astronomical telescope.
36. Find angular magnification of a simple microscope (magnifying glass)
37. Find angular magnification of a compound microscope.
38. Study working and structure of camera.
39. Study working and structure of sextant.
40. Compare the different scales of temperature and verify the conversion formula.
41. Determine the specific heat of lead shots.
42. Find the coefficient of linear expansion of a metallic rod.
43. Find the heat of fusion of ice.
44. Find the heat of vaporization.
45. Determine relative humidity using hygrometer.

**7 ET-203: D.C. MACHINES AND BATTERIES.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Total Contact Hours:** |  | | | |
| Theory: | 64 | **T** | **P** | **C** |
| Practical: | 96 | 2 | 3 | 3 |

**AIM** To enable students understand basic principles, construction, working and control techniques of DC machines. Also understand types, working and charging of secondary cells/batteries.

1. **D.C. MACHINES FUNDAMENTALS 6 Hrs.**
   1. Review of Faraday's Laws of Electromagnetic Induction, Flemings right hand rule, Lenz's Law, and force on a current carrying conductor.
   2. Parts of D.C Machines, body, yoke, field, poles, armature, commutator, etc.
   3. Armature winding, single layer, double layer, simplex, duplex, lap and wave.
2. **D.C MACHINE AS D.C. GENERATOR 20 Hrs.**
   1. Principle of working of elementary D.C generator.
   2. E.M.F equation of D.C generator and problem solving.
   3. Types of Generator, separately exited, self exited, shunt, series and compound.
   4. No load characteristics of separately and self exited shunt generator, critical resistance solving problems.
   5. On load, internal, external characteristics & problem solving of generators voltage regulation, method of compounding, degree of compounding.
   6. Armature reaction & commutation.
   7. Interpoles or compoles.
   8. Power stages, losses and efficiency, condition for maximum efficiency.
   9. Parallel operation of shunt & compound generator, load sharing.
   10. Safety while working on generators
3. **D.C. MACHINES AS D.C. MOTOR 26 Hrs.**
   1. Principle & working of elementary D.C motor.
   2. Back e.m.f and torque development in D.C motors, torque equation.
   3. Electrical, Mechanical, V/Ia characteristics of series, shunt, compound (Differential) motors.
   4. Comparison of D.C motors, and their applications.
   5. Power stages, losses, BHP and efficiency of D.C. motors.
   6. Speed control of D.C motor by changing field flux, armature current and voltage.
   7. Merits and demerits of different speed controlling methods.
   8. Necessity and Design of Motor Starter, 3 & 4 points starter.
   9. Controllers, manual, automatic magnetic, semi-automatic.
   10. Testing of D.C machines, Dynamometer, Hopkinson tests.
   11. Safety while working on motors.
4. **BATTERIES 12 Hrs.**
   1. Primary cells, types, construction, dry cell.
   2. Secondary cells, storage cells.
   3. Types of storage cells, Lead Acid, Nickel iron, Nickel Cadmium.
   4. Chemical action during charging and discharging of Lead Acid battery.
   5. Construction and working of Lead Acid battery.
   6. Preparation of electrolytes of given specific gravity.
   7. Variation in specific gravity during charging & discharging.
   8. Effect of specific gravity on e.m.f.
   9. Construction & working of Nickel iron cell.
   10. Construction & working of Nickel-Cadmium Cell.
   11. Safety in preparation of electrolytes and handling acids.
   12. Safe disposal of chemicals

**ET-203: D.C. MACHINES & BATTERIES INSTRUCTIONAL OBJECTIVES**

**TIME SCHEDULE**

|  |  |  |  |
| --- | --- | --- | --- |
| S.NO. | MAJOR TOPICS | NO. OF PERIODS | NO. OF QUESTIONS IN Q.  PAPER. |
| 1. | D.C. Machine Fundamentals | 6 | 1 |
| 2. | D.C. Generator | 20 | 2 |
| 3. | D.C. Motor | 26 | 2 |
| 4. | Batteries | 12 | 1 |
|  | Total: | 64 | 6 |

1. **UNDERSTAND THE FUNDAMENTALS OF D.C. MACHINES**
   1. State Faraday's Laws of Electromagnetic induction
   2. Derive e=di/dt equation
   3. State flemings right hand rule.
   4. State Lenz's Law.
   5. Explain force developed on a current carrying conductor lying in magnetic field.
   6. State parts of D.C. machine, body, yoke, field poles and winding, commutators, armature
   7. Draw Armature winding, lap, wave, single layer,double layer, simplex and duplex.
   8. Calculate and develop given armature winding for lap & wave duplex winding.

### UNDERSTAND THE WORKING OF D.C. MACHINES AS D.C. GENERATORS

* 1. Explain principle of single loop D.C. generator.
  2. Derive EMF equation of a D.C. generator and solve related problems.
  3. List types of D.C. generator depending upon excitation (self and separately excited).
  4. List types of D.C. generator showing their connections (Shunt, series, compound).
  5. Draw no load characteristics of separately and self-excited shunt generators.
  6. Evaluate critical resistance from O.C.C for a given machine.
  7. Solve problems relating to o.c.c critical resistance, emf and speed.
  8. Draw on-load internal, external characteristics for series, shunt and compound generators.
  9. Solve problems relating to load characteristics.
  10. State levels of compounding of compound generator, as under & over compounding.
  11. Explain armature reaction.
  12. Define commutation.
  13. Explain purpose of Inter-poles
  14. Express power stages in D.C. generators and its efficiency.
  15. Solve problems on power stages and efficiency of D.C. generator.
  16. State conditions for maximum efficiency of a D.C. generator.
  17. Solve problems on efficiency of D.C. generator.
  18. Explain parallel operation of series shunt and compound generators.

### UNDERSTAND CONSTRUCTION, TYPES AND USES OF D.C MOTORS

* 1. Explain working principle of an elementary D.C. motor.
  2. State back e.m.f produced in motor armature.
  3. Explain development of torque due to back e.m.f.
  4. Derive motor torque equation.
  5. Draw electrical, mechanical, N/Ia characteristics of series, shunt and compound (Differential/ commulative) motors.
  6. Classify dc motors (Series, shunt, compound).
  7. State application of motors depending upon their characteristics.
  8. Explain power stages in D.C. motors, BHP, losses, efficiency.
  9. Solve problems on power stages of DC motors.
  10. Describe speed control of dc motors, by changing field flux, armature current and voltage.
  11. Compare different speed control methods
  12. Explain controllers, manual, automatic and semi-automatic.
  13. Describe importance of testing of dc machines.
  14. Explain dynamometer, Hopkinson & Swinburn tests.

### UNDERSTAND CONSTRUCTION, TYPES AND CHARGING OF BATTERIES

* 1. Define primary cell.
  2. State type of cells
  3. Describe working of primary cells.
  4. State uses of Dry cell
  5. Explain working of dry cell.
  6. Explain the working of secondary cell and battery (Storage cell, accumulator, lead acid, and alkaline).
  7. Sketch construction of lead acid battery.
  8. Discuss chemical process in lead acid battery on charging and discharging.
  9. State method of preparation of electrolyte for a given specific gravity.
  10. State the effects of charging and discharging on the specific gravity of the electrolyte.
  11. Draw sketch of Nickel iron cell
  12. Describe working of Nickel iron battery.
  13. Draw sketch of Nickel Cadmium battery.

### ET-203: D.C. MACHINES AND BATTERIES LIST OF PRACTICALS:

Note: Students should demonstrate concern for personal and equipment safety while working in Lab.

1. Study of constructional features of D.C machine.
2. Identification of terminals, polarity, determination of resistance of field and armature windings.
3. Developing Lap winding diagram for a given armature.
4. Develop wave winding diagram for a given armature.
5. Calculating winding factor, and develop winding diagram lap and wave for a given armature.
6. Rewinding an armature, session I.
7. Rewinding armature, session II.
8. Rewinding armature, session III (last).
9. Connecting and operating D.C machine as separately exited generator and to plot its O.C.C.
10. Connecting and operating D.C machine as self excited shunt generator and to plot its O.C.C. and to find critical resistance.
11. Operate a series generator and draw its external characteristics.
12. Operate a shunt generator and draw its external characteristics.
13. Plot external characteristics of compound generator for level, under and over compounding.
14. Parallel operation of two shunt generators.
15. Determination of copper, iron & friction losses by actual loading.
16. Study of starting and controlling equipment.
17. Connecting starter and controlling circuit with a shunt motor.
18. Connecting a machine as series motor (operation of fractional H.P series motor).
19. Determination of motor efficiency by direct loading.
20. Experimentally plot speed-torque characteristics of a shunt motor.
21. Plotting speed-current characteristics from data of a shunt motor.
22. Plotting Torque-current characteristics from experimental data of a shunt motor.
23. Plot torque-current characteristic of a series motor from experimental data.
24. Draw speed-torque characteristics of a series motor from experimental data.
25. Plot speed-current characteristic of compounded motor.
26. Draw Torque-current characteristics of compound motor.
27. Controlling speed of a shunt motor by changing field current & armature current.
28. Controlling speed of a series motor by armature and field diverter.
29. Determination of B.H.P of motor by brake test.
30. Determination of efficiency of motor by Swinburn test.
31. Determination of torque and efficiency by dynamo meter.
32. Regenerative or Hopkinsons test.
33. Study constructional features of lead acid battery.
34. Preparation of electrolyte (H2SO4) of a given specific gravity and charging lead acid battery.

\*\* Students must prepare practical journal 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 examination.

### TEXT/REFERENCE BOOKS

1. A Course in Electrical Engineering Vol.I By Dawes, L. Chester.
2. Audel's Electric motor guide.
3. A Text Book of Electrical Technology by B.L. Theraja.
4. D.C Machines by Audel's.
5. Electrical Generator By Kates-Stafford.
6. Direct Current Motors & Generators by M.C. Mongal-Keth-Rouson.

### 3.8 ET-273: ELECTRICAL INSTRUMENTS AND MEASUREMENTS

**Total Contact Hours:**

Theory: 64 **T P C**

Practical: 96 2 3 3

**AIM:** To enable students understand fundamental forces acting in electrical measuring instruments, and the construction, working & applications of the whole range of measuring instruments. This range includes special purpose and electronic instruments. This course also provides information on measuring bridges in common use.

### CLASSIFICATION OF INSTRUMENTS 6 Hrs.

* 1. Absolute instruments.
  2. Secondary instruments.
  3. Indicating instruments.
  4. Recording instruments.
  5. Integrating instruments.
  6. Digital instruments.
  7. Analog instruments.

### EFFECTS UTILIZED IN MEASURING INSTRUMENTS

2.1 Magnetic effect.

2.2. Heating effect

* 1. Chemical effect.
  2. Electrostatic effect.
  3. Electromagnetic effect.

### FORCES ACTING IN AN INSTRUMENT

* 1. Deflecting force.
  2. Controlling force.
  3. Damping force.

### TANGENT GALVANOMETER

* 1. Theory of Tangent galvanometer.
  2. Parts of tangent galvanometer.

### DISTINCTION BETWEEN INDICATING AND RECORDING INSTRUMENT

* 1. Construction, distinction.
  2. Working distinction

### DEFLECTING FORCE ACTING IN THE INSTRUMENT 6 Hrs.

6.1 Calculation of Force/Torques.

### CONTROLLING/RESTORING FORCES

* 1. Gravity control.
  2. Spring control.

### DAMPING FORCES AND THEIR NECESSITY

* 1. Air damping.
  2. Fluid damping.
  3. Eddy current damping.

### BALANCING OF MOVING PARTS

* 1. Torque/weight ratio calculation.
  2. Balancing weight.

### CONSTRUCTIONAL FEATURES OF ANALOG INSTRUMENT

* 1. Construction of scales.
  2. Reading of scales.
  3. Types of Pointer and methods of their mounting.
  4. Types of springs.
  5. Mounting of springs.
  6. Types of bearings and their role in an instrument.
  7. Types of casing of an instrument.

### PERMANENT MAGNET MOVING COIL INSTRUMENT 3 Hrs.

* 1. Working Principle.
  2. Construction.
  3. Application.

### SHUNTS 8 Hrs.

* 1. Construction of shunts purpose.
  2. Calculation and application.
  3. Material used for shunts.

### MULTIPLIER

* 1. Purpose of multiplier and calculations.
  2. Construction
  3. Material used for multipliers.

### MOVING IRON ATTRACTION TYPE INSTRUMENT

* 1. Working principle.
  2. Construction
  3. Application

### MOVING IRON REPULSION TYPE INSTRUMENT

* 1. Working principle.
  2. Construction
  3. Application.

### ERRORS IN AM-METERS AND VOLTMETERS

* 1. Causes of error.
  2. Removing error.
  3. Calibration.

### BI METALLIC TYPE INSTRUMENT 6 Hrs.

* 1. Working principle.
  2. Construction
  3. Application.

### THERMOCOUPLE TYPE INSTRUMENT

* 1. Types of Thermocouples.
  2. Working principle.
  3. Application.

### TEMPERATURE MEASUREMENT DEVICES

* 1. Types (resistance, thermocouple, Radiation Pyrometers).
  2. Working principle.
  3. Application.

### MOVING COIL DYNAMOMETER INSTRUMENT

* 1. Working Principles.
  2. Construction as Am-meter
  3. Construction as Voltmeter.
  4. Construction as Wattmeter.
  5. Errors and their remedies.
  6. Advantages and disadvantages over other types.

### SHADED POLE TYPE INSTRUMENT 2 Hrs.

* 1. Working Principle
  2. Construction.
  3. Application.

### ENERGY METER SINGLE PHASE 9 Hrs.

* 1. Types.
  2. Construction of single phase Energy meter (induction type).
  3. Working Principle.
  4. Types of scales in use and reading the scale.
  5. Errors in energy meter.
  6. Calibration of Energy meter.

|  |  |  |
| --- | --- | --- |
| **23.** | **THREE** | **PHASE ENERGY METER** |
|  | 23.1 | Construction of induction type. |
|  | 23.2 | Working Principle. |
|  | 23.3 | Application. |

### MAXIMUM DEMAND INDICATOR

* 1. Construction.
  2. Working Principle.
  3. Application & reading.

### OHM METER

* 1. Working Principle.
  2. Construction.
  3. Application.

### A.V.O. METER

* 1. Construction.
  2. Scale reading.
  3. Application.

### MEAGER (INSULATION TESTER)

* 1. Working principle.
  2. Construction.
  3. Application.

|  |  |  |
| --- | --- | --- |
| **28.** | **EARTH** | **RESISTANCE TESTER** |
|  | 28.1 | Constructions. |
|  | 28.2 | Operations. |
|  | 28.3 | Application. |

### RESISTANCE MEASURING BRIDGES (WHEAT STONE & KELVIN'S DOUBLE BRIDGE)

* 1. Construction.
  2. Working Principle.
  3. Uses.

### MURRAY LOOP TEST

* 1. Working Principle.
  2. Application.

### BLAVIER & EARTH LOOP TEST

* 1. Working principle.
  2. Application.

### INSTRUMENT TRANSFORMERS 10 Hrs.

* 1. Types (C.T & P.T).
  2. Working and advantages.
  3. Vector diagram.
  4. Theory of C.T & P.T
  5. Phase angle.
  6. Standard ratios, rating, burden.
  7. Error reducing methods.

### POWER FACTOR METERS

* 1. Types according to supply.
  2. Types according to construction.
  3. Working principle of each.

### DIGITAL METERS 8 Hrs.

* 1. Types.
  2. Uses.
  3. Explanation with the aid of block diagram.
  4. Error.

### F.E.T & TRANSISTOR VOLTMETER 6 Hrs.

* 1. Working (Block diagram).
  2. Application.

### OSCILLOSCOPE

* 1. Types
  2. Construction.
  3. Operation.

### SIGNAL GENERATORS 4 Hrs.

* 1. Types (AF & RF)
  2. Working Principle.
  3. Construction.
  4. Application.

### MEASUREMENT OF CAPACITANCE & INDUCTANCE

* 1. Measuring Inductance
  2. Measuring Capacitance.

### FREQUENCY METER

* 1. Types (Resonance and Weston, Digital).
  2. Construction.
  3. Working Principle.
  4. Application.

### LUX METERS

* 1. Types.
  2. Working principle.
  3. Applications.

### SYNCHRONOSCOPES

* 1. Types.
  2. Construction.
  3. Working principle.
  4. Uses.

### TACHOMETERS 6 Hrs.

* 1. Types (Mechanical-Electrical & Electronic).
  2. Construction.
  3. Application.

### ET-273: ELECTRICAL INSTRUMENTS AND MEASUREMENTS

**INSTRUCTIONAL OBJECTIVES**

**TIME SCHEDULE**

|  |  |  |  |
| --- | --- | --- | --- |
| S.NO. | MAJOR TOPICS | NO. OF PERIODS | NO. OF QUESTIONS IN  Q. PAPER |
| 1. | Classification, effect of current indicating,  recording and integrating instruments. (1-5) | 6 | ½ |
| 2. | Deflecting forces, controlling & damping.  General constructions. (6-14) | 6 | ½ |
| 3. | Permanent magnet moving coil & moving iron  instruments (15-17) Cost estimation - Labour cost estimation | 6 | ½ |
| 4. | Bi-Metal, thermocouple, dynamometer, shaded  pole and rectifier instruments (18-22) | 6 | ½ |
| 5. | Shunts, multipliers, Avo, Meager as insulation  tester & Earth resistant tester (23-28) | 8 | 1 |
| 6. | Energy meters and their errors. (29-31) | 4 | ½ |
| 7. | Digital meters, frequency meter, resistance  measuring bridges & their applications (32-36) | 8 | ½ |
| 8. | Instrument transformers, power factor meters,  temp. measurement & LUX meter (37-40) | 8 | 1 |
| 9. | FET meter, C.R.O., VTVM & Synchronoscope  (41-43) | 6 | ½ |
| 10. | Tacho-meter, M.D.I., signal generator &  capacitance measurement (44-47) | 6 | ½ |
|  | Total: | 64 | 6 |

1. **UNDERSTAND THE DIFFERENCE BETWEEN PRIMARY AND SECONDARY INSTRUMENTS WITH FURTHER CATEGORIES OF SECONDARY INSTRUMENTS**
   1. Differentiate between the absolute and secondary instruments.
   2. State the difference among indicating, recording and integrating instruments.
   3. State apparent constructional difference.
   4. Explain the applications of each type.

### UNDERSTAND THE EFFECTS AND MEASURING INSTRUMENTS

* 1. Explain the magnetic effects and its sources.
  2. Explain the heating effects and its sources.
  3. Define the chemical effects and its sources.
  4. Explain electrostatic effects and its sources.
  5. Explain electro magnetic effect and its elements. (Amp-Turn)

### UNDERSTAND VARIOUS FORCES ACTING IN A MEASURING INSTRUMENT

* 1. Explain deflecting force and the methods of providing it.
  2. Explain controlling force and the methods of providing it.
  3. Explain damping force and the methods of providing it.

### KNOW THE WORKING OF TANGENT GALVANOMETER

* 1. State the working principle of Tangent Galvanometer.
  2. State the applications of Tangent Galvanometer.

### UNDERSTAND THE DIFFERENCE BETWEEN INDICATING AND RECORDING INSTRUMENTS

* 1. Explain the construction and use of indicating instrument.
  2. Explain the use of recording instruments.
  3. Write its advantages over indicating instruments.
  4. State common applications of recording instruments.

### UNDERSTAND THE METHOD OF PRODUCING DEFLECTING FORCE/TORQUE

* 1. Explain various methods of producing deflecting force.
  2. Explain difference between force and torque.
  3. Explain the factors on which its strength is based.
  4. Derive formula for moving coil instrument.

### UNDERSTAND THE TYPES OF CONTROLLING/RESTORING FORCES

* 1. Explain Gravity force and its applications in instruments.
  2. Understand spring control.
  3. State types of springs
  4. Explain materials of springs used in instruments.
  5. Explain the method of mounting springs.
  6. State its strength & position controlling system.

### UNDERSTAND DIFFERENT DAMPING FORCES AND TECHNIQUES

* 1. Explain Air, Oil & eddy current damping.
  2. Explain the method of their production.
  3. Draw the sketch of the systems.
  4. Explain under, normal & dead beat damping.

### UNDERSTAND PURPOSE AND TECHNIQUES OF BALANCING MOVING PARTS

* 1. Explain the effect of unbalancing & balancing.
  2. Calculate torque weight ratio
  3. Explain types and weights used and their position.
  4. Describe fixing of balance weight.

### UNDERSTAND METER SCALES, THEIR TYPES AND GRADUATION

* 1. State types of scales (simple, mirror multiscales).
  2. Explain the parallax and its effect in reading.
  3. Explain reason for creeping wide range.
  4. State precautions for reading analog scale readings
  5. Explain why some scales are not uniform.

### UNDERSTAND THE POINTER DESIGN AND MATERIALS USED

* 1. Explain types of pointers in use .
  2. Explain the material used, with reasons.
  3. Explain their fixing techniques
  4. Explain the care required in using & repairing pointers.

### UNDERSTAND CONTROL SPRING TYPES, MATERIALS AND THEIR FIXING

* 1. Explain hair & helix spring.
  2. Explain characteristics of material.
  3. Explain the method of their fixing on post.

### UNDERSTAND BEARING TYPES, MATERIALS NECESSITY AND LUBRICATION

* 1. Explain need & types of bearing in use.
  2. Explain material used, their merits & demerits.
  3. Explain the lubrication techniques & lubricants used,

### UNDERSTAND WORKING OF PERMANENT MAGNET MOVING COIL INSTRUMENT

* 1. Explain the working principle.
  2. Explain the parts and their role in such instruments.
  3. Draw sketches of each part.
  4. Explain difference in winding and sensitivity when used as am-meter, volt meter and Ohm-meter.

### UNDERSTAND THE WORKING PRINCIPLE, PARTS AND USES OF MOVING IRON ATTRACTION TYPE INSTRUMENTS

* 1. Explain the working principle.
  2. Draw sketches to show the assembly.
  3. Explain the applications of such instruments.
  4. State names of parts.

### MOVING IRON REPULSION TYPE INSTRUMENTS

* 1. As above for serial-15 objective.

### KNOW BI-METALLIC INSTRUMENTS

* 1. State the working principle of Bi-metallic instruments and state materials used.
  2. State the applications of such instruments.

### UNDERSTAND THERMOCOUPLE TYPES OF INSTRUMENTS

* 1. Explain the working principle of thermocouples
  2. Draw sketch of thermocouples
  3. State various materials used.
  4. State the applications.

### UNDERSTAND ELECTRODYNAMIC INSTRUMENT

* 1. Explain the working principle
  2. Name various parts
  3. State working of each part.
  4. Draw internal sketch showing parts.
  5. State the uses of such instruments.

### UNDERSTAND SHADED POLE TYPE INSTRUMENTS

* 1. Explain the working principle
  2. State application.
  3. Name parts of the instrument
  4. Draw sketch.
  5. State the merits & demerits of such instruments.

### UNDERSTAND VARIOUS KINDS OF DYNAMOMETER TYPE INSTRUMENTS

* 1. Explain the working principle
  2. Explain connection as am meter, as voltmeter and as wattmeter.
  3. Draw sketches in each case.
  4. Enlist merits and demerits

21.4 Explain errors and their remedies.

### DESIGN SHUNTS FOR RANGE EXTENSION

* 1. Explain purpose of shunt.
  2. Know kind of materials used.
  3. Calculate value for shunt resistor for given meter's range extension.
  4. Design physical dimensions & power rating of shunt.

### DESIGN MULTIPLIER FOR RANGE EXTENSION

* 1. Explain the purpose of multiplier.
  2. Calculate values for multiplier for given meter's range extension.
  3. Know the kinds of materials used.
  4. Design physical dimensions & power rating of multipliers.

### UNDERSTAND OHM METERS

* 1. Explain the working principle of Analog Ohm meter.
  2. Explain scale reading on different range settings.
  3. State precautions of using ohm meters.

### UNDERSTAND THE WORKING AND USES OF AVO METER

* 1. State kinds of AVO meter (Multimeters).
  2. Explain Working principle of analog multimeter
  3. Explain Working Of Digital type mete, using block diagram.
  4. Draw scales and state reading techniques.
  5. Explain use on live circuits as am-meter and voltmeter.

### UNDERSTAND THE WORKING & USE OF MEAGER

* 1. Explain working principle of meager.
  2. Explain operation for continuity, short circuit and open circuit tests.
  3. Explain scale reading
  4. Draw sketch, naming each part.

### UNDERSTAND WORKING AND USE OF EARTH RESISTANCE TESTER

* 1. Explain the working principle of earth tester.
  2. Draw sketch
  3. State applications

### UNDERSTAND WORKING AND USE OF SINGLE PHASE INDUCTION TYPE ENERGY METER

* 1. Explain the working principle
  2. Draw sketch showing assembly
  3. Enlist name of the parts
  4. Explain working of each part
  5. Explain scale reading
  6. Enlist errors and their causes.
  7. Explain calibration techniques.

### UNDERSTAND WORKING AND USE OF THREE PHASE ENERGY METERS

* 1. Explain construction and working
  2. Enlist parts for such errors
  3. Explain calibration techniques

### UNDERSTAND THE VARIOUS SOURCES OF ERROR IN METERS AND THEIR REMEDIES

* 1. Explain reason and sources of errors in voltmeter and am- meter
  2. Enlist remedial measures.
  3. Explain calibration method with standard instrument

### UNDERSTAND PRINCIPLE, TYPES AND USES OF DIGITAL METERS

* 1. Explain working principle (Block diagram)
  2. Explain types in lab use (Voltmeter, Ammeter, Ohmmeter, AVO meter, watt meter (single phase & three phase), Energy meter (single phase & three phase) and frequency meter)
  3. Enlist possible causes of errors.

### UNDERSTAND WORKING PRINCIPLE AND TYPES OF FREQUENCY METER

* 1. Explain principle of resonance type meter.
  2. Explain principle of reed type meter.
  3. Explain principle of weston type.
  4. Explain principle of digital type (Block diagram only)

### UNDERSTAND PRINCIPLE OF RESISTANCE MEASURING BRIDGES AND THEIR APPLICATION

* 1. Explain working principle of wheat stone bridge.
  2. Calculate unknown resistance using wheat stone bridge.
  3. Explain its construction and use
  4. Explain working principle of Kelvin's double bridge.
  5. Explain construction and use.
  6. Calculate resistance value using Kelvin's Bridge.

### UNDERSTAND MURRAY LOOP TEST AND ITS APPLICATION

* 1. Explain working principle
  2. Explain its use for under ground cables.
  3. Calculate fault distance using loop test.

### UNDERSTAND BLAVIOR AND EARTH OVER LAP TEST

* 1. Explain working principle of each
  2. Explain applications.

### UNDERSTAND WORKING PRINCIPLE OF INSTRUMENT TRANSFORMERS

* 1. Explain working principle of P.T with vector diagram
  2. Explain application of P.T's.
  3. Explain construction and working principle of C.T with vector diagram
  4. Explain application of C.T's.
  5. Explain angle of phase difference, standard ratio, ratings and permissible errors.
  6. Enlist possible errors and their remedies.
  7. Explain personal and instrument safety

### UNDERSTAND EFFECTS ON INSTRUMENT TRANSFORMERS

* 1. Explain effect of burden
  2. Calculate burden on C.T. and P.T.
  3. Explain effect of frequency and variable current on C.T. and P.T.
  4. Draw circuit diagrams of a loaded C.T. and P.T.

### UNDERSTAND POWER FACTOR METERS

* 1. State types with respect of supply (Single and three phase)
  2. State types with respect to construction (Dynamometer,, moving iron).
  3. Explain working principle of each type.
  4. Draw circuit diagram.

### UNDERSTAND TYPES OF TEMPERATURE MEASURING DEVICES

* 1. Explain working of resistance type device
  2. Explain working of thermocouple
  3. Explain radiation type pyrometer
  4. Explain principle of each
  5. Explain the application of each.

### KNOW ASSEMBLY AND WORKING OF LUX METER

* 1. State the types and working principle.
  2. Enlist applications.

### KNOW THE WORKING PRINCIPLE OF FET AND TRANSISTOR VOLTMETER

* 1. State the working principle of F.E.T type voltmeter and its use.
  2. State the working principle of transistor type voltmeter (Block diagram only)

### UNDERSTAND WORKING PRINCIPLE OF OSCILLOSCOPE

* 1. Explain working of Oscilloscope tube
  2. Enlist parts of Oscilloscope
  3. Explain applications for finding wave shape and frequency.

### UNDERSTAND WORKING PRINCIPLE CONSTRUCTION AND APPLICATION OF SYNCHRONOSCOPE

* 1. State types of synchrono scope
  2. State working principle of each
  3. Explain application of each type.

|  |  |  |
| --- | --- | --- |
| **44.** | **KNOW** | **WORKING PRINCIPLE OF SPEED/R.P.M MEASURING INSTRUMENTS** |
|  | 44.1 | State working principle of speed counter (Mechanical) |
|  | 44.2 | State working principle of dynamometer type speedometer |
|  | 44.3 | State working principle of electronic counter. |
|  | 44.4 | State method of use of each |

### UNDERSTAND MAXIMUM DEMAND INDICATOR AND IT USE

* 1. Explain construction and principle of working.
  2. Draw connection diagram.
  3. Explain the methods of taking and interpreting its readings.

### KNOW WORKING OF SIGNAL GENERATOR

* 1. State construction and use.
  2. State types (AF & RF)

### UNDERSTAND USE OF SIGNAL GENERATOR FOR MEASURING C. & L.

* 1. Explain use of signal generator for inductance `L' measurement
  2. Explain use of signal generator for capacitance measurement

### ET-273 ELECTRICAL INSTRUMENTS & MEASUREMENTS LIST OF PRACTICALS

Note: The students should show concern for personal and equipment safety while working in Lab. Also show safe handling of instruments.

1. a. Demonstration of Absolute & Secondary instruments.

b. Study of constructional features of tangent galvanometer and its use for finding current.

1. Demonstration of various effects used as forces in instrument (magnetic heating, electrostatic etc.)
2. Comparative study of indicating, integrating & recording instruments.
3. Study of methods of Damping forces (Air friction, fluid friction, eddy current) in instruments.
4. a. Making sketches of different types of pointers fitted on shafts with weight. b Study of hair spring their mounting on shaft tension/position adjustment.
5. Dismantling and assembling of moving iron attraction type instrument and making sketch.
6. Dismantling and assembling of permanent magnet instrument and making sketch.
7. Dismantling and assembling of moving iron repulsion type instrument and making sketch.
8. a. Study of Thermocouple, their variety and shapes used in measuring instruments.

b. Study of thermistor used for control of current.

1. Demonstration of various pyrometers and their use in measuring instruments.
2. Study of dynamometer parts and making their sketch.
3. Demonstration of shaded pole type instruments and sketch the parts and assembly.
4. a) Study of shunts and making a shunt for extending range of D.C. Am meter.

b) Study and make multiplier for extending the range of a galvanometer.

1. a) Study the parts of induction type wattmeter with their sketches.

b) Using an induction type wattmeter for measuring power of a lamp.

1. a) Study of ohm-meter, its scale and practice of using it.
2. a) Study of Avometer (analog type), its scale reading practice and use as Voltmeter and Ammeter.

b) Practice the use of A.V.O meter analog & digital for low and high resistance measurements.

1. Study of meager and practice of its use for continuity, short circuit and insulation testing.
2. Using an earth resistance tester for finding earth resistance.
3. Study of single phase energy meter and its connections, meter reading.
4. Study of three phase energy meter and its connections, meter reading.
5. Study the types of frequency meter & to use it on lines.
6. Using wheat stone bridge for resistance measurement.
7. Study of C.T. & P.T. their use with instruments & relays (A power station may also be visited).
8. Study of P.F. meter and finding power factor of all kind of loads (Resistive, Inductive Capacitive, and Mixed).
9. Connecting power factor meter for measuring PF .of an un balanced load 3-phase.
10. Study and use of LUX METER.
11. Study of Flux meter and measuring field strength.
12. Practice the use of C.R.O for displaying & measuring of Electrical quantities.
13. Study of synchrono scope and practice of using for operation of alternators in parallel.
14. Study of M.D.I meter and its use on line.
15. Measurement of capacitance & inductance.

Note: \* Industrial visits for this course are recommended.

\*\* Students must prepare theory and practical note books and get 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.

### RECOMMENDED BOOKS

1. Testing Instruments by Audel's.
2. Electrical Instruments & Measurement by E.W. Golding.
3. Electronic Measuring Instruments by G.D. Link.
4. Elect. Technology by B.L. Theraja.
5. Industrial Electrical Measurement & Instruments by Kenelm Edgeumbe.
6. Fundamentals of Electrical Measurements by C.T. Baldwin.
7. A Text Book of Electrical Engineering by S.L. Uppal.
8. Electronics for Today & Tomorrow. by Tom Duncan.
9. Electrical and Electronics Instruments and Measurements by Syed Muhammad Azeem Urdu Bazar Lahore.
10. An introduction to Electrical Instrumentation by B.A. GREGORY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ET- 253** | **A.C. MACHINES** | | | |
| **Total Contact Hours**  Theory | 128 | **T** | **P** | **C** |
| Practical | 192 | 4 | 6 | 6 |

**AIM** At the end of this course the student will be able to have an insight into the construction, working principles and behavior of machines under different operating conditions and an awareness of their losses and efficiency. The knowledge gained will form basis for carrying out repair and maintenance of these machines, an area covered in the programme concurrently.

## COURSE CONTENTS

1. **SINGLE PHASE TRANSFORMER 36 Hrs.**
   1. Definition, principle, basic parts.
   2. EMF equation, transformation ratio.
   3. Classification of transformer - core, mode of operation, use and cooling.
   4. Transformer operation (ideal) - On No load, on load, with resistive load, phasor diagram, with inductive, phasor diagram, with Capacitive load, phasor diagram.
   5. Transformer operation (Practical) - parameters, primary resistance, secondary resistance, primary leakage reactance, secondary leakage reactance, secondary, equivalent resistance, equivalent reactance referred to secondary, referred to primary, Exciting conductance and susceptance, equivalent circuit diagrams referred to primary & secondary, operation of practical transformer on load of different power factor, phasor diagram, approximate and exact voltage drop in transformer, regulation, percent resistance, reactance and impedance.
   6. Transformer losses & efficiency, Iron and copper losses. Ordinary and all - day efficiencies, maximum efficiency, cooling of transformers.
   7. Transformer tests and specifications - Insulation test, Ratio test, Polarity test, open circuit test, short circuit test, Back-to-back/Sumpner’s test.
   8. Parallel operation of 1 phase transformers
   9. Special transformers, construction, principle and use - Instrument transformers, Auto transformer (with its apparent power advantage), Welding transformer, Rotating core transformer.

## 3 -PHASE TRANSFORMER. 15 Hrs.

* 1. Construction and working of 3 phase transformer.
  2. Connection groups of 3 phase transformer, name-plate rating.
  3. Connection of single phase transformers for 3 phase & 2 phase transformation, - Star-Star, Star-Delta, Delta-Star, Delta-Delta, open Delta, Scott, Transformation of 3 phase to 6 phase & vice versa.
  4. Calculation of 3-phase transformer.

## A.C MOTORS INTRODUCTION

* 1. General. **1 Hr.**
  2. Preference of A.C motors over DC motors.
  3. Classifications.

## THREE PHASE INDUCTION MOTORS. 20 Hrs.

* 1. Production of rotating magnetic field by 3 phase & 2 phase EMFs.
  2. Construction of squirrel cage & wound rotor induction motor.
  3. Principle of rotation of S.C. rotor, synchronous speed, rotor speed, slip, frequency of rotor induced current.
  4. Motor parameters (stator resistance, reactance, rotor resistance, rotor reactance in starting & running condition. Condition for maximum starting & running torque.
  5. Power stages in induction motor, Resistance measurement, No load & blocked rotor tests to determine losses, efficiency & parameters of motor. Equivalent circuit.
  6. Starting of 3 ph induction motor.
  7. Speed control of induction motor.

## SINGLE PHASE MOTOR. 12 Hrs.

* 1. Classification.
  2. Split phase motor.
  3. Shaded pole motor.
  4. Repulsion motor.
  5. Series motor.
  6. Fan Motor as example of External Rotor motor

## SYNCHRONOUS GENERATOR. 32 Hrs.

6.1. Construction - Stator, Rotor, Armature winding (single layer, two layer, chain), Hydrogen cooling for large machines

6.2 Principle. EMF equation.

6.3. Performance of Synchronous Generator on Load.

* 1. Voltage variation on load
  2. Armature Reaction
  3. Synchronous impedance
  4. Phasor Diagram of Loaded Synchronous Generator on different power factors.
  5. Regulation & its Determination by Synchronous Impedance Method.
  6. O.C. and S.C. tests
  7. Calculation of voltage regulation
  8. Synchronization of Generator by different methods (lamp bright, lamp dark, synchroscope).
  9. Load sharing.
  10. Brushless A.C. Generator: Construction, Working & Uses.

## SYNCHRONOUS MOTOR. 12 Hrs.

* 1. Principle, construction, operation & uses of 3 phase synchronous motor
  2. Principle, construction operation, characteristics & uses of unexcited single phase synchronous motor (Reluctance & Hysteresis Motor).
  3. Permanent magnet synchronous motor – efficiency considerations and starting of motor.

## RECOMMENDED BOOKS:-

1. A.C Machines Fundamentals by J. Chapmann
2. B.L Theraja. Electrical Technology
3. Electrical Machines by V.U Bakhshi & V.A Bakhshi
4. A.C Machines by Afzal Bashir & Khalid Mahmood
5. Philips Kemp. Alternating Current Electrical Engineering
6. Drinkall Hadik Grant. Alternator Current Motors
7. Kates-Stafford. Electrical Generator
8. Coral H-Dunlop. Transformers

## ET- 253 A.C MACHINES INSTRUCTIONAL OBJECTIVES

1. **UNDERSTAND CONSTRUCTION & PRINCIPLE OF TRANSFORMER.**
   1. Define transformer as step up and step down.
   2. Describe parts of transformer.
   3. Explain principle of transformer.

1.4 a) Describe classification of transformer.

b) Differentiate core type & shell type transformer.

* 1. Derive EMF equation of transformer.
  2. Solve problems related to above.

## UNDERSTAND OPERATION OF TRANSFORMER ON NO LOAD AND LOAD.

* 1. Differentiate between ideal & practical transformer.
  2. Draw the phasor diagram of transformer on no load and load
  3. Explain components of no load primary current.
  4. Calculate energy component & magnetizing component of no load current.
  5. Explain the Inrush current when load is connected.
  6. Distinguish between primary leakage flux, & secondary leakage flux.
  7. State methods of reducing leakage flux.
  8. State the relation of current & transformation ratio rating it to KVA.

## UNDERSTAND EQUIVALENT CIRCUIT OF TRANSFORMER.

* 1. Identify the primary resistance, secondary resistance, primary reactance, secondary reactance and magnetizing - branch components
  2. Convert the parameters of primary side onto secondary and vice versa, calculating equivalent values
  3. Draw the equivalent circuit of transformer.
  4. Draw the phasor diagram of transformer loaded with resistive, inductive, capacitive load with parameters referred to (a) both sides (b) primary (c) secondary.
  5. Solve problems on equivalent circuit of transformers under different loading conditions.

## CALCULATE REGULATION OF TRANSFORMER.

* 1. Define regulation.
  2. State factors on which regulation depend.
  3. Explain the voltage drop in transformer.
  4. Derive expression for approximate voltage drop & discuss exact voltage drop.
  5. Define % Resistance, % Reactance & % Impedance.
  6. State formula for % impedance.
  7. Calculate regulation for various loading conditions.

## CALCULATE EFFICIENCY OF TRANSFORMER.

* 1. List the losses in transformer.
  2. Identify the parts in which these losses occur and the causes for the losses to occur.
  3. Define efficiency.
  4. Differentiate between commercial efficiency & all day efficiency.
  5. Calculate all day efficiency.
  6. Solve numerical on Losses & Efficiency
  7. Derive conditions for maximum efficiency and hence calculate maximum efficiency.

## UNDERSTAND TESTS OF TRANSFORMER.

* 1. List transformer tests.
  2. Describe various tests.
  3. Interpret the results of tests as parameters of equivalent circuit and components of losses.
  4. Solve numerical problems, related to open circuit test & short circuit test.

## OPERATE TRANSFORMER IN PARALLEL.

* 1. State the need of parallel operation.
  2. Describe the conditions for parallel operation and how these are fulfilled.
  3. Explain parallel operation under various conditions
  4. Solve problems on parallel operation of transformers, related to load-sharing.

## UNDERSTAND CONSTRUCTION AND WORKING OF SPECIAL PURPOSE TRANSFORMER.

* 1. Describe construction & working of special purpose transformers (such as auto- transformer, instrument transformers, welding transformer, rotating core transformer).
  2. State the uses of special purpose transformer.
  3. Describe the apparent power advantage of Auto transformer.

## UNDERSTAND CONSTRUCTION & WORKING OF 3 PHASE TRANSFORMER.

* 1. State advantages & disadvantages of 3 phase transformer over 1 phase transformer and 3-phase transformer over a bank of three phase transformers.
  2. Describe the construction of 3 phase transformer (insulation, winding arrangement, core, cooling, terminals).

## UNDERSTAND THE CONNECTION GROUPS OF 3- PHASE TRANSFORMER.

* 1. Enlist connection groups of 3 phase transformer.
  2. Explain the voltage relationships & phasor diagrams of different groups along with their application
  3. Explain the vector groups: Dd0, Yy0, Dd6, Dy11.

## A) UNDERSTAND TRANSFORMATION FROM 1 PHASE TO 2 PHASE & 3 PHASE & VICE VERSA USING SINGLE PHASE TRANSFORMERS.

**B) UNDERSTAND TRANSFORMATION OF 3 PHASE TO SIX PHASE.**

* 1. Explain with phasor diagram transformation of 1 phase to 3 phase & 2 phase by using 3/2 single phase transformer (Star-star, Delta-Delta, Star-Delta, Delta-Star, open delta, scott.)
  2. Compare different connection as mentioned above
  3. Draw diagram of different methods for obtaining 6 phase from 3- phase (Double star, double delta, diametrical)
  4. Explain the 6 phase to 3 phase transformation.

## UNDERSTAND THE COOLING METHODS OF TRANSFORMER.

* 1. State necessity of cooling of transformer
  2. List cooling methods.
  3. Explain methods of cooling
  4. State the location & function of (a) Breather (b) explosion vent (c) conservator (d) oil level indicator.
  5. Explain the construction and operation of Buchholz's Relay.

## A.C. MOTORS.

1. **COMPREHEND CONSTRUCTION AND WORKING OF A.C. SYNCHRONOUS MOTORS.**
   1. List parts of synchronous motor.
   2. Explain principle of production of rotating magnetic field
   3. Explain principle of working of synchronous motor
   4. Explain the performance of synchronous motor on load with phasor diagram
   5. Explain the effect of varying excitation on the AC line current (magnitude and phase) in synchronous Motors.
   6. Explain the significance and use of V-curves of synchronous motor
   7. Solve simple problems related to induced e.m.f., line current and PF.
   8. Explain the phenomenon of hunting
   9. State how hunting is prevented
   10. State starting methods of Synchronous motor
   11. State the field of application of synchronous motor
   12. Describe the construction & principle of unexcited synchronous motor (Reluctance & Hysteresis Motor)
   13. Compare the efficiency of a permanent magnet synchronous motor with induction motor
   14. Fan Motor as example of External Rotor motor

## COMPREHEND THE CONSTRUCTION AND WORKING OF 3 PHASE

**INDUCTION MOTORS.**

* 1. State the function of different parts of 3 phase induction motor
  2. State the principle of working of 3-phase induction motor
  3. Derive the equation relating torque, power and slip, and for the pull out torque
  4. Solve problem on the performance of induction motor relating torque, slip and power.
  5. Explain the relationship between slip and toque using slip-torque curve.
  6. Explain losses in an induction motor
  7. Calculate efficiency of induction motor for given slip and torque/power conditions.
  8. Explain blocked rotor and no-load tests.
  9. Derive parameters of equivalent circuit from tests.
  10. Explain general principles of 3 phase stator winding
  11. Define terms related to winding
  12. Classify the windings as short and full-pitched, single and double-layer, progressive and retrogressive
  13. Draw winding diagrams of typical slot pole combinations
  14. State the methods of starting of induction motor
  15. Sketch the circuit diagram of induction motor & explain its working with D.O.L. starter, Y-delta starter, Auto transformer starter
  16. Describe speed control methods

## COMPREHEND WORKING OF 1- PHASE INDUCTION MOTOR.

* 1. State the types of 1 phase Induction motor
  2. Explain principle of working of split phase, capacitor & shaded pole motor
  3. State speed control methods of 1 phase induction motor

## COMPREHEND WORKING OF COMMUTATOR MOTOR.

* 1. State different type of AC commutator motors
  2. Explain the principle of repulsion motor, a.c, series motor, universal motor
  3. Describe speed control methods of commutator motor

## UNDERSTAND BRAKING OF AC MOTORS.

* 1. Define braking
  2. Describe methods of braking of induction motor
  3. Explain the principle of braking as applied to induction motor

## SYNCHRONOUS GENERATOR

1. **UNDERSTAND THE CONSTRUCTION & CLASSIFICATION OF SYNCHRONOUS GENERATOR**.
   1. Describe the construction of alternator
   2. Classify alternators based on speed and poles (salient, smooth cylindrical).
   3. Compare rotating field type with rotating armature type
   4. List the parts with materials used
   5. State the function of each part
   6. Describe salient pole construction
   7. List types armature winding used in synchronous generator
   8. Define terms related to armature winding: pitch and pitch factors, distribution factor, single and double layer, overhang etc.
   9. Compare different armature windings
   10. Draw the winding diagrams

## UNDERSTAND THE PRINCIPLE OF SYNCHRONOUS GENERATOR

* 1. Explain the principle of alternator
  2. Derive the emf equation of synchronous generator
  3. State advantages of rotating field construction
  4. State need of exciter
  5. List various types of exciters (main, pilot & static)
  6. Explain the static excitation in synchronous generator (brush less excitation)
  7. Solve problems on equation (emf of alternator)
  8. Describe measures of wave-form improvement

## COMPREHEND THE PERFORMANCE, TESTING OF ALTERNATORS (SYNCHRONOUS GENERATOR).

* 1. State reasons for voltage variation on load
  2. State importance of voltage regulation
  3. Define regulation of synchronous generator
  4. Define synchronous impedance
  5. State the effect of synchronous impedance on terminal voltage
  6. Draw the phasor diagram for loads at different power factors
  7. Describe O.C & S.C test on alternator
  8. Calculate regulation of 1-phase and 3-phase alternator by synchronous impedance method
  9. State the importance & drawbacks of synchronous impedance method
  10. Explain phasing of 3-ph alternator in star, delta
  11. Describe hunting
  12. Calculate regulation for different load power-factors, using synchronous impedance method.

## COMPREHEND THE PROCEDURE FOR VOLTAGE CONTROL & SYNCHRONIZATION.

* 1. State the necessity of parallel operation
  2. State conditions for synchronism
  3. Explain the synchronization procedure for 3-ph and 1-ph alternators using bright lamp method, dark lamp method, synchronoscope
  4. Explain method for adjusting the loads shared by two alternators or one alternator with infinite bus bar
  5. State the voltage control of alternators using Thyristor regulator
  6. Calculate the load sharing by two alternators in parallel.

## ET- 253 A.C. MACHINES

**LIST OF PRACTICALS TRANSFORMERS**

1. Study various transformers.
2. Determination of transformation ratio.
3. Determination of polarity of 1 phase transformer.
4. Transformer winding Project I.
5. Transformer winding Project I (Contd).
6. Open circuit test.
7. Short circuit test.
8. Determination of regulation of 1 phase transformer.
9. Determination of efficiency by direct loading.
10. Determination of efficiency by back to back test.
11. Parallel operation 1 phase transformer.
12. Study and connection of auto transformer.
13. Verification of current & voltage ratio of an auto transformer.
14. Study of 3 phase transformer & its connection.
15. Transformer winding project I (Contd).
16. Connecting 3 single phase transformer in Star-Star, & Star-Delta.
17. Connecting 3 single phase transformer in Delta-Delta & Delta-Star.
18. Connecting two 1 phase transformers in open delta & in scott.
19. Transformer project I (Contd).
20. Transformer project I (Contd).
21. Parallel operation, 3 phase transformers.
22. Connect 3-phase transformers as per given vector groups (Yy0, Dd0, Dy11, Dd6)

## A.C MOTORS.

1. Verification of rotating magnetic field.
2. Study 3 phase motors.
3. Measuring starting & running currents of induction motor.
4. Study slip torque curves.
5. Determination of slip of stroboscope.
6. Connecting 3 phase motor with (a) D.O.L. (b) Auto Transformer, starters.
7. Connecting 3 phase motor with (a) Star-Delta starter & (b) 3 position push button starter.
8. Determination of efficiency of 3 phase motor.
9. Speed control by primary voltage control method & rotor resistance control method.
10. Cascade control of motor.
11. Starting of wound rotor motor.
12. Study of connection of split phase motor.
13. Study & connection of shaded pole motor.
14. Project II induction motor winding session I.
15. Study of repulsion motor.
16. Work on project II. Session II
17. Work on project II. Session III
18. Work on project II. Session IV
19. Work on project II. Session V
20. Work on project II. Session VI
21. Work on project II. Session VII
22. Work on project II. Session VIII

## SYNCHRONOUS GENERATORS

1. Study of alternator & its operation.
2. Study effect of speed on frequency.
3. Practice alternator winding.
4. Practice alternator winding.
5. Open circuit test.
6. Short circuit test.
7. Determination of voltage regulation (synchronous impedance method).
8. Parallel operation of alternators by dark lamp method.
9. Parallel operation of alternators by bright lamp method.
10. Study sharing of WATTS and VARS load of two parallel-operating alternators.
11. Study power angle with change of load.

## SYNCHRONOUS MOTORS

1. Study of operation as Synchronous motor.
2. Starting of synchronous motor using various methods.
3. Study effect of excitation on armature current & power factor.
4. Study of Torque angle with change of load.

## CONVERTERS AND RECTIFIERS

1. Study & operate motor generator set.
2. Study of brushless A.C generator.
3. Study of servomotor.

### 3.11 ET-261 APPLICATION OF COMPUTER IN ELECTRICAL TECHNOLOGY

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Total Contact Hours** | T  0 | P  3 | C  1 |  |
| Practical: 96 |  |  |  |  |

**AIM** The course aims at providing practice in the development and use of simple computer programmes in high level languages such as C++. It provides an opportunity for the use of dedicated software packages for solving electrical networks.

### LIST OF PRACTICALS

1. To use C++ as a tool for problem solving in Electrical Technology such as: -
   1. Application for the addition, subtraction, multiplication, division, and calculation of powers, roots and exponentials etc.
   2. Application for trigonometric and inverse trigonometric functions.
   3. Calculation of impedances in polar form.
   4. Calculation of impedances in rectangular form.
   5. Combination of impedances in series involving conversion from polar to rectangular and vice versa.
   6. Repeated use of rectangular to polar conversion as a part of subroutine of a file.
   7. Solution of R.L.C. series and parallel circuits.
   8. Calculation of A.C. powers, active and reactive components.
   9. Calculation for improvement of power factor.
2. Use of following computer software for developing/analyzing electrical networks:-
   1. ORCAD
   2. MULTISIM
   3. PSPICE
3. Introduction to machine language.
4. Introduction to PLC (Hardware and software).

**TEXT/REFERENCE BOOKS**

1. Introductory Circuit Analysis by Boylestad. (10th Edition)
2. C++ How to Program by Deitel and Deitel
3. Manuals for

3.1 ORCAD

3.2 MULTISIM

3.3 PSPICE

1. Introduction to PLC Controllers by Nebojsa Matic

## ET- 282 DIGITAL LOGIC DESIGN

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

**AIM** This course is aimed to provide sufficient knowledge in digital and industrial electronics so as to make the student capable of working with control systems employing this technology. Students should be able to understand and assemble functional projects in digital & logic electronics.

1. **INTRODUCTION.** 2 Hrs.
   1. Comparison of digital and analogy quantities
   2. Review of Number Systems
   3. BIT, BYTE, NIBBLE and WORD
   4. Laws and Rules Boolean Algebra

## LOGIC GATES (ALL INCLUDE LOGIC, TRUTH TABLE AND TTL CIRCUITRY) 4 Hrs.

* 1. NOT (Inverter)
  2. OR
  3. AND
  4. NAND
  5. NOR
  6. XOR
  7. XNOR
  8. Application of Gates.

## ARITHMETIC LOGIC CIRCUITS(INCLUDING LOGIC AND CIRCUITY). 3 Hrs.

* 1. Half adders
  2. Full adders
  3. Half and full subtractor
  4. Comparators

## COMBINATIONAL LOGIC AND DATA PROCESSING CIRCUITS. 3 Hrs.

* 1. Decoders
  2. BCD-to-Decimal Decoders (such as 7445)
  3. Seven-Segment Decoders and Displays
  4. Encoders(IC's such as 74147)
  5. Multiplexers and logic (IC's such as 74150)
  6. De-Multiplexers (IC's such as 74154)

## LATCHES AND FLIP-FLOPS. 4 Hrs.

* 1. RS Latch
  2. Clocked RS Flip-Flop
  3. D Flip-Flop
  4. JK Flip-Flop
  5. T-Flip-Flop

1. **CLOCKS & TIMERS.** 4 Hrs.
   1. TTL Clock
   2. 555 - astable, monostable
   3. Applications
2. **SHIFT REGISTERS.** 3 Hrs.
   1. Introduction, shift-Right and shift Left
   2. Serial in-serial out
   3. Serial-in parallel-out
   4. Parallel-in serial-out
3. **COUNTERS.** 3 Hrs.
   1. Introduction, types
   2. Asynchronous counter
   3. 2-BIT, 3-BIT, Decade, Asynchronous counter
   4. Synchronous Counter
   5. 2-BIT, 3-BIT, Decade Synchronous counters
4. **MEMORIES.** 3 Hrs.
   1. Introduction, volatile, non-volatile,
   2. ROM, Types of ROM
   3. RAM, Types of RAM

## D/A AND A/D CONVERTERS. 3 Hrs.

* 1. Introduction
  2. D/A converter
  3. A/D converter

## TEXT/REFERENCE BOOKS

1. Digital principles and applications by Albert Paul Malvino, Goutam Saha, Donald P Leach – 7th edition
2. Digital Fundamentals by FLOYD
3. Digital logic and computer design by M. Morris Mano – 5th edition

## ET- 282 DIGITAL LOGIC DESIGN

**INSTRUCTIONAL OBJECTIVES**

## KNOW BASIC TERMS RELATED TO DIGITAL ELECTRONICS.

* 1. State in a tabulated form the merits and demerits of analog & digital quantities
  2. Define basic terms related to digital electronics.

## UNDERSTAND THE WORKING OF LOGIC GATES, USING TRUTH TABLES AND TTL and CMOS CIRCUITRY.

* 1. Define the logic gates NOT, OR, AND, NAND, NOR, XOR, XNOR.
  2. Draw truth tables for the logic gates, showing symbols and equations.
  3. Explain logic gates, using TTL and CMOS circuitry.

## UNDERSTAND ARITHMETIC CIRCUITS FOR LOGIC CIRCUIT ELEMENTS.

* 1. Define elements of arithmetic logic circuits: half-adder, full-adder, subtractor, comparators.
  2. Explain the operation of arithmetic logic circuits (as above), using symbols, and block-diagram.
  3. Explain the inter-connection and inter-conversion of arithmetic logic circuits

## UNDERSTAND THE WORKING AND USES OF COMBINATIONAL LOGIC CIRCUITS, INCLUDING DATA PROCESSING CIRCUITS.

* 1. Define the terms multiplexers, demultiplexers, decoders, encoders.
  2. Explain multiplexers, using logic circuits & block-diagrams (multiplexers using IC's such as 74150).
  3. Explain Demultiplexers using block-diagrams (using IC's such as 74154).
  4. Explain using block diagram, BCD and its conversion to Decimals, using IC's, such as 7445.
  5. Explain seven segments decoders, showing block diagrams, giving examples for letters & digits.
  6. Describe the operation of combinational logic circuits as applied to data processing circuits.
  7. Explain the working of 7-segment display circuit

## UNDERSTAND FLIP-FLOPS AS ELEMENTS OF DIGITAL LOGIC CIRCUITS, USING BLOCK DIAGRAMS.

* 1. Define Latch flip-flops & triggers.
  2. State different types of flip-flops at triggers
  3. Explain various flip-flops (RS, Clocked RS, D, JK and T), using block diagrams for describing their functions.
  4. Describe the functions of Edge trigger circuits, with the help of circuit diagram.

## UNDERSTAND THE WORKING OF CLOCKS & TIMERS FOR

**APPLICATIONS IN DIGITAL LOGIC CIRCUITS.**

* 1. Define timers, clocks, enlisting their types
  2. Explain with the help of block diagram, the TTL Clock
  3. Explain 555 timer, describing its use as astable and monostable multivibrators
  4. Give examples of the use of clocks and timers for digital circuits, showing block diagrams.

## EXPLAIN THE FUNCTION OF SHIFT REGISTERS, USING BLOCK DIAGRAMS.

* 1. Define shift-registers, stating its various types
  2. Describe the function of the following shift registers, using block-diagrams:-
     1. Serial-in, serial-out (SISO)
     2. Serial-in, parallel-out (SIPO)
     3. Parallel-in, serial-out (PISO)
     4. Parallel-in, parallel-out (PIPO)
  3. Explain shift-Right and Shift-Left registers

## UNDERSTAND DIGITAL COUNTERS & CLOCK USING BLOCK DIAGRAMS.

* 1. Enlist various types of counters
  2. Describe various types of counters using block diagram (Asynchronous, synchronous).
  3. Explain working 2-BIT, 3-BIT, Decade Asynchronous Counters.
  4. Explain working of 2-BIT, 3-BIT, Decade Synchronous Counters.

## KNOWS VARIOUS TYPES OF MEMORIES.

* 1. Define various types of memories: ROM, PRM, EPROM, RAM.
  2. State memory of common memory devices in KB, MB.
  3. Know the system of memory addressing.

## UNDERSTAND INTERCONVERSION OF ANALOG AND DIGITAL SIGNALS, USING BLOCK DIAGRAMS.

* 1. State need for D/A and A/D conversion.
  2. Describe the system of D/A conversion using block diagram.
  3. Explain the system of A/D conversion, using block diagram.
  4. Give example of a simple system from analog input to analog output, using A/D & D/A converters.

## ET-282-DIGITAL LOGIC DESIGN

**LIST OF PRACTICALS**

1. Identify and verify truth tables for AND, OR, NOT Gates IC's
2. Identify and verify truth tables for NOR, NAND, XOR, XNOR, Gates IC's
3. Construct and verify truth tables for half adder, full adder, subtractor
4. Study multiplexing and demultiplexing circuits
5. Construct and verify decoder circuit using 74-series IC
6. Construct seven-segment decoder circuit and verify its function
7. Construct and verify the functions of Latch using NAND, NOR Gates.
8. Construct and verify the functions of Clocked RS Flip-Flop
9. Construct and verify the functions of D Flip-Flop
10. Construct and verify the functions of JK Flip-Flop
11. Connect a 555 IC as
    1. Astable multivibrator
    2. Monostable multivibrator
    3. Bistable multivibrator
12. Connect and observe the working of shift registers (SISO, SIPO, PISO, PIPO).
13. Identify, connect and observe working of ripple and synchronous counters
14. Connect and observe working of D/A and A/D converters
15. Assemble and observe working of frequency counter
16. Prepare project to demonstrate application of digital logic design – 4 weeks
    1. Design the project
    2. Implementation on bread board
    3. Implementation on PCB

**4. Curriculum Standards for the Third Year**

**4.1 Gen**-**311 Islamist and Pakistan Studies**

### DAE

**DAE Technology**



**Technology**

**DAE Technology**



**DAE Technology**



**DAE Technology**



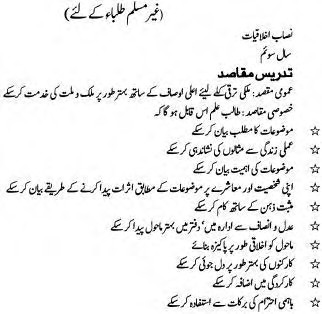
**DAE Technology**



**DAE Technology**



**DAE Technology**



**4.2 GenC-312 Chinese Synthesis -1**

**Total learning time: 96**

Theory : 48  **T P C**

Practice: 48 1.5 1.5 2

|  |  |  |  |
| --- | --- | --- | --- |
| **Course objective:** Cultivate the comprehensive Chinese ability of overseas students in China, and they can pass the HSK4 exam through this vocabulary.  **Course content** | | | |
| Learning situation | Learning content (specific work tasks) | Class hours | |
| Lesson 1 Simple love | 32 new words; Language points: not only ..... but also/still/and; Never; Just; Even if ..... also .....; On ..... | 3 hours | |
| Lesson 2 A true friend | 30 new words; Language points: Just right; Almost; Although; However; And ... | 3hours | |
| Lesson 3 The manager is very impressed with me. | 31 new words; Language points: Quite; Original; In addition; Firstly....... secondly......; No matter. | 3 hours | |
| Lesson 4 Don’t be too anxious to make money. | 31 new words; Language points: Think; Originally; And; According to; Even | 3hours | |
| Lesson 5 Buy only the right ones, not the expensive ones. | 30 new words; Language points: Affirmative; Moreover; Actual; For ......; Especially | 3hours | |
| Lesson 6 You get what you pay for | 30 new words; Language points: Actually; Times; Worthy; Among them; Under ...... | 3 hours | |
| Lesson 7 The best doctor is yourself. | 30 new words; Language points: Estimate; Can’t wait; Compound words overlap; If; Not only ..... but also ....... | 3 hours | |
| Lesson 8 There is no shortage of beauty in life. | 30 new words; Language points: Make; As long as; No; Therefore; Often. | 3 hours | |
| Lesson 9 Sunshine always appears after wind and rain. | 30 new words; Language points: Don’t; Pass; But; Results; Go! | 3 hours | |
| Lesson 10 The standard of happiness | 30 new words; Language points: However; Indeed; In the opinion of .....; Because, For example. | 3 hours | |
| Lesson 11  Reading is good, reading good books, loving reading | 30 new words; Language points: Even; Otherwise, No matter; However; At the same time. | 3hours | |
| Lesson 12  Discover the world with heart | 30 new words; Language points: And; And then Also; For; Noun quantifier overlap; contrary. | 3 hours | |
| Lesson 13  Drinking tea and watching Beijing Opera | 30 new words; Language points: General; Occasionally; By; Conduct; With. | 4hours | |
| Lesson 14  Protect mother earth | 30 new words; Language points: Enough; With; Since; Therefore; Something. | 4 hours | |
| Lesson 15  The art of teaching children | 30 new words; Language points: Remember; Make; Must; Come; About. | 4 hours | |
| **Recommended/Reference Books:** | | |  |

1. *HSK Standard Course*, edited by Jiang Liping, Beijing Language and Culture University Press, ISBN978-7-5619-3809-9.

2. *Chinese Proficiency Grading Standards for International Chinese Language Education*, compiled by State Language Commission, Beijing Language and Culture University Press, ISBN9877561957196.

|  |  |
| --- | --- |
| **Teaching objective** |  |
| 1. Quality objective: Tell Chinese stories well, convey Chinese voices, show Chinese images, and cultivate international students who know China, love China, and be friends with China.  2. Knowledge objective: Master HSK4 pronunciation, vocabulary, sentence patterns, syntax, culture and other knowledge.  3. Ability objective: Have certain listening, speaking, reading, writing skills and preliminary translation skills. Be able to conduct basically complete, coherent and effective social communication on complex topics such as daily life, study and work. |  |
|  |
| **Practice list** |  |
| |  |  |  | | --- | --- | --- | | Serial number | Learning situation | Teaching hours | | 1 | Simple love | 3 hours | | 2 | A true friend | 3 hours | | 3 | The manager is very impressed with me. | 3 hours | | 4 | Don’t be too anxious to make money. | 3hours | | 5 | Buy only the right ones, not the expensive ones. | 3 hours | | 6 | You get what you pay for. | 3hours | | 7 | The best doctor is yourself. | 3 hours | | 8 | Sunshine always appears after wind and rain. | 3 hours | | 9 | There is no shortage of beauty in life. | 3 hours | | 10 | The standard of happiness | 3hours | | 11 | Reading is good, reading good books and loving reading. | 3 hours | | 12 | Discover the world with heart | 3 hours | | 13 | Drinking tea and watching Beijing Opera | 4hours | | 14 | Protect mother earth | 4 hours | | 15 | The art of teaching children | 4 hours | |  |

**4.3 GenC-311 Chinese listening**

**Total learning time: 48**

Theory 0 **T P C**

Practice 48 0 1.5 0.5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course objective:** This lesson aims to improve Chinese learners’ listening ability in an all-round way, especially the listening ability based on daily conversations and discourse segments. As follows:  1. Be able to listen to the sound, rhyme and tone of mandarin.  2. Be able to understand mandarin and talk about common problems in daily life and study.  3. Be able to understand the basic content of the narration of things in specific context and the basic intention of the speaker.  **Course practice content:** | | | | |
| Learning situation | Learning content (specific work tasks) | Class hours | | |
| Lesson 1 See off those who depart and welcome those who arrive | Dialogue: See off those who depart and welcome those who arrive; Essay 1: Hospitality; Essay 2: Shake hands. | 1 hours | | |
| Lesson 2 Neighbours | Dialogue: neighbors; Essay 1: Several of my neighbors; Essay 2: Their home | 1hours | | |
| Lesson 3 Unlike China. | Dialogue: Unlike China; Essay 1: Knowledge of seating arrangement; Essay 2: Language of hands | 1 hours | | |
| Lesson 4 What gift is good? | Dialogue: What gift is good? Essay 1: Socialization on university campus; Essay 2: How to give gifts? | 1 hours | | |
| Lesson 5 Thank you for your birthday. | Dialogue: Thank you for your “birthday”; Essay 1: A red apple; Essay 2: Raise your hand. | 1 hours | | |
| Lesson 6 Marriage | Dialogue: Marriage; Essay 2: He is in my heart; Essay 3: Miss G’s mate selection criteria | 1 hours | | |
| Lesson 7 A “two-person” family | Dialogue: A “two-person” family; Essay 1: Go shopping with my wife; Essay 2: You can eat anything. | 1 hours | | |
| Lesson 8 Hold high hopes for one’s child | Dialogue: Hold high hopes for one’s child; Essay 1: On the education of the only child; Essay 2: Dialogue between father and son | 1 hours | | |
| Lesson 9 Mother and son. | Dialogue: Mother and son; Essay 1: Love; Essay 2: Heartbeat and life span | 1 hours | | |
| Lesson 10  Life is gone | Dialogue: Life is gone; Essay 1: Spend yesterday’s money and tomorrow’s money; Essay 2: When is the best time to buy something | 1 hours | | |
| Lesson 11  Charging | Dialogue: Charging; Essay 1: How to improve learning efficiency; Essay 2: Chop and change | 1 hours | | |
| Lesson 12 Be cheerful. | Dialogue: Be cheerful; Essay 2: About losing weight; Essay 3: New ways to lose weight | 1 hours | | |
| Lesson 13 You’d better quit. | Dialogue: You’d better quit; Essay 1: On the education of the only child; Essay 2: Dialogue between father and son | 1 hours | | |
| Lesson 14 How can I have a good rest | Dialogue: How can I have a good rest; Essay 1: Talk about “cold”; Essay 2: Mobile phones have changed our lives. | 1 hours | | |
| Lesson 15 Whose turn is it? | Dialogue: Whose turn is it?; Essay 1: A pair of pants; Essay 2: Be in a dilemma | 1 hours | | |
| Lesson 16 Discrepancy | Dialogue: Discrepancy; Essay 1: Men in East-West Dialect; Essay 2: Differences in South China | 1 hours | | |
| Lesson 17 What should I say? | Dialogue: What should I say? Essay 1: Eat another bowl; Essay 2: Unfortunate words | 1 hours | | |
| Lesson 18 Name | Dialogue: Name; Essay 1: Pen name, stage name and cybername; Essay 2: Name and translation of goods | 1 hours | | |
| Lesson 19 Change jobs | Dialogue: Change jobs; Essay 1: Ways for college students to find jobs; Essay 2: Interview | 2 hours | | |
| Lesson 20 Saying Chinese New Year | Dialogue: Say Chinese New Year; Essay 1: The origin of Spring Festival couplets; Essay 2: Stealing Spring Festival couplets | 2 hours | | |
| Lesson 21 Penguin’s love and marriage | Dialogue: Penguin’s love and marriage; Essay 1: If cheetahs participate in the Olympic Games; Essay 2: Birds | 2 hours | | |
| Lesson 22 Talk about advertising | Dialogue: Talk about advertising; Essay 1: The wonderful use of advertising; Essay 2: Public service advertisement | 2 .5hours | | |
| Lesson 23 Use of computers | Dialogue: Use of the computers; Essay 1: 5G is coming; Essay 2: Virtual School under 5G Technology | 2.5 hours | | |
| Lesson 24 Environmental Protection | Dialogue: Environmental Protection; Essay 1: Garbage classification; Essay 2: Overview of China | 2.5 hours | | |
| Lesson 25 Clothes make the man. | Dialogue: Clothes make the man; Essay 1: How much is it? Essay 2: Four seasons diet | 2.5 hours | | |
| HSK4 listening training | Listening training of HSK4 real questions | 2 hours | | |
| HSK4 listening training | Listening training of HSK4 real questions | 2 hours | | |
| HSK4 listening training | Listening training of HSK4 real questions | 2 hours | | |
| HSK4 listening training | Listening training of HSK4 real questions | 2 hours | | |
| HSK4 listening training | Listening training of HSK4 real questions | 2 hours | | |
| HSK4 listening training | Listening training of HSK4 real questions | 2 hours | | |
| HSK4 listening training | Listening training of HSK4 real questions | 2 hours | | |
| **Recommended/Reference Books:** | | |  | |
| 1. *Chinese Listening Course III*, edited by Hu Bo and Yang Xuemei, Beijing Language and Culture University Press, ISBN9787561955956.  **Teaching objective** | | | |  |
| 1. Quality objective: Tell Chinese stories well, convey Chinese voices, show Chinese images, and cultivate international students who know China, love China, and be friends with China.  2. Knowledge objective: Master the listening content of HSK4 level.  3. Ability objective: Be able to understand informal conversations or speeches involving the content of level 4 topics and tasks; Be able to avoid the influence of unnecessary repetition, pause and other factors, and accurately obtain the main information; Be able to listen to the implication and be aware of the cultural factors involved in dialogue or speech. | | | |  |
|  |

**4.4 Genc-321 Spoken Chinese**

**Total learning time 48**

Theory 0  **T P C**

Practice 48 0 1.5 0.5

|  |  |  |  |
| --- | --- | --- | --- |
| **Course objective:** This lesson aims to improve Chinese learners’ oral expression ability in an all-round way, especially their comprehensive oral expression ability based on daily conversations and discourse segments. As follows:  1. Through the training of common sentence patterns and grammatical structures, learners can form correct pronunciation and intonation.  2. Through word analysis and application, learners can skillfully use common words in intermediate Chinese.  3. Through dialogue exercises and functional project training in specific contexts, learners can communicate and express clearly, accurately and appropriately by using common sentence patterns.  4. Through situational exercises, learners can discuss general topics in social life (such as campus life, interpersonal relationships, study and work, social hotspots, etc.), and form a preliminary expression ability in paragraphs.  **Course practice content** | | | |
| Learning situation | Learning content (specific work tasks) | Class hours | |
| Lesson 1  Is there a place to eat nearby? | This lesson teaches students to learn about places to eat and play sports near their schools, and how to introduce their respective schools. | 1 hours | |
| Lesson 2 What are your plans? | This lesson teaches students how to plan after the holiday, so that students can learn how to make specific plans. | 1 hours | |
| Lesson 3  There’s nothing wrong with the wrong name | This lesson mainly teaches students how to address their friends’ families and how to address waiters; Learn how to address correctly on different occasions. | 1 hours | |
| Lesson 4  Will this work | This lesson mainly teaches students how to address strangers, and learn to address strangers correctly in any case. | 1 hours | |
| Lesson 5  Where are you from | This lesson mainly teaches students to introduce their hometown. Students can briefly introduce their hometown, climate, places of interest and population. | 1 hours | |
| Lesson 6  My hometown | This lesson mainly teaches students about the words and language points of their hometown. Students can introduce the population, weather, scenery and economy of their hometown. | 1 hours | |
| Lesson 7  Have you ever thought about working here | This lesson mainly teaches students about their plans to go or stay after graduation, and analyzes the advantages and disadvantages of going or staying. | 1 hours | |
| Lesson 8  Hometown song | This lesson mainly teaches students to learn to sing a hometown song and express their yearning for their hometown. | 1 hours | |
| Lesson 9 A working ghost | This lesson mainly teaches students that this article introduces workaholics by telling stories, a ghost who loves to work. | 1 hours | |
| Lesson 10 What are you crazy about? | This lesson mainly teaches students to learn related words, grammar points and how to introduce their own families by introducing what crazy people are in a family of three. | 1 hours | |
| Lesson 11 I want to know more Chinese students. | This lesson mainly teaches some words and grammar points related to school associations, and learns how to meet some new friends in an unfamiliar environment. | 1 hours | |
| Lesson 12 You are welcome to join | This lesson mainly teaches the process of how to apply to join a school club, and how to choose the club you want to join. | 1 hours | |
| Lesson 13 It’s my treat today | This lesson mainly teaches word-level grammar points related to hospitality, as well as the specific location and points for attention of hospitality. | 1 .5hours | |
| Lesson 14 Do you have takeout? | This lesson mainly teaches words and grammar points related to ordering takeout, and learns how to order takeout online. | 1 .5hours | |
| Lesson 15 I want to return these pants. | This lesson mainly teaches words and grammar points about goods return, and learns how to return goods in shopping malls. | 1 .5hours | |
| Lesson 16 Review | Review the course content in Lesson 1-15 | 1.5 hours | |
| Lesson 17 Please enjoy your meal. | This lesson mainly teaches grammar and words related to communication with waiters in fast food restaurants, and can correctly express their own meaning and ideas. | 1 .5hours | |
| Lesson 18 I want to rent a house. | This lesson mainly introduces the grammar and words about renting a house, and learns how to find and rent a suitable house. | 1 .5hours | |
| Lesson 19 Rent an apartment with a person of the opposite gender | This lesson mainly teaches grammar and words related to sharing with people, and learns how to find sharing people. | 1.5 hours | |
| Lesson 20 What’s to be done? | This lesson mainly teaches the planned grammar and words after graduation, so that students can have a clear understanding of their future life choices. | 1.5 hours | |
| Lesson 21 There is such a good thing in the world. | This lesson mainly teaches the matters needing attention when looking for a job, so that students can avoid being cheated when looking for a job. | 2 hours | |
| Lesson 22 How do you study? | This lesson mainly teaches grammar and vocabulary related to learning methods, and explores our own learning methods. | 2 hours | |
| Lesson 23 I like exams. | This lesson mainly teaches grammar points and words about exams, so that students can use relevant sentence patterns correctly in communication. | 2 hours | |
| Lesson 24 What new job have you found? | This lesson mainly teaches how to find a job-related grammar and words in school, so that students can use this sentence pattern correctly in communication. | 2 hours | |
| Lesson 25 I want to find a job. | This lesson mainly teaches grammar and vocabulary related to interview and job application, and learns how to apply relevant knowledge points to apply for jobs. | 2hours | |
| Lesson 26 How is your Xi’an tour arranged? | This lesson mainly teaches vocabulary and language points related to travel plans, and learns how to arrange travel plans reasonably. | 2 hours | |
| Lesson 27 Xinjiang is so fun. | This lesson introduces the climate, scenic spots, beliefs and specialties of Xinjiang. Let students know more about Xinjiang. | 2 hours | |
| Lesson 28 I usually read bestsellers. | This lesson mainly teaches grammar and words related to favorite books and best-selling books, so that students can learn to recommend books to classmates and students. | 2 hours | |
| Lesson 29 My favorite book | This lesson mainly teaches students to learn grammar and words about a favorite book, and learn to introduce a favorite book to friends. | 2 hours | |
| Lesson 30 Going home soon? | This lesson mainly teaches about the arrangement after studying in China, and recalls the most unforgettable things during studying in China. | 2 hours | |
| Lesson 31 The most unforgettable lesson | This lesson mainly teaches medical students to learn the usage of stethoscopes and the difference between the heartbeat of patients and that of normal people. | 2 hours | |
| Lesson 32 Review | Review the course content in Lesson 16-31 | 2 hours | |
|  |  |  | |
| **Recommended/Reference Books:** | | |  |

1. *Developing Chinese* - *Intermediate Speaking Course I*; Editor-in-Chief: Lu Zhiying; Press: Beijing Language and Culture University Press; ISBN:9787561930687, etc.

|  |  |
| --- | --- |
| **Teaching objective** |  |
| 1 Knowledge objective: Students master common sentence patterns and grammatical structures, correct pronunciation and intonation, common sentence patterns and grammatical structures.  2 Ability objective: Through the study of this lesson, learners can skillfully use common words in intermediate Chinese, communicate and express clearly, accurately and appropriately by using common sentence patterns, and discuss general topics in social life (such as campus life, interpersonal relationship, study and work, social hot spots, etc.), forming a preliminary expression ability in paragraphs.  3 Quality objective: Cultivate a group of international students who know, are friends of, are pro China and love China, and cultivate the ability of international students to correctly explain their views in Chinese, self-study, and actively find and solve problems. |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **4.5 EAT-311** | | **Electrical Chinese** | |  | | | |
| Total contact hours: | | | **32** | **T** | | **P** | **C** |
| Theory: | | | 32 | **1** | | **0** | **1** |
| Practice: | | | 0 |
| **AIMS:** | This course focuses on the practical application of Chinese in professional scenes, and selects the actual work materials from electrical safety, common electrical tools, instruments and meters, low-voltage electrical control system, power supply and distribution system, PLC control system and industrial robots, so as to create a real context, so that students can master the Chinese vocabulary and norms of electrical work, and be able to communicate in technical language. | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Common Expressions for Electrical safety**     1. Necessary Words for Safety Protection    2. Identification of Safety Signs    3. Electrical Safety Regulations    4. Reading Literature    5. Dialogues for Safety | | | | | 5 | | |
| 1. **Common Expressions for Common Electrical Tools & Accessories**     1. Necessary Words for Common Electrical Tools & Accessories    2. Common Phrases for Using Tools    3. Operation Standards of Safekeeping and Using of the Electrical Tools    4. Reading Literature    5. Common Dialogues for Using tools | | | | | 5 | | |
| 1. **Common Expressions for Instruments**     1. Necessary Words for Instruments    2. Common Phrases for Instrument Operation    3. Operation Specification for Instruments    4. Reading Literature    5. Common Dialogues for Instruments | | | | | 5 | | |
| 1. **Common Expressions for Low-Voltage Electrical Control System**    1. Necessary Words for Low-Voltage Electrical Control System    2. Common Phrases for Low-Voltage Electrical Control System    3. Operation Specification for Low-Voltage Control Cabinet    4. Reading Literature    5. Common Dialogues for Low-Voltage Electrical Control System | | | | | 5 | | |
| 1. **Common Expressions for PLC Control System**    1. Necessary Words for PLC Control System    2. Common Phrases for PLC Control System    3. Operation Specification for PLC Control System    4. Reading Literature    5. Common Dialogues for PLC Control System | | | | | 6 | | |
| 1. **Common Expressions for Industrial Robot**    1. Necessary Words for Industrial Robot    2. Common Phrases for Industrial Robot    3. Operation Specification for Industrial Robot    4. Reading Literature    5. Common Dialogues for Industrial Robot | | | | | 6 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Industrial Chinese - Electrical Automation Technology (basic), National Open University Press 2. Industrial Chinese - Electromechanical integration technology (basic), National Open University Press 3. Siemens S7-1200 PLC System Manual 4. Professional English for industrial robots, Zhang Mingwen, Huazhong University of science and Technology Press | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Common Expressions for Electrical safety**     1. Master the meaning and usage of necessary words related to electrical safety    2. Be able to identify the common safety signs    3. Master common electrical safety specifications    4. Understand the expression of reading literature    5. Be able to use basic safety terms for communication | | | | |  | | |
| 1. **Common Expressions for Common Electrical Tools & Accessories**     1. Master the meaning and usage of necessary words related to common electrical tools and accessories    2. Master the phrases of daily electrical tools    3. Master the storage and use specifications of daily electrical tools    4. Understand the expression of reading literature    5. Be able to communicate about the use of electrical tools | | | | |  | | |
| 1. **Common Expressions for Instruments**     1. Master the meaning and usage of necessary words related to common electrical instruments    2. Master the phrases of daily instrument operation    3. Master the operation specifications of instruments    4. Understand the expression of reading literature    5. Be able to communicate about the use of instruments | | | | |  | | |
| 1. **Common Expressions for Low-Voltage Electrical Control System**    1. Master the meaning and usage of necessary words related to low-voltage electrical control system    2. Master common operating phrases of low-voltage electrical control system    3. Master the operation specification of low voltage electrical control cabinet    4. Understand the expression of reading literature    5. Be able to communicate about the low-voltage electrical control system | | | | |  | | |
| 1. **Common Expressions for PLC Control System**    1. Master the meaning and usage of necessary words related to PLC control system    2. Master common operating phrases of PLC control system    3. Master the operation specification of PLC control system    4. Understand the expression of reading literature    5. Be able to communicate about the PLC control system | | | | |  | | |
| 1. **Common Expressions for Industrial Robot**    1. Master the meaning and usage of necessary words related to industrial robot    2. Master common operating phrases of industrial robot    3. 5.3 Master the operation specification of industrial robot    4. Understand the expression of reading literature    5. Be able to communicate about the industrial robot | | | | |  | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **4.6 EAT-322** | | **Electronic Skill Training** | |  | | | |
| Total contact hours: | | | **128** | **T** | | **P** | **C** |
| Theory: | | | 32 | **1** | | **3** | **2** |
| Practice: | | | 96 |
| **AIMS:** | Use appropriate electronic components and tools, reasonably layout and wiring, weld circuit boards with correct functions and beautiful appearance, be able to use electronic measuring instruments for testing and troubleshooting of common electronic circuits, and be able to use circuit design methods for circuit design.   1. Enable to properly used common electronic instruments. 2. Enable to recognize and draw simple electronic circuit drawing. 3. Enable to install and debug simple electronic circuit drawing. 4. Enable to design simple electronic circuit drawing. | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Manufacture of LED Light Control Lamp**     1. Electronic circuit composition    2. Diode and triode    3. Electronic circuit diagram    4. Assemble component on strip board / PCB | | | | | 6 | | |
| 1. **Manufacture and Debugging of Adjustable Regulated Power Supply**     1. Working principle of rectification, filtering and voltage stabilization    2. Electronic circuit commissioning method    3. Fabrication of regulated power supply    4. Measurement of AC and DC parameters    5. Troubleshooting a project | | | | | 4 | | |
| 1. **Fabrication of Square Wave Generator**     1. Operational amplifier    2. Manual welding / disassembly welding    3. Printed circuit board    4. Assembly of common electronic components    5. Use of oscilloscope    6. Schematic drawing    7. PCB fabrication, layout, wiring | | | | | 6 | | |
| 1. **Manufacture of Electronic Doorbell**     1. The 555 timer    2. Mono-stable trigger    3. Integrated circuit identification    4. Electronic simulation | | | | | 4 | | |
| 1. **Design and Manufacture of Three Person Voting Device**     1. Design method of combinational logic circuit    2. And gate, or gate and not gate | | | | | 6 | | |
| 1. **Making of Digital Clock**     1. Sequential logic circuit design method    2. Working principle of counter    3. Modular design    4. Project evaluation | | | | | 6 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Analog electronic technology 2. Digital electronic technology 3. Integrated course of Electronic Technology Teaching 4. Electronic technology training course | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Manufacture of LED Light Control Lamp**    1. Understand the basic electronic circuit configuration    2. Master the working principle and parameters of diodes. / Master the working principle and parameters of the transistor    3. Be able to draw drawings of electronic circuits    4. Be able to assemble correctly component on strip board / PCB | | | | |  | | |
| 1. **Manufacture and Debugging of Adjustable Regulated Power Supply**     1. Understand the function and principle of rectification, filtering and voltage stabilization    2. Master the function of electronic circuit commissioning method    3. Be able to fabricate regulated power supply    4. Be able to Measure AC and DC parameters    5. Master circuit troubleshooting methods | | | | |  | | |
| 1. **Fabrication of Square Wave Generator**     1. Understand the principle of Operational amplifier    2. Be able to solder/disassemble weld by hand    3. Learn about the structure of a printed circuit board    4. Master the assembly method of common electronic component    5. Be able to draw circuit schematics correctly with AD software    6. Ability to PCB fabrication, layout, wiring | | | | |  | | |
| 1. **Manufacture of Electronic Doorbell**     1. Understand the principle of the 555 timer    2. Understand the principle of monostable trigger    3. Master the method of integrated circuit identification | | | | |  | | |
| 1. **Design and Manufacture of Three Person Voting Device**     1. Understand design method of combinational logic circuit    2. Master the working principle of and gate, or gate and not gate | | | | |  | | |
| 1. **Making of Digital Clock**     1. Sequential logic circuit design method    2. Master the working principle of counter    3. Master the method of modular design    4. Master the method of project evaluation | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. Look at the diagram to build a simple electronic circuit and debug it 2. Fabricate regulated power supply 3. Fabrication of square wave generator 4. Manufacture of electronic doorbell 5. Design and manufacture of three person voting device 6. Making of digital clock | | | | | 8  16  16  16  16  24 | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EAT-332** | | **4.7 Installation and maintenance of electrical control system** | |  | | | |
| Total contact hours: | | | **128** | **T** | | **P** | **C** |
| Theory: | | | 32 | **1** | | **3** | **2** |
| Practice: | | | 96 |
| **AIMS:** | This course takes three-phase asynchronous motor as the controlled object. By learning the working principle of common low-voltage electrical components, students can accurately select and use various common low-voltage electrical components. Skilled complete the design, installation and commissioning of various common electrical control systems. Skilled use multi-meter to detect and maintain electrical control system.   1. Be able to accurately select low-voltage electrical components 2. Be able to accurately design common electrical control systems and be skilled in installation and commissioning Enable to design and debug servo motor drive control 3. Be able to skillfully use multi-meter to detect and repair electrical control system | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Common low voltage apparatus**    1. Function and classification of low voltage apparatus    2. Contactor    3. Relay    4. Common switching appliances    5. Fuse    6. Master appliance    7. Actuator    8. Troubleshooting of common low voltage electrical appliances | | | | | 9 | | |
| 1. **One way operation control of three-phase asynchronous motor**    1. Safe use of electricity and electric shock rescue    2. Drawing rules and common symbols of electrical control system diagram    3. Three phase asynchronous motor inching electrical control    4. Electrical control of one-way continuous operation of three-phase asynchronous motor    5. Usage of multi-meter | | | | | 5 | | |
| 1. **Forward and reverse rotation control of three-phase asynchronous motor**    1. Electrical control of single interlock forward and reverse rotation of three-phase asynchronous motor High speed counter instruction    2. Electric control of double interlock forward and reverse rotation of three-phase asynchronous motor | | | | | 4 | | |
| 1. **Starting and braking control of three-phase asynchronous motor**    1. Electrical control of Y-D step-down starting of three-phase asynchronous motor    2. Electric control of three-phase asynchronous motor braking    3. Electrical control of two speed motor | | | | | 6 | | |
| 1. **Travel and sequence control**    1. Main contents and general procedures and basic principles of electrical control system design    2. Design steps and methods of electrical principle circuit    3. Electrical control of automatic shuttle movement    4. Electric control of automatic feeding of heating furnace    5. Electrical control of belt conveyor | | | | | 8 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Factory electrical control equipment and skill training (Second Edition), Tian Shuzhen, Machinery Industry Press 2. Motors and drives (Third Edition), Xu Xiaofeng, Higher Education Press 3. Factory electrical control technology, Zhang Yunbo, Higher Education Press | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Common low voltage apparatus**    1. Master the classification method of low-voltage electrical appliances    2. Master the type, function and use method of contactors and be able to select them accurately    3. Master the functions and application methods of various relays and be able to select them accurately    4. Master the functions and use methods of various switching appliances and be able to select them accurately    5. Master the type, function and use method of fuse and be able to select accurately    6. Master the functions and use methods of various master appliances and be able to select them accurately    7. Master the common faults of various low-voltage electrical appliances | | | | |  | | |
| 1. **One way operation control of three-phase asynchronous motor**    1. Master the precautions for safe use of electricity； Be able to skillfully carry out electric shock rescue according to the electric shock situation    2. Master the commonly used graphic symbols and text symbols in electrical diagrams; Master the drawing rules of electrical schematic diagram    3. It can accurately install and control the inching electrical control circuit of three-phase asynchronous motor    4. It can accurately install and debug the electrical control circuit of three-phase asynchronous motor with one-way continuous operation    5. Be able to skillfully use multi-meter to detect and repair the faults of electrical control circuit | | | | |  | | |
| 1. **Forward and reverse rotation control of three-phase asynchronous motor**    1. It can accurately install, debug and troubleshoot the single interlock forward and reverse electrical control circuit of three-phase asynchronous motor    2. It can accurately install, debug and troubleshoot the double interlock forward and reverse electrical control circuit of three-phase asynchronous motor | | | | |  | | |
| 1. **Starting and braking control of three-phase asynchronous motor**    1. It can accurately install, debug and troubleshoot the electrical control circuit of Y-D step-down starting of three-phase asynchronous motor    2. It can accurately install, debug and troubleshoot the electrical control circuit of reverse braking of three-phase asynchronous motor    3. It can accurately install, debug and troubleshoot the electrical control circuit of the two speed motor that automatically converts according to the principle of time | | | | |  | | |
| 1. **Travel and sequence control**    1. Master the main contents, general procedures and basic principles of electrical control system design    2. Master the design method of electrical principle circuit    3. According to the control requirements, realize the design, installation, commissioning and troubleshooting of the electrical control circuit of automatic round-trip movement    4. According to the control requirements, realize the design, installation, commissioning and troubleshooting of the electric control circuit for automatic feeding of the heating furnace    5. According to the control requirements, realize the design, installation, commissioning and troubleshooting of the electrical control circuit of the belt conveyor | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. Detection of common low voltage electrical components 2. Installation and debugging of three-phase asynchronous motor inching electric control circuit 3. Installation, debugging and troubleshooting of electrical control circuit for one-way continuous operation of three-phase asynchronous motor 4. Installation, debugging and troubleshooting of single interlock forward and reverse electrical control circuit of three-phase asynchronous motor 5. Installation, debugging and troubleshooting of double interlock forward and reverse electrical control circuit of three-phase asynchronous motor 6. Installation, commissioning and troubleshooting of electrical control circuit for Y-D step-down starting of three-phase asynchronous motor 7. Installation, debugging and troubleshooting of electric control circuit for reverse braking of three-phase asynchronous motor 8. Installation, debugging and troubleshooting of electrical control circuit of two speed motor 9. Design, installation, debugging and troubleshooting of electric control circuit for automatic shuttle movement 10. Design, installation, commissioning and troubleshooting of electric control circuit for automatic feeding of heating furnace Design and debug of reciprocating motion control system of ball screw sliding table 11. Design, installation, commissioning and troubleshooting of electrical control circuit of belt conveyor | | | | | 10  2  6  8  8  10  6  8  12  12  14 | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Gen-331** | | **4.8 Introduction to Artificial Intelligence** | |  | | | |
| Total contact hours: | | | **54** | **T** | | **P** | **C** |
| Theory: | | | 16 | **0.5** | | **1.5** | **1** |
| Practice: | | | 48 |
| **AIMS:** | Through the study and training of this course, cultivate students' concept of "intelligence"; Enable students to understand the basic theories, methods and technologies of artificial intelligence, and improve the ability to use intelligent products; Enhance students' logical thinking and experimental ability, and lay a foundation for developing high-level AI technology applications in their respective fields in the future.   1. Systematically understand the brief history of AI development and master the basic ideas and concepts of AI. 2. Systematically understand the specific application scenarios and functions of AI in all walks of life, and master the basic concepts and knowledge of AI. 3. The system grasps the specific application of artificial intelligence methods and technologies, and can correctly understand the methods of machine learning and reinforcement learning. | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Introducing Artificial Intelligence** 2. Artificial intelligence in movies 3. The development history of artificial intelligence 4. The future development trend of artificial intelligence | | | | | 2 | | |
| 1. **Artificial Intelligence Application** 2. The application of artificial intelligence in security protection 3. The application of artificial intelligence in security protection 4. The application of artificial intelligence in intelligent customer service 5. Application of artificial intelligence in automatic driving | | | | | 3 | | |
| 1. **The python foundation of artificial intelligence** 2. Python basic string talk 3. Data types and basic operations 4. Flow control statement 5. Waffle board usage and instructions 6. Waffle programming interface introduction | | | | | 3 | | |
| 1. **Artificial intelligence case realization--Little mathematician** 2. Case Introduction 3. Image distribution of trigonometric functions 4. Machine learning application development process | | | | | 4 | | |
| 1. **Artificial intelligence case realization--Boxing coach** 2. Case Introduction 3. Angular velocity and acceleration 4. Attitude sensor introduction | | | | | 4 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Artificial Intelligence Application Xiao Zhengxing Nie Zhe Higher Education Press 2. Fundamentals of artificial intelligence application Hu Ling, Xu Weijin China Railway Press Co., Ltd | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Introducing Artificial Intelligence**     1. Understand the basic definition of AI and its application in movies    2. Systematically understand the development history of artificial intelligence    3. Understand the future development trend of artificial intelligence | | | | |  | | |
| 1. **Artificial Intelligence Application**     1. Understand the changes and impacts of artificial intelligence on modern life    2. Familiar with the application and penetration of artificial intelligence in security, medical treatment, intelligent customer service, driverless, etc. | | | | |  | | |
| 1. **The python foundation of artificial intelligence** 2. Master the basic grammar of Python 3. Familiar with the use of waffle development board 4. Familiar with waffle programming interface | | | | |  | | |
| 1. **Artificial intelligence case realization--Little mathematician**     1. Understand the concept of knowledge representation and knowledge atlas, production representation, frame representation, state space representation, and representation of knowledge atlas    2. Understand machine learning, scope, learning methods and challenges of machine learning | | | | |  | | |
| 1. **Artificial intelligence case realization--Boxing coach**     1. Understand artificial neural network, neuron and deep learning    2. Understand computer vision, image and video recognition, pattern recognition, language recognition and biometric recognition    3. Understand the working principle of attitude sensor and master the application of attitude sensor in human motion analysis | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. Discussion on Artificial Intelligence 2. AI project experience in the training room 3. Communicate with Xiao Ai 4. Experience iFLYTEK AI translation 5. Experience Baidu artificial intelligence 6. Waffle board draws interesting graphics   ·Introduction to the use of turtle drawing module  ·Drawing polygons and multi-pointed stars  ·Draw complex graphics   1. Waffle board realizes BMI calculator   ·Screen printout  ·Write a complete BMI calculator   1. Draw function graph 2. Collect data set 3. Train and export the model 4. Deployment model 5. Recognize the punch 6. Collect data set 7. Train and export the model 8. Deployment model 9. Boxing action matching | | | | | 2  2  2  2  2  2  6  2  4  2  4  4  2  4  4  4 | | |

**GenC-342 4.9 Chinese Synthesis -2**

**Total learning time: 96**

Theory: 48 T P C

Practice: 48 1.5 1.5 2

|  |  |  |  |
| --- | --- | --- | --- |
| **Course objective:**Cultivate the comprehensive Chinese ability of foreign students in China, and pass the HSK4 examination through the study of the course.  **Course content** | | | |
| Learning situation | Learning content (specific task) | Class hours | |
| Lesson 1  Life can be better | 30 new words; Language points: Yes; I’m afraid; to the end; Take for example; Dare. | 2 hours | |
| Lesson 2  Man and nature | 30 new words; Language points: Just; Do; Times; For…, do…; Still. | 2 hours | |
| Lesson 3  Technology and the world | 30 new words; Language points: Yes or no; cannot bear sth; next; in addition to; take…as… | 3 hours | |
| Lesson 4  The taste of life | 30 new words; Language points: interrogative pronouns are used flexibly to express any reference; Upper; Come out; in general; lie in. | 3 hours | |
| Lesson 5  Scenery on the road | 30 new words; Language points: v+ ing +v+ ing; I Just; Exactly? Get up; V+ up. | 3 hours | |
| HSK4 simulation training 1 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 2 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 3 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 4 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 5 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 6 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 7 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 8 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 9 | Explanation of HSK4 real examination questions | 3.5hours | |
| HSK4 simulation training 10 | Explanation of HSK4 real examination questions | 3.5hours | |
| **Recommended/Reference Books:** | | |  |

1. *HSK Standard Course*, edited by Jiang Liping, Beijing Language and Culture University Press, ISBN978-7-5619-3809-9.

|  |  |
| --- | --- |
| 2. *Chinese Proficiency Grading Standards for International Chinese Language Education*, compiled by State Language Commission, Beijing Language and Culture University Press, ISBN9877561957196.  **Teaching objective** |  |
| 1. Quality objective: Tell Chinese stories, convey Chinese voice, display Chinese image, and cultivate international students who know, love and love China.  2. Knowledge objective: Master HSK4 phonetics, vocabulary, sentence patterns, syntax, culture and other knowledge.  3. Ability objective: Have certain listening, speaking, reading and writing skills and preliminary translation skills. Be able to conduct basically complete, coherent and effective social communication on complex topics such as daily life, study and work. |  |
|  |
| **Practice list** |  |
| |  |  |  | | --- | --- | --- | | Serial number | Learning situation | Teaching hours | | 1 | Life can be better | 2 hours | | 2 | Man and nature | 2 hours | | 3 | Technology and the world | 3 hours | | 4 | The taste of life | 3 hours | | 5 | Scenery on the road | 3 hours | | 6 | HSK4 real examination training | 3.5 hours | | 7 | HSK4 real examination training | 3.5 hours | | 8 | HSK4 real examination training | 3.5 hours | | 9 | HSK4 real examination training | 3.5 hours | | 10 | HSK4 real examination training | 3.5 hours | | 11 | HSK4 real examination training | 3.5 hours | | 12 | HSK4 real examination training | 3.5 hours | | 13 | HSK4 real examination training | 3.5 hours | | 14 | HSK4 real examination training | 3.5 hours | | 15 | HSK4 real examination training | 3.5 hours | |  |

**GenC-352 4.10 Chinese Reading and Writing**

**Total learning time 48**

Theory 0 T P C

Practice 48 0 1.5 0.5

|  |  |  |  |
| --- | --- | --- | --- |
| **Course objective:**  This lesson aims to comprehensively develop and improve learners’ Chinese language ability, Chinese communication ability, Chinese comprehensive application ability, Chinese learning interest and Chinese learning ability.  1. Through the standardized teaching of Chinese, Chinese characters and related cultural knowledge, as well as scientific and systematic language skills training such as listening, speaking, reading and writing, the learners’ ability to distinguish and match the forms and meanings of Chinese elements (pronunciation, Chinese characters, vocabulary and grammar) is comprehensively cultivated and improved.  2. The ability to accurately receive and output Chinese information in specific texts, contexts and social and cultural conventions.  3. Be able to use Chinese to express orally and in writing appropriate discourse situations and discourse features;  4. With the help of the textbook content and its teaching implementation, the learners’ Chinese learning motivation and autonomous learning ability are constantly strengthened.  **Course practice content** | | | |
| Learning situation | Learning content (specific work tasks) | Class hours | |
| Lesson 1 Learn as soon as you can. | This lesson mainly teaches the grammar and vocabulary related to *You can learn as soon as you can*, reads and understands China decades ago, and learns the significance of “if it comes, it will be easy”. | 3 | |
| Lesson 2 Travel around the world | This lesson mainly teaches the grammar and vocabulary related to *Travel around the world*, reads and understands the words related to “self-help”, and learns the significance of “where there is a will, there is a way”. | 3 | |
| Lesson 3 Open a window. | This lesson mainly teaches grammar and vocabulary related to *Open a window*, reads and understands “China’s Time-honored Brand”, “Fair Price” and “Famous Tobacco and Alcohol”, and learns the significance of “seeing is believing”. | 3 | |
| Lesson 4 Be interested in everything. | This lesson mainly teaches grammar and vocabulary related to *Be interested in everything*, reads and understands the importance and significance of life, and learns the significance of “a young idler, an old beggar”. | 3 | |
| Lesson 5 The Yellow River has ninety-nine bends | This lesson mainly teaches grammar and vocabulary related to *The Yellow River has ninety-nine bends*, reads and understands slogans and meanings of different times, and learns the important significance of “I don’t know the true face of Lushan Mountain, only because I am in this mountain”. | 3 | |
| Lesson 6 It won’t change for a while. | This lesson mainly teaches grammar and vocabulary related to *It won’t change for a while*, reads and understands the meaning of ancient Chinese architecture and plaques, and learns the significance of “the waves behind the Yangtze River push the waves ahead, and each generation is stronger than the other”. | 3 | |
| Lesson 7 Who stole my days? | This lesson mainly teaches grammar and vocabulary related to *Who stole my days*, reads and understands the meaning of “being fair and square”, and learns the significance of “spring is the plan of a year, morning is the plan of a day, and diligence is the plan of a lifetime”. | 3 | |
| Lesson 8 Development is the last word | This lesson mainly teaches the grammar and vocabulary related to *Development is the last word*, reads and understands the traditional calligraphy of ancient Chinese celebrities, and learns the significance of “the weather is inferior to the geographical location, and the geographical location is inferior to the harmony between people”. | 3 | |
| Lesson 9 Wait for me to call back at home. | This lesson mainly teaches the grammar and vocabulary related to *Wait for me to call back at home*, reads and understands the meaning of the school motto of Beijing Normal University, and learns the significance of “people who have no foresight must have immediate worries”. | 3 | |
| Lesson 10  There is a wisdom called the golden mean. | This lesson mainly teaches the grammar and vocabulary related to “There is a wisdom called the golden mean”, reads and understands the differences between foreigners’ signatures and Chinese signatures, and learns the significance of “different people have different views on the same thing”. | 3 | |
| Lesson 11 Learn Chinese well before going home. | This lesson mainly teaches grammar and vocabulary related to “Learn Chinese well before going home”, reads and understands the meaning of “inscription”, and learns the great significance of “He who knows others is clever, and he who knows himself is wise; He who wins others is strong, and he who wins himself is powerful”. | 3 | |
| Lesson 12 I have a wish in my heart. | This lesson mainly teaches grammar and vocabulary related to “I have a wish in my heart”, reads and understands the meaning of “restaurant” and “wineshop”, and learns the significance of “what you do not wish upon yourself, extend not to others”. | 3 | |
| Lesson 13 Feeling better and better. | This lesson mainly teaches grammar and vocabulary related to “Feeling better and better”, and reads and understands what to do in that department of the school after coming to China. Learn the significance of “the sea is wide with fish leaping, and the sky is high with birds flying”. | 3 | |
| Lesson 14 Action is better than heart | This lesson mainly teaches grammar and vocabulary related to “Action is better than heart”, reads and understands how to register if you are ill in China, and learns the significance of “reading thousands of books and traveling thousands of miles”. | 3 | |
| Lesson 15 I love China for the tip of my tongue | This lesson mainly teaches the grammar and vocabulary related to “I love China for the tip of my tongue”, reads and understands the significance and customs of Chinese traditional culture, such as Spring Festival couplets, and learns the significance of “our life has a limit but knowledge has none”. | 3 | |
| Lesson 16 | Review the course content in Lesson 1-15 | 3 | |
| **Recommended/Reference Books:** | | |  |

1. *Developing Chinese* - *Elementary Reading and Writing Course II*; Editor-in-Chief: Li Quan, Wang Shuhong, Yao Shujun; Press: Beijing Language and Culture University Press; ISBN:9787561934616, etc.

|  |  |
| --- | --- |
| **Teaching objective** |  |
| 1. Knowledge objective: Students master basic Chinese knowledge such as characters, words, phrases, sentences, paragraphs and discourses. Through standardized teaching of Chinese, Chinese characters and related cultural knowledge, they can master scientific and systematic language skills training such as listening, speaking, reading and writing.  2. Ability objective: Through the study of this lesson, comprehensively develop and improve learners’ Chinese language ability, Chinese communication ability, Chinese comprehensive application ability, Chinese learning interest and Chinese learning ability; Cultivate and improve learners’ ability to distinguish and match the forms and meanings of Chinese elements (pronunciation, Chinese characters, vocabulary and grammar) in an all-round way.  3. Quality objective: Cultivate a group of international students who know China, are friends with China, pro China and love China, and cultivate the ability of international students to correctly explain their views in Chinese, self-study and actively discover and solve problems. |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EAT-342** | | **4.11 Industrial Robot Technology** | |  | | | |
| Total contact hours: | | | **112** | **T** | | **P** | **C** |
| Theory: | | | 16 | **0.5** | | **3** | **1.5** |
| Practice: | | | 96 |
| **AIMS:** | Through the study of this course, students can systematically master the system structure of ABB industrial robots, the use of teaching aids, the creation of industrial robot coordinate system, i/o communication configuration, apply the instructions of industrial robots such as MoveL, MoveC, MoveJ to realize the functions of triangular trajectory, circular trajectory, handling, PCB patch, etc., and be proficient in industrial robot system recovery and backup, revolution counter update, system maintenance, etc. Lay a good theoretical and technical foundation for follow-up study and work. | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **industrial robot system cognition**     1. Structural cognition of industrial robots    2. On off operation and emergency stop recovery of industrial robots    3. Safety knowledge of industrial robots    4. Daily maintenance of industrial robots | | | | | 2 | | |
| 1. **Basic operation of industrial robot teaching pendant**     1. Know ABB Robot teaching device    2. Main menu operation interface of teaching pendant    3. Common parameter settings of teaching pendant    4. Backup and recovery of industrial robot system | | | | | 2 | | |
| 1. **Use of industrial robot operation mode**     1. Operation mode and parameter setting of industrial robot    2. Uniaxial motion    3. Linear motion    4. Repositioning motion | | | | | 3 | | |
| 1. **Industrial robot coordinate system**     1. Types of industrial robot coordinate systems    2. Establishment and application of tool coordinate system    3. Establishment and application of work piece coordinate system | | | | | 3 | | |
| 1. **I/O communication of industrial robots**     1. Configuration of standard I/O board of industrial robot    2. I/O signal configuration of industrial robot    3. Industrial robot I/O signal simulation and shortcut key setting | | | | | 3 | | |
| 1. **Basic programming instructions and applications of industrial robots**     1. RAPID program and its establishment    2. Application of MoveAbsJ instruction    3. Application of MoveJ and MoveL instructions    4. Application of MoveC instruction    5. Definition and assignment of program data    6. Logical judgment instruction    7. Program call and set / reset instructions    8. Application of offset function | | | | | 3 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Industrial robot operation and programming, zhangchunzhi Higher Education Press 2. Programming and operation of industrial robots, panying University of Electronic Science and Technology Press 3. Robot studio Chinese Manual | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **industrial robot system cognition**     1. It can accurately analyze the structure and important components of industrial robot system    2. Accurately carry out on-off operation and emergency stop recovery of industrial robots    3. Able to use industrial robots safely    4. It can accurately carry out the daily maintenance of industrial robots | | | | |  | | |
| 1. **Basic operation of industrial robot teaching pendant**     1. Skilled use robot teaching device    2. Skilled operate the robot teaching pendant main menu    3. Skilled set the time parameters and language parameters of the robot teaching pendant    4. Accurately backup and restore the robot system | | | | |  | | |
| 1. **Use of industrial robot operation mode**     1. It can accurately set the operation mode and common parameters of industrial robots    2. It can accurately realize the uniaxial motion of industrial robots    3. It can accurately realize the linear motion of industrial robots    4. It can accurately realize the relocation movement of industrial robots | | | | |  | | |
| 1. **Industrial robot coordinate system**     1. Accurately understand the characteristics of each coordinate system of industrial robot    2. Be able to accurately establish the tool coordinate system and verify it    3. Be able to accurately establish the work piece coordinate system and verify it | | | | |  | | |
| 1. **I/O communication of industrial robots**    1. It can accurately configure the standard I/O board of industrial robots    2. It can accurately configure industrial robot I/O signals    3. It can accurately simulate i/o signals and set shortcut keys | | | | |  | | |
| 1. **Basic programming instructions and applications of industrial robots**    1. Be able to accurately establish rapid programs and program modules    2. It can use MoveAbsJ command to adjust robot posture    3. Be able to use MoveJ instruction and MoveL instruction to write programs    4. Be able to write programs with MoveC instructions    5. Be able to accurately establish various program data and skilled use assignment instructions    6. Be able to use logical judgment instructions to write programs    7. Be able to accurately use program call and set / reset instructions    8. Write programs accurately using offset functions | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. On off operation and emergency stop recovery of industrial robots 2. Using robot teaching pendant 3. Time parameter and language parameter setting of robot teaching pendant 4. Backup and recovery of industrial robot system 5. Industrial robot revolution counter update 6. Operation mode and parameter setting of industrial robot 7. Operate the robot for single axis motion 8. Operate the robot for linear motion 9. Operate the robot for relocation movement 10. Establish tool coordinate system and adjust tool attitude 11. Establish work piece coordinate system and adjust tool attitude 12. Configuration of DSQC652 industrial robot standard i/o board 13. I/O signal configuration of industrial robot 14. Industrial robot i/o signal simulation operation and shortcut key setting 15. Establish RAPID program and program module 16. Draw a triangle 17. Draw a circle 18. Robots use different tools according to different i/o signals 19. Chip assembly 20. Handling and stacking | | | | | 2  2  2  2  4  2  4  2  4  4  4  2  4  4  2  6  6  8  16  16 | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EAT-351** | | **4.12 The Design of Intelligent Product Based on Arduino** | |  | | | |
| Total contact hours: | | | **64** | **T** | | **P** | **C** |
| Theory: | | | 16 | **0.5** | | **1.5** | **1** |
| Practice: | | | 48 |
| **AIMS:** | Adopting Arduino IDE controls the essential components, such as LED, key switch, nixie tube， LCD, steering gear and temperature sensor etc. , through the study on Arduino technology and the hardware and software design methods. Enable to properly used Micro850 controller   1. Master the use of the Arduino kit 2. Master the basic programming syntax of Arduino 3. Enable to design and manufacture of electronic products with Arduino platform | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Introduction of Arduino**     1. What is Arduino    2. The hardware composition    3. Arduino IDE | | | | | 2 | | |
| 1. **Coloured Flashing LED Lights**     1. The circuit design of coloured lights with buttons    2. Breath lights | | | | | 4 | | |
| 1. **Display of Digital Tube（Interesting Dice）**    1. Display of numbers    2. Digital dice | | | | | 2 | | |
| 1. **Adopting Arduino Controls Motor**     1. Adopting Arduino controls Dc motor    2. Steering gear | | | | | 2 | | |
| 1. **Arduino Control LCD**     1. Character Display    2. Manufacture of Electronic Clock | | | | | 3 | | |
| 1. **Serial Communication Base on Arduino**     1. Serial Communication    2. Control LED Lamp through Serial Communication | | | | | 3 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Arduino Development from Beginning to Practice 2. Arduino development practice guide | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Introduction of Arduino**     1. Master the hardware composition    2. Understand Arduino IDE    3. Master basic operations of Arduino | | | | |  | | |
| 1. **Coloured Flashing LED Lights**     1. Master the structure and usage with function: digitalWrite()    2. Be able to write and analyze the control program of colorful LED lights    3. Master the structure and usage with function: pinMode()    4. Master the structure and usage with function: digitalRead()    5. Be able to build and debug button-circuit    6. Be able to write and analyze the control program of breath lights | | | | |  | | |
| 1. **Display of Digital Tube(Interesting Dice)**    1. Master the structure and usage with sevseg library and functions    2. Master the working principle of multi-digit digital tube    3. Master code writing and analysis of digital tube    4. Understand code optimization and testing of digital tube    5. Master the structure and usage with mapping function map()    6. Master the structure and usage with random function random()    7. Master the structure and usage with random seed function randomSeed()    8. Be able to simulate/make/tes/improve t the digital dice circuit using Protues | | | | |  | | |
| 1. **Adopting Arduino Controls Motor**     1. Understand the working principle of DC motor    2. Understand the mgain parameters of DC motor    3. Understand code writing of steering gear control    4. Be able to make and debug the steering gear control circuit | | | | |  | | |
| 1. **Arduino Control LCD**     1. Understand invoking commands for library function    2. Be able to construct and debug the electronic clock circuit | | | | |  | | |
| 1. **Serial Communication Base on Arduino**     1. Understand of serial communication code    2. Be able to transmit data with computer | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. Basic operations of Arduino 2. Make colorful flashing LED lights 3. Write and analyze the control program of colorful LED lights 4. Write and analyze the control program of Key controled LED lights 5. Write and analyze the control program of breath lights 6. Code writing and analysis of digital tube 7. Code optimization and testing of digital tube 8. Making and testing of key plus 1 circuit 9. Code implementation and parsing of digital dice 10. Mini fan production and debugging 11. Steering gear detection 12. Making and debugging of steering gear control circuit 13. Display basic characters 14. Construction and debugging of electronic clock circuit 15. Detection of temperature sensor and humidity sensor 16. Compilation and analysis of serial communication code 17. Connect and debug the circuit for serial communication control LED lamp | | | | | 2  2  2  2  2  2  4  2  2  4  4  2  4  2  4  4  4 | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EAT-362** | | **4.13 Installation and Commissioning of PLC Control System** | |  | | | |
| Total contact hours: | | | **128** | **T** | | **P** | **C** |
| Theory: | | | 32 | **1** | | **3** | **2** |
| Practice: | | | 96 |
| **AIMS:** | Through the study of this course, students can systematically master the basic principle, instruction system, programming method of Siemens programmable controller (PLC), initially have the ability to use PLC to design, install and debug the automatic control system, and lay a good theoretical and technical foundation for the follow-up study of related professional courses. | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Introduction to S7-1200 PLC**     1. CPU products and functional features of S7-1200 PLC    2. Hardware structure and installation wiring of S7-1200 PLC    3. Installation and interface introduction of TIA Portal software    4. Configuration, simulation and debugging of S7-1200 PLC    5. Working principle and data type of S7-1200 PLC | | | | | 6 | | |
| 1. **Programming and debugging of S7-1200 PLC basic control instructions**     1. Forward and reverse control of three-phase asynchronous motor - basic bit logic instructions    2. Single button control motor start and stop - positive and negative jump instructions    3. Start and stop control of multiple motors - set and reset instructions    4. Time-sharing start stop control of belt conveyor - timer instructions    5. Cycle forward and reverse control of motor counting - counter instructions    6. Transportation trolley call system control - shift and compare instructions    7. Cycle lighting control of running water lamp - cyclic shift instructions    8. Temperature alarm system control - mathematical operation and conversion instructions    9. Responder control - logical operation instructions    10. Sequence control of mixing tank - sequence control instructions | | | | | 18 | | |
| 1. **Programming and debugging of S7-1200 PLC function and organization blocks**     1. Start and stop control of two motors based on FC    2. Y-Δ step-down starting control of three motors based on FB | | | | | 4 | | |
| 1. **Ethernet communication of S7-1200**    1. Remote start and stop control of two motors    2. Data transmission control of two S7-1200 | | | | | 4 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. S7-1200 PLC programming and application(Version 3), Liao Changchu, China Machine Press 2. Siemens S7-1200 PLC application technology project tutorial, Wu Fanhong, Electronic Industry Press 3. Siemens S7-1200 PLC System Manual | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Introduction to S7-1200 PLC**     1. Be able to correctly select PLC according to its performance, characteristics, and control functions    2. Understand the composition and basic working principle of PLC    3. Be able to skilled connect the input and output equipment of PLC and understand the internal memory allocation of PLC    4. Be able to skilled operate TIA Portal software    5. Be able to use TIA portal software for configuration, simulation and debugging | | | | |  | | |
| 1. **Programming and debugging of S7-1200 PLC basic control instructions**    1. Master the format and function of S7-1200 PLC bit logic instructions    2. Be able to correctly draw the working principal diagram of the motor forward and reverse PLC control system    3. Be able to correctly complete the wiring, programming, and debugging of the motor forward and reverse PLC control system    4. Master the format and function of S7-1200 PLC positive and negative jump instructions    5. Be able to correctly draw the working principal diagram of the single button control motor start and stop    6. Be able to correctly complete the wiring, programming, and debugging of the single button control motor start and stop    7. Master the format and function of S7-1200 PLC set and reset instructions    8. Be able to correctly complete the wiring, programming, and debugging of the start and stop control of multiple motors    9. Master the format and function of S7-1200 PLC timer instructions    10. Be able to correctly complete the wiring, programming, and debugging of the time-sharing start stop control of belt conveyor    11. Master the format and function of S7-1200 PLC counter instructions    12. Be able to correctly complete the wiring, programming, and debugging of the cycle forward and reverse control of motor counting    13. Master the format and function of S7-1200 PLC shift and compare instructions    14. Be able to correctly complete the wiring, programming, and debugging of the transportation trolley call system control    15. Master the format and function of S7-1200 PLC cyclic shift instructions    16. Be able to correctly complete the wiring, programming, and debugging of the cycle lighting control of running water lamp    17. Master the format and function of S7-1200 PLC mathematical operation and conversion instructions    18. Be able to correctly complete the wiring, programming, and debugging of the temperature alarm system control    19. Master the format and function of S7-1200 PLC logical operation instructions    20. Be able to correctly complete the wiring, programming, and debugging of the responder control    21. Master the format and function of S7-1200 PLC sequence control instructions    22. Be able to correctly complete the wiring, programming, and debugging of the sequence control of mixing tank | | | | |  | | |
| 1. **Programming and debugging of S7-1200 PLC function and organization blocks**    1. Master the programming method of S7-1200 and the use of blocks    2. Be able to correctly complete the programming, and debugging of the start and stop control of two motors based on FC    3. Be able to correctly complete the programming, and debugging of the Y-Δ step-down starting control of three motors based on FB | | | | |  | | |
| 1. **Ethernet communication of S7-1200**    1. Be able to connect the PLC network, use the PLC network to realize the machine connection control, and understand the communication method of PLC    2. Be able to correctly complete the programming, and debugging of the remote start and stop control of two motors    3. Be able to correctly complete the programming, and debugging of the data transmission control of two S7-1200 | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. Forward and reverse control of three-phase asynchronous motor 2. Single button control motor start and stop 3. Start and stop control of multiple motors 4. Time sharing start stop control of belt conveyor 5. Cycle forward and reverse control of motor counting - counter instructions 6. Transportation trolley call system control - shift and compare instructions 7. Cycle lighting control of running water lamp - cyclic shift instructions 8. Temperature alarm system control - mathematical operation and conversion instructions 9. Responder control - logical operation instructions 10. Sequence control of mixing tank - sequence control instructions 11. Start and stop control of two motors based on FC 12. Y-Δ step-down starting control of three motors based on FB 13. Remote start and stop control of two motors 14. Data transmission control of two S7-1200 | | | | | 8  6  8  6  8  8  4  8  8  8  8  8  4  4 | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EAT-372** | | **4.14 Frequency Conversion and Servo System** | |  | | | |
| Total contact hours: | | | **112** | **T** | | **P** | **C** |
| Theory: | | | 16 | **0.5** | | **3** | **1.5** |
| Practice: | | | 96 |
| **AIMS:** | This course focuses on ac speed control system and mainly involves the parameter settings and speed regulation of frequency converter, stepping motor drive control, servo motor drive control, as well as the control method based on PLC to frequency converter, servo driver and stepper driver, so that the students have the preliminary design, debugging and troubleshooting ability of inverter, servo motor, stepping motor control system and they can promote the application of PLC.   1. Enable to properly used Micro850 controller 2. Enable to design and debug frequency conversion system 3. Enable to design and debug stepping motor control system 4. Enable to design and debug servo motor drive control | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Micro850 controller basics**    1. Hardware structure of the Micro850 controller    2. Micro850 controller programming software    3. Common ladder diagram commands of the Micro850 controller    4. Common function block commands of the Micro850 controller | | | | | 2 | | |
| 1. **Fundamentals of inverter technology**    1. Function and principle of frequency converter    2. Functions of each terminal of the converter    3. Frequency converter keyboard operation    4. Motor parameters of frequency converter    5. Parameters of frequency converter starting source and speed source    6. Frequency parameters of frequency converter    7. Acceleration and deceleration time parameters of the converter    8. Frequency converter stop mode    9. Frequency converter monitoring and protection parameters    10. Communication method between frequency converter and PLC    11. Frequency converter start up wizard usage    12. Control converter through PLC | | | | | 4 | | |
| 1. **Control system design and debug of ball screw sliding table**    1. The structure of ball screw slide table    2. High speed counter instruction    3. Introduction and application of frequency converter instruction block    4. HMI configuration | | | | | 2 | | |
| 1. **Step control of synchronous belt based on PLC**    1. Principle of stepper motor driver    2. Setting of dip switch for stepper motor driver    3. Function of stepper motor driver terminal    4. Stepper motor configuration in PLC    5. Common instruction blocks for stepper motors | | | | | 2 | | |
| 1. **Servo drive system basics**    1. Introduction of servo drive system    2. Understanding of servo driver hardware    3. Cable connecting to the servo drive system    4. Servo drive system no-load debugging    5. Wiring and functions of each port of servo driver    6. Servo system in position mode    7. Servo system in speed mode    8. Servo system in torque mode    9. Communication method between servo system and PLC | | | | | 3 | | |
| 1. **Motion control of three axis writing machine based on PLC**    1. Introduction of the controlled object of the three-axis writing machine    2. Method of axis replication | | | | | 3 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Ac Servo and Frequency Conversion Technology and Application (4th edition), Gong Zhonghua, Posts and Telecommunications Press 2. Frequency Converter and Servo Application, Li Fangyuan, China Machine Press 3. LD5 Servo System Manual 4. AB PF525 Frequency Converter Manual | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Micro850 Controller basics**    1. Master the hardware structure and the meaning of each indicator    2. Understand the basic use of programming software    3. Be able to write control program and download and debug as required | | | | |  | | |
| 1. **Fundamentals of Inverter Technology**    1. Understand the function and principle of frequency converter    2. Master the function of each terminal of the frequency converter    3. Be able to use keyboard to adjust parameters    4. Be able to set parameters as required    5. Communicate frequency converter and PLC    6. Be able to design and debug frequency convert system | | | | |  | | |
| 1. **Control system design and debugging of ball screw sliding table**    1. Understand the structure of ball screw slide table    2. Understand the high speed counter instruction    3. Be able to configure HMI    4. Be able to design and debug control system of ball screw slide table according to different requires | | | | |  | | |
| 1. **Step control of synchronous belt based on PLC**    1. Understand the principle of stepper motor driver    2. Be able to set dip switch for stepper motor driver    3. Be able to design and debug control system of synchronous belt according to different requires | | | | |  | | |
| 1. **Servo drive system basics**    1. Understand the structure and function of servo control system    2. Understand the servo driver hardware and the cable    3. Cable Connecting to the Servo Drive System    4. Understand the functions and setting methods of different modes    5. Be able to use the servo software    6. Communicate the servo and PLC    7. Be able to design and debug servo control system | | | | |  | | |
| 1. **Motion control of three axis writing machine based on PLC**    1. Understand the structure and control method of the three-axis writing machine    2. Master the method of Axis Replication    3. Be able to achieve bidirectional movement of each axis of the three-axis writer through external buttons. | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. Recognize and Install the Micro850 Controller 2. Create basic programs using Micro850 Controller 3. Create function block programs using Micro850 Controller 4. Hardware Connection of frequency converter 5. Set parameters with the panel 6. Control the frequency converter by panel 7. Control the frequency converter by terminals 8. Establish communication between inverter and PLC 9. Start the Inverter using the Wizard 10. Control converter using PLC 11. Design and debug of reciprocating motion control system of ball screw sliding table 12. Design and debug of control system for regression at any position of ball screw slide table 13. Design and debug of control system for relative movement of ball screw slide table 14. Absolute motion of the synchronous belt at the origin 15. Reciprocating Motion of the Synchronous Belt 16. Control servo using PLC 17. Implement bidirectional movement of each axis of the three-axis writer through external buttons | | | | | 2  4  4  4  4  4  8  4  2  8  8  6  6  8  8  8  8 | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **EAT-382** | | **4.15 Power supply and distribution technology** | |  | | | |
| Total contact hours: | | | **80** | **T** | | **P** | **C** |
| Theory: | | | 32 | **1** | | **1.5** | **1.5** |
| Practice: | | | 48 |
| **AIMS:** | Through the study and practice of this course, students will be basically familiar with the structure and principle of power supply and distribution system, and preliminarily master the skills of power transformation and distribution operation and management, operation and maintenance of electrical equipment, fault analysis and troubleshooting of power supply system and equipment. Develop safe and civilized operation habits, understand and learn new technologies of relevant enterprises, and initially have the ability of operation, management and engineering design of power supply system.   1. Be familiar with power supply and distribution system. 2. Master the selection and use of transformers and high and low voltage electrical equipment. 3. Master the basic knowledge of operation, operation and maintenance of power supply and distribution system. 4. Have the ability to read power system drawings and equipment drawings. 5. Master the configuration and setting of common protection relays, power lines and transformer protection. 6. Preliminarily have the skills of substation operation and management, and the operation and maintenance of electrical equipment. | | | | | | |
| Course Contents | | | | | **Hours** | | |
| 1. **Setting of substation and distribution station**    1. Brief introduction of power system    2. Selection of operation mode of power supply and distribution system    3. Factory Substation Main Circuit Diagram understanding    4. Site Selection and Installation Arrangement of Substations | | | | | 4 | | |
| 1. **Factory Load Statistics and Transformer Selection**    1. Electric load calculation    2. Selection of Transformers in Substations    3. Compensation of power factor | | | | | 4 | | |
| 1. **Selection of electrical equipment for substations**    1. Definition and classification of electrical equipment    2. Selection method of high-voltage electrical equipment    3. High and low voltage switch electrical equipment    4. High and low voltage fuses and arresters    5. Power transformer    6. Power distribution device | | | | | 8 | | |
| 1. **Secondary circuit and automatic device of substation**    1. Secondary circuit overview    2. Operating power    3. High voltage circuit breaker control loop    4. Central signal loop    5. Measuring and Insulation Monitoring Devices    6. Secondary circuit installation wiring diagram    7. Automatic reclosing device    8. Standby power automatic input device | | | | | 6 | | |
| 1. **Protection of Transformer and Distribution System**    1. Basic Concepts of Relay Protection    2. Commonly used protection relays and their wiring methods    3. Relay protection of high voltage power lines    4. Relay protection of power transformers | | | | | 6 | | |
| 1. **Operation and maintenance of substations**    1. Power outage and power transmission operation in substations    2. Inspection of transformation and distribution equipment and lines | | | | | 4 | | |
| **Recommended / Reference Books:** | | | | |  | | |
| 1. Factory power supply and distribution technology Zhou Leting, Wang Junwei Higher Education Press 2. Power Supply and Distribution Technology (3rd Edition) Liu Jiecai Machinery Industry Press 3. Practical power grounding technology Li Jinglu, Hu Yi, Liu Chunsheng China Electric Power Press 4. Transmission Line Construction Tang Xiaoqing China Electric Power Press | | | | |  | | |
| **Instructional Objectives** | | | | |  | | |
| 1. **Setting of substation and distribution station**    1. Be able to correctly describe the composition of the power system and the functions of each part, and master the knowledge of power plants, substations, power grids, etc;    2. Understand the general situation and composition of the power supply and distribution system, master the operation mode of the power system and the operation mode of the low-voltage distribution system;    3. Be able to correctly describe the definition of the main circuit diagram of the substation, master the drawing form of the main circuit diagram of the substation, correctly understand the selection principle of the main wiring diagram of the substation, and understand the basic form of the main circuit diagram of 10kv/0.4kv substation and the application occasions of various forms;    4. Be able to correctly describe the classification and function of substations, and master the principles and methods of site selection for substations. | | | | |  | | |
| 1. **Factory Load Statistics and Transformer Selection**    1. Be able to draw the power load curve correctly, and master the method of load calculation using the coefficient method;    2. Be able to correctly calculate the active power loss and reactive power loss of the power transformer, and master the method of selecting the number and capacity of transformers in the substation;    3. Master the manual compensation method of power factor, and can correctly determine the capacity of the transformer according to the calculated load after the compensation power is connected. | | | | |  | | |
| 1. **Selection of electrical equipment for substations** 2. Be able to correctly distinguish primary and secondary equipment; 3. Be able to correctly describe the high and low voltage switchgear commonly used in power supply and distribution systems and their functions, structural features, models and specifications; 4. Master the functions, structural features, models and specifications of high and low voltage fuses and arresters; 5. Master the functions, structural features, models and specifications of power transformers; 6. Understand the composition and operation of power distribution units. | | | | |  | | |
| 1. **Secondary circuit and automatic device of substation**    1. Familiar with the composition of the secondary circuit of power transformation and distribution;    2. Familiar with the classification and application of operating power supply;    3. Understand the requirements and composition of the control loop of the high-voltage circuit breaker control loop, and be able to draw the basic control loop of the high-voltage circuit breaker;    4. Understand the type of the central signal and the requirements of the signal loop, and be able to correctly analyze the central accident signal loop and the central pre-announcement signal loop;    5. Understand the configuration principles of measuring instruments, and be able to correctly analyze the working principle of the insulation monitoring device of the DC system;    6. Be able to correctly describe the composition and wiring requirements of the secondary circuit installation wiring diagram;    7. Be able to correctly analyze the working principle of the automatic reclosing device;    8. Be able to correctly analyze the working principle of the standby power supply automatic input device. | | | | |  | | |
| 1. **Protection of Transformer and Distribution System**    1. Be able to correctly describe the tasks and requirements of relay protection;    2. Can correctly describe the types of common protection relays, and can choose the corresponding wiring method according to the protection requirements;    3. Master the over-current protection principle with time limit and inverse time over-current protection principle, and be able to draw its wiring diagram;    4. Understand the type and scope of relay protection of power transformers. | | | | |  | | |
| 1. **Operation and maintenance of substations**    1. Be able to fill in the work ticket correctly and master the sequence of the switching operation;    2. Understand the inspection items and inspection cycle of the electrical equipment of the substation and master the basic operation and maintenance requirements and standards. | | | | |  | | |
| **List of Practicals** | | | | | **Hours** | | |
| 1. Selection of operation mode of power supply and distribution system (high voltage system and low voltage system). 2. Selection of Transformers in Substations. 3. Understanding and Operation of High Voltage Circuit Breakers. 4. Understanding and Selection of High Voltage Fuse. 5. Understanding and Wiring of Transformer. 6. Recognition and installation of high-voltage power distribution devices. 7. Selection and installation of low-voltage electrical equipment. 8. High voltage circuit breaker control control circuit wiring.   ·Control switch wiring  ·Position Signal Loop Wiring  ·Anti-jump Latching Loop Wiring   1. Wiring of the central signal loop.   ·The wiring of the accident signal circuit where the central reset cannot repeat the action  ·Central reset can repeat the action of the accident signal circuit wiring  ·Central advance signal circuit wiring   1. Auto-recloser wiring. 2. Relay Characteristics of Commonly Used Protection Relays.   ·Measurement of the action value and return value of the electromagnetic current relay  ·Measurement of the action value and return value of the electromagnetic voltage relay  ·Measurement of action value and return value of electromagnetic time relay and setting of delay time  ·Relay Characteristics of Electromagnetic Signal Relays   1. Configuration and Setting of Power Line Relay Protection. 2. Configuration and Setting of Power Transformer Relay Protection. 3. High and low voltage switchgear switching operation. 4. Inspection of power transformers. | | | | | 2  2  2  2  4  2  2  4  4  2  2  4  4  6  6 | | |

**5. STEVTA Course Review Committee Recommendations**

|  |  |  |
| --- | --- | --- |
| **Sr. No** | **TEVTA Course Review Committee Recommendations** | **Status** |
| 1. | **Mr. Hakim Ali Ujjan**  Associate Professor (Electrical), GPI (B) Dadu. | Convener |
| 2. | **Mr. Fahim Akhter**  Assistant Professor (Electrical), GPSIT Landhi Karachi. | Member |
| 3. | **Engr. Farhan Khan Rind**  Lecturer (Electrical), GJMPI, Malir Karachi. | Member |
| 4. | **Mr. Kifayatullah Senior Instructor (Electrical)**  CoE Kotri. | Member |