**STATE BOARD OF TECHNICAL EDUCATION & TRAINING**

Diploma in Electronics & Communication Engineering

DRAFT CURRICULUM C-16

**SYLLABUS**

III SEMESTER

S.No. Subject Code Subject Name Page No.

1 EC-301 Engineering mathematics-III

2 EC-302 Electronic Devices & Circuits

3 EC-303 Network Analysis

4 EC-304 Analog Communication

5 EC-305 Digital Electronics

6 EC-306 Electronic Measuring Instruments

7 EC-307 Electronic Devices& Circuits Lab

8 EC-308 Communication skills and Life skills lab

9 EC-309 Digital Electronics & ECAD Tools Lab

10 EC-310 Analog Communication Lab

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **DIPLOMA IN ELECTRONICS &COMMUNICATION ENGINEERING** | | | | | | | | |
| **C-16 SCHEME OF INSTRUCTIONS AND EXAMINATIONS**  **III SEMESTER** | | | | | | | | |
| **Subject Code** | **Name of the subject** | **Instruction periods/week** | | **Total periods/year** | **Scheme of Examination** | | | |
|  |  | **Practical** | **Duration(Hours)** | **Sessional marks** | **End exam marks** | **Total marks** |
|  |  |  |  |
| THEORY SUBJECTS | |  |  |  |  |  |  |  |
| EC-301 | Engineering mathematics-III | 4 |  | 60 | 3 | 20 | 80 | 100 |
| EC-302 | Electronic Devices & Circuits | 5 |  | 75 | 3 | 20 | 80 | 100 |
| EC-303 | Network Analysis | 5 |  | 75 | 3 | 20 | 80 | 100 |
| EC-304 | Analog Communication | 5 |  | 75 | 3 | 20 | 80 | 100 |
| EC-305 | Digital Electronics | 4 |  | 60 | 3 | 20 | 80 | 100 |
| EC-306 | Electronic Measuring Instruments | 5 |  | 75 | 3 | 20 | 80 | 100 |
| PRACTICAL SUBJECTS | |  |  |  |  |  |  |  |
| EC-307 | Electronic Devices& Circuits Lab |  | 3 | 45 | 3 | 40 | 60 | 100 |
| EC-308 | Communication skills and Life skills lab |  | 4 | 60 | 3 | 40 | 60 | 100 |
| EC-309 | Digital Electronics & ECAD Tools Lab |  | 4 | 60 | 3 | 40 | 60 | 100 |
| EC-310 | Analog Communication lab |  | 3 | 45 | 3 | 40 | 60 | 100 |
|  | Total | 28 | 14 | 630 |  | 280 | 720 | 1000 |

**III SEMESTER**

**ENGINEERING MATHEMATICS – III**

**(Common to all Branches)**

**Subject Title : Engineering Mathematics-III**

**Subject Code : EC- 301**

**Periods per week : 04**

**PeriodsperSemester : 60**

**Time Schedule with BLUE PRINT**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No** | **Major Topic** | **No of Periods** | **Weightage of Marks** | **Short Type** | | | **Essay Type** | | |
|  | **Unit - I** |  |  | R | U | App | R | U | App |
| **1** | **Indefinite Integration** | 18 | 32 | 2 | 2 | 0 | 1 | 1 | 0 |
|  | **Unit - II** |  |  |  |  |  |  |  |  |
| **2** | **Definite Integration and its applications** | 17 | 31 | 0 | 1 | 1 | 1/2 | 1 | 1 |
|  | **Unit - III** |  |  |  |  |  |  |  |  |
| **3** | **Numerical Integration** | 05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 |
|  | **Unit - IV** |  |  |  |  |  |  |  |  |
| **4** | **Differential Equations of first order** | 20 | 37 | 2 | 2 | 0 | 1/2 | 1 | 1 |
|  | **Total** | 60 | 110 | 4 | 5 | 1 | 2 | 3 | 3 |
|  |  |  | Marks: | 12 | 15 | 3 | 20 | 30 | 30 |
|  |  | **R:** | **Remembering type** | | | 32 marks | |  |  |
|  |  | **U:** | **Understanding type** | | | 45 marks | |  |  |
|  |  | **App:** | **Application type** | | | 33 marks | |  |  |

**ENGINEERING MATHEMATICS-III**

**COMMON TO ALL BRANCHES**

**OBJECTIVES**

Upon completion of the subject the student shall be able to

**Unit-I**

**1.0 Use IndefiniteIntegration to solve engineering problems**

1.1 Explain the concept of Indefinite integral as an anti-derivative.

1.2 State the indefinite integral of standard functions and properties of Integrals ∫ (u + v) *dx*  and*∫ku dx* where *k* is constant and *u, v* are functions of *x.*

1.3 Solve integration problems involving standard functions using the above rules.

1.4 Evaluate integrals involving simple functions of the following type by the method of substitution.

i*) ∫f(ax + b) dx where f(x) dx* is in standard form*.*

*ii) ∫ [f(x)]n  f ′(x) dx*

*iii) ∫f′(x)/[f(x)] dx*

*iv) ∫f {g(x)} g ′(x) dx*

1.5 Find the Integrals of *tan x, cot x, sec x* and *cosec x* using the above.

1.6Evaluate the integrals of the form*∫SinmθCosnθ. dθ* where m and n are positive integers.

1.7 Evaluateintegrals of powers of *tan x* and *sec x*.

1.8 Evaluate the Standard Integrals of the functions of the type



1.9 Evaluate the integrals of the type

.

1.10 Evaluate integrals using decomposition method.

1.11 Evaluate integrals using integration by parts with examples.

1.12 State the Bernoulli’s rule for evaluating the integrals of the form.

1.13 Evaluate the integrals of the form*∫ex [f(x) + f ′(x)] dx.*

**Unit-II**

**2.0 Understand definite integral and use it in engineering applications**

2.1 State the fundamental theorem of integral calculus

2.2 Explain the concept of definite integral.

2.3 Calculate the definite integral over an interval.

2.4 State various properties of definite integrals.

2.5 Evaluate simple problems on definite integrals using the above properties.

2.6 Explain definite integral as a limit of sum by considering an area.

2.7 Find the areas under plane curves and area enclosed between two curves using integration.

2.8 Obtain the volumes of solids of revolution.

2.9 Obtain the mean value and root mean square value of the functions in any given interval.

**COURSE CONTENT**

**Unit-I**

**Indefinite Integration:**

1**.** Integration regarded as anti-derivative – Indefinite integral of standard functions. Properties

of indefinite integral. Integration by substitution or change of variable. Integrals of the form

sinmθ. cosnθ. where m and n are positive integers. Integrals of tan x, cot x, sec x, cosec x and powers of tan x, sec x by substitution.

Evaluation of integrals which are reducible to the following forms :



Integration by decomposition of the integrand into simple rational, algebric functions. Integration by parts , Bernoulli’s rule.

**Unit-II**

**Definite Integral and its applications:**

2. Definite integral-fundamental theorem of integral calculus, properties of definite integrals, evaluation of simple definite integrals. Definite integral as the limit of a sum. Area under plane curves – Area enclosed between two curves. Volumes of solids of revolution.Mean and RMS values of a function on a given interval.

**Reference Books:**

1. Integral Calculus Vol.I, by M.Pillai and Shanti Narayan

2. Thomas’ Calculus, Pearson Addison –Wesley Publishers

**ELECTRONIC DEVICES & CIRCUITS**

Subject title : **Electronic Devices & Circuits**

Subject code : EC-302

Periods/week : 05

Periods/semester : 75

**Rationale:** Electronic devices and circuits is a core subject. Since semiconductor devices and circuits form the basis of Electronics & Communication Engineering, knowledge of semiconductor devices and their applications is very much essential for an Electronics and communication engineering student not only from the industry point of view but also from knowledge perspective. Stress is laid on study of the behavior of various devices and circuits including practical applications. This course serves as a foundation for other advanced courses.

**TIME SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl** | **Major Topics** | **Periods** | **Weightage of Marks** | **Short Answer Questions** | **Essay Type Questions** |
| 1 | FETs and MOSFETs | 12 | 16 | 2 | 1 |
| 2 | Small signal amplifiers | 12 | 16 | 2 | 1 |
| 3 | Multi-stage &Feedback amplifiers | 15 | 26 | 2 | 2 |
| 4 | Power & Tuned amplifiers | 15 | 26 | 2 | 2 |
| 5 | Oscillators | 9 | 13 | 1 | 1 |
| 6 | Special semiconductor devices | 12 | 13 | 1 | 1 |
|  | TOTAL | 75 | 110 | 10 | 8 |

**Objectives:**On completion of the study of the subject a student should be able to comprehend the following.

* 1. **Understand the working of FETs AND MOSFETs.**
  2. Compare JFET and BJT
  3. List the merits of JFET over BJT.
  4. Explain the principle of operation of n-channel JFET with a sketch
  5. Draw and explain the drain characteristics of JFET.
  6. Define pinch-off voltage of JFET.
  7. Draw and explain the mutual characteristics of JFET.
  8. Define important parameters of JFET and obtain the relation among them.
  9. List the important specifications of JFET
  10. List the important applications of JFET
  11. Explain the use of JFET as current source with a circuit diagram
  12. Classify the different types of JFETs
  13. Explain the construction and principle of operation of depletion type n-channel MOSFET.
  14. Explain the construction and principle of operation of enhancement type n-channel MOSFET.
  15. Compare JFET and MOSFET.
  16. Explain the principle of operation of CMOSFET.

2.0 **Understand the working of small signal amplifiers.**

1. Explain the basic amplifier concept using BJT-CE mode.
2. Explain the reason for wide use of CE amplifier.
3. Explain the concept of DC and AC load line.
4. Explain the selection of operating point on DC load line with waveforms.
5. List the factors affecting the Q-point.
6. Explain thermal runaway
7. State the need for proper biasing in amplifier circuits.
8. List the types of biasing circuits.
9. Define stabilization in amplifier circuits.
10. Define the various stability factors (S, Sβ, SVBE)
11. Derive an expression for stability factor in CE configuration.
12. Explain the fixed bias circuit and derive its stability factor.
13. Explain the collector to base resistor method of biasing and derive its stability

factor.

1. Explain the self bias circuit and derive its stability factor.
2. Draw the circuit of single stage RC Coupled CE amplifier.
3. Mention the merits of Resistor -Capacitor coupling
4. Mention the names of components such as biasing Resistors, Coupling capacitor ,Emitter Bypass capacitor , Emitter Resistor and Load Resistor of CE Amplifier
5. State the purpose of each component in RC coupled CE amplifier circuit
6. Define gain, frequency response and bandwidth of an amplifier.
7. Mention the reasons for fall in gain at both low and high frequencies in RC coupled amplifier
8. Define h-parameters of a transistor.
9. Draw the circuit of common source FET amplifier and explain its operation.

**COURSE CONTENT:**

* 1. **FETs AND MOSFETs.**

Compare JFET and BJT-List the merits of JFET over BJT- principle of operation of n-channel JFET - drain characteristics of JFET- pinch-off voltage of JFET- mutual characteristics of JFET.

-important parameters of JFET - important specifications of JFET- applications of JFET -use of JFET as current source – JFET classification -Construction and principle of -operation of depletion type n-channel MOSFET.-Explain the construction and principle of operation of enhancement type n-channel MOSFET.- JFET and MOSFETComparison -Principle of operation of CMOSFET.

2.0 **Understand the working of small signal amplifiers.**

Basic amplifier concept using BJT-CE mode.-Reason for wide use of CE amplifier-Concept of DC and AC load line-Selection of operating point on DC load line with waveforms.-Factors affecting the Q-point.-Thermal –runaway-Need for proper biasing in amplifier circuits-Types of biasing circuits-Stabilization in amplifier circuits.-Various stability factors (S, Sβ, SVBE)-Expression for stability factor in CE configuration-Fixed bias circuit and its stability factor-Collector to base resistor method of biasing and its stability-factor-Self bias circuit and its stability factor. Single stage RC Coupled CE amplifier-Merits of Resistor -Capacitor coupling -Biasing Resistors, Coupling capacitor ,Emitter Bypass capacitor , Emitter Resistor and Load Resistor of CE Amplifier -Purpose of each component in RC coupled CE amplifier circuit-Gain, frequency response and bandwidth of an amplifier-Reasons for fall in gain at both low and high frequencies in RC coupled amplifier- h-parameters of a transistor.-Circuit of common source FET amplifier

**REFERENCE BOOKS:**

1. Electronic Devices and Circuits by .David A.Bell 4th edition PHI
2. Electronic Devices and Circuits – T.F. Bogart Jr, J.S.Beasley and G.Rico, Pearson Education,6th edition, 2004.
3. Electronic Principles by Albert Malvino. – J Bates. 7th edition Tata McGraw-Hill Education (TMH) Publishers.
4. Principles of Electronics by V.K. Mehta. S Chand & Company, 2008

**EC 303- NETWORK ANALYSIS**

**Subject title : Network Analysis**

**Subject code : EC-303**

**Periods/week : 05**

**Periods/semester : 75**

**Rationale:** Network analysis is a core subject which gives a clear insight in to the Electronics &communication Engineering. Care has been taken to limit the Mathematical treatment, just appropriate for a diploma holder

**TIME SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Major topics** | **No. of periods** | **Weight age of marks** | **Short Answer Questions** | **Essay Questions** |
| 1 | Basics of electrical circuits and Kirchhoff’s laws | 10 | 16 | 2 | 1 |
| 2 | Network theorems | 15 | 26 | 2 | 2 |
| 3 | Mesh current and Node voltage analysis | 16 | 26 | 2 | 2 |
| 4 | Transient analysis | 10 | 13 | 1 | 1 |
| 5 | Two port networks | 12 | 13 | 1 | 1 |
| 6 | Filters and Attenuators | 12 | 16 | 2 | 1 |
|  | **Total** | **75** | **110** | **10** | **8** |

**OBJECTIVES**

**Upon completion of the course the student should be able to**

**1.0 Understand the basics of electrical circuits and Kirchhoff’s laws**

1. Define active and passive elements.
2. Define energy source and classify the energy sources.
3. Explain ideal voltage source and ideal current source
4. Convert ideal voltage source to ideal current source and vice versa.
5. State limitations of Ohm’s law.
6. State Kirchhoff’s current law and Kirchhoff’s voltage law.
7. Solve simple problems using Kirchhoff’ s Voltage Law
8. Solve simple Problems using Kirchhoff’s Current law
9. Explain the concept of mutual inductance as a circuit parameter
10. Mention the formula for coupling coefficient
11. Explain the Dot rule for coupled circuits
12. Explain the phenomenon of reflected coupled impedance.
13. Explain the phenomenon of coupled impedance in single tuned circuits.
14. Explain the phenomenon of coupled impedance in double tuned circuits.
15. Define the critical coupling, loose coupling and tight coupling.
16. Explain the reasons for double humps in tight coupled circuits.
17. List applications of tuned circuits

**2.0 Understand network theorems**

1. State Thevenin’s and Norton’s theorem.
2. Apply the above theorems to solve networks.
3. Explain the use of above theorems in electronic circuits
4. State superposition theorem
5. Solve simple problems using the above theorem
6. State Maximum power transfer theorem.
7. Solve simple problems using the above theorem.
8. Explain the importance of impedance matching for maximum power transfer.
9. State Reciprocity theorem
10. Explain the importance of Reciprocity theorem by giving examples like Co axial cable and flat twin lead cable used in Television systems.
11. List the advantages and limitations of above theorems.
12. Explain star and Delta configurations of resistances.
13. Give transformation formulas from Star to Delta & Delta to Star (no derivation).
14. Solve simple problems on Star/Delta and Delta/Star transformation.

**COURSE CONTENT:**

**1.0 Basics of electrical circuits and Kirchoff’s laws**

Active and passive elements- resistance, capacitance and inductance parameters- Energy source and classify the energy sources- Ideal voltage source and Ideal current source- Ideal voltage source to ideal current source and vice versa- Limitations of Ohm’s law- Kirchhoff’s current law and Kirchhoff’s voltage law-Solve simple problems using Kirchhoff’ s Voltage Law -Solve simple Problems using Kirchhoff’s Current law- Concept of mutual inductance as a circuit parameter- Formula for coupling coefficient- Dot rule for coupled circuits- phenomenon of reflected coupled impedance- Phenomenon of coupled impedance in single tuned circuits- Phenomenon of coupled impedance in double tuned circuits - Critical coupling, loose coupling and tight coupling- Reasons for double humps in tight coupled circuits- Applications of tuned circuits

**2.0 Network theorems**

Thevenin’s, and Norton’s theorems - Solve networks- Use of above theorems in electronic circuits- Superposition theorem - Maximum power transfer theorems-Solve simple problems using the above theorem- Importance of impedance matching for maximum power transfer- Reciprocity theorem- Importance of Reciprocity theorem - advantages and limitations of above theorems- Star and Delta configurations of resistances- Formulas from Star to Delta & Delta to Star (no derivation)-Solve simple problems on Star/Delta and Delta/Star transformation.

**REFERENCE BOOKS:**

1. Network Analysis by M.E Van Valkenberg, Prantice Hall India, 3rd Edition
2. .Electric Circuits -Joseph Edminister ,Schaum Series  publishers.
3. Circuits & Networks by A. Sudhakar and Shyammohan S Palli Tata McGraw- Hill
4. Electric circuit theory . Dr. M. Arumugam&  Dr. N. Premkumaran Khanna Publishers, New Delhi
5. *A Course in* Electrical Circuit Analysis by Soni and Gupta*, “Dhanpat Rai & Sons*

**ANALOG COMMUNICATION**

Subject title : A**nalog Communication**

Subject code : EC-304

Periods/week : 05

Periods/semester : 75

**Rationale:** Analog communications is another core subject which forms the basis for Communication Engineering. Hence understanding of Analog Communication is very much essential for an electronics and communication engineering student not only from the industry point of view but also from knowledge perspective also. Stress is laid on the study of fundamentals. This course serves as a foundation for other advanced courses.

# TIME SCHEDULE

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl** | **Major topics** | **No. of periods** | **Weightage of marks** | **Short Answer Questions** | **Essay Questions** |
| 1 | Basics of Communication System & Noise | 15 | 16 | 2 | 1 |
| 2 | Analogue modulation techniques | 15 | 26 | 2 | 2 |
| 3 | Transmitters & Receivers | 15 | 26 | 2 | 2 |
| 4 | Wave propagation | 15 | 26 | 2 | 2 |
| 5 | Antennas | 15 | 16 | 2 | 1 |
| **Total** | | **75** | **110** | **10** | **8** |

**OBJECTIVES**

On completion of the study of the subject a student should be able to comprehend the following:

1. **Understand basics of Communication systems.** 
   1. Describe the basic elements of a communication system with block diagram.
   2. Explain frequency spectrum and mention the usage of frequencies for different applications
   3. Define modulation
   4. State the need for modulation in communication systems.
   5. Define amplitude modulation
   6. Draw the wave form of an AM wave
   7. Define Frequency modulation
   8. Draw the waveform of FM Wave
   9. Define phase modulation
   10. Distinguish between baseband, carrier, and modulated signals and give examples.
   11. Explain the relationship between channel bandwidth, baseband bandwidth and transmission time.
   12. List causes of distortion in transmission and measures for distortion less transmission.
   13. Explain the terms time domain and frequency domain.
   14. Classify different types of noise
   15. Distinguish between internal and external Noise
   16. Define signal to noise ratio, noise figure and noise temperature
2. **Understand the principles of Analogue Modulation Techniques**
   1. Derive the time-domain equation for an AM signal.
   2. Define the modulation index of an AM signal.
   3. Draw the frequency spectrum of an AM signal.
   4. Describe the effects of over modulation.
   5. Calculate the bandwidth of an AM signal.
   6. Derive the relation between total power and carrier power in AM
   7. Solve simple problems
   8. Explain the need for DSBSC and SSB modulation
   9. List the advantages and disadvantages of SSB
   10. List applications of SSB.
   11. Explain Vestigial side band transmission
   12. State the need for angle modulation
   13. List two types of angle modulation
   14. Derive the time domain equation for FM signal
   15. Define the modulation index of an FM signal
   16. Compare AM , FM and PM
   17. Explain narrow band and wide band FM
   18. Define pre-emphasis and de-emphasis
   19. State the need for pre-emphasis and de-emphasis in FM

**COURSE CONTENT**

**1.0 Basics of Communication systems.**

elements of a communication system - block diagram- frequency spectrum - frequencies for different applications- modulation- need for modulation in communication systems- amplitude modulation- wave form of an AM wave- Frequency modulation - waveform of FM Wave- phase modulation- baseband, carrier, and modulated signals - relationship between channel bandwidth, baseband bandwidth and transmission time- causes of distortion in transmission -measures for distortion less transmission- time domain and frequency domain- types of noise- internal and external Noise- signal to noise ratio, noise figure and noise temperature

**2.0 Analog Modulation Techniques**

time-domain equation for an AM signal- modulation index of an AM signal- frequency spectrum of an AM signal- effects of over modulation- bandwidth of an AM signal- relation between total power and carrier power in AM-Solve simple problems- need for DSBSC and SSB modulation- advantages and disadvantages of SSB- applications of SSB- Vestigial side band transmission

angle modulation- types of angle modulation- time domain equation for FM signal- modulation index of an FM signal- noise triangle in FM-Comparison of AM , FM and PM- narrow band and wide band FM- pre-emphasis and de-emphasis- need for pre-emphasis and de-emphasis in FM

**REFERENCE BOOKS:**

1. Electronic communications systems by Roy Blake, Thomson Delmar,2002.
2. Electronic Communication System by George Kennedy- Bernard DavisTata Mcgraw Hill Education Private Limited

# Principles Of Electronic Communication Systems by Herbert Taub& Donald L Schilling, 3rd Edition-2009.McGraw Hill Education (India) Private Limited

1. Radio communication by G.K.Mithal- khanna publishers
2. Antennas and Wave propagation by K.D.Prasad- SathyaPrakasahan Publications.

**DIGITAL ELECTRONICS**

**Subject Title : DIGITAL ELECTRONICS**

**Subject Code : : EC-305**

**Periods/Week : 5**

**Periods/Semester : 60**

**Rationale:** Digital Electronics is a core subject as Digital Electronics form the basis for Digital Communication and Microcontrollers .Hence the understanding of Digital electronics and their applications is very much essential for an electronics and communication engineering from the industry point of view Stress is laid on study of the behaviour of various devices and circuits including practical applications. This course serves as a foundation for other advanced courses.

**TIME SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl** | **Major topics** | **No. of periods** | **Weightage of marks** | **Short Answer Questions** | **Essay Questions** |
| 1 | Basics of Digital Electronics | 12 | 19 | 3 | 1 |
| 2 | Logic Families | 6 | 13 | 1 | 1 |
| 3 | Combinational Logic circuits | 14 | 26 | 2 | 2 |
| 4 | Sequential Logic Circuits | 12 | 26 | 2 | 2 |
| 5 | Counters and Semiconductor Memories | 16 | 26 | 2 | 2 |
|  | Total | **60** | **110** | **10** | **8** |

**OBJECTIVES:**

On completion of this unit the student shall be able to

1. **Understand the basics of Digital Electronics**
   1. Explain Binary, Octal, Hexadecimal number systems.
   2. Compare the above with Decimal system.
   3. Convert a given decimal number into Binary, Octal, and Hexadecimal numbers and vice versa.
   4. Convert a given binary number into octal and hexadecimal number system and vice versa.
   5. Perform binary addition, subtraction, Multiplication and Division.
   6. Write 1’s complement and 2’s complement numbers for a given binary number.
   7. Perform subtraction of binary numbers in 2’s complement method.
   8. Explain the use of weighted and Un-weighted codes.
   9. Write Binary equivalent number for a number in 8421, Excess-3 and Gray Code and vice-versa.
   10. Explain the use of alphanumeric codes (ASCII & EBCDIC)
   11. Explain the importance of parity Bit.
   12. State different postulates in Boolean algebra.
   13. Explain the basic logic gates AND, OR, NOT gates with truth table.
   14. Explain the working of universal logic gates (NAND, NOR gates) using truth tables.
   15. Explain the working of an exclusive – OR gate with truth table.
   16. State De-Morgan’s theorems.
   17. Explain De-Morgan’s theorems
   18. Realize AND, OR, NOT operations using NAND, NOR gates.
   19. Apply De-Morgan’s theorems related postulates to simplify Boolean expressions (up to three variables).
   20. Explain standard representations for logical functions (SOP and POS form)
   21. Write Boolean expressions from the given truth table.
   22. Use Karnaugh map to simplify Boolean Expression (up to 4 variables only)
2. **Understand different logic families.**
   1. Give the classification of digital logic families ( like TTL, CMOS and ECL).
   2. List the important characteristics of Digital ICs
   3. Explain logic levels and Voltage requirements of TTL and CMOS ICs
   4. Define propagation delay and Noise margin,
   5. Explain Fan-in and Fan-out capacity of a digital IC.
   6. Explain Power dissipation.
   7. Explain figure of merit of a logic family
   8. Explain the working of open collector TTL NAND gate with a circuit diagram.
   9. Explain the working of Totem pole output TTL NAND gate with a circuit diagram.
   10. Explain the working of CMOS NAND gate with a circuit diagram.
   11. Compare the TTL, CMOS and ECL logic families.
   12. Give IC numbers of different two input Digital IC Logic gates( One for each type)

**COURSE CONTENT**

**1.0 Basics of Digital Electronics**

Binary, Octal, Hexadecimal number systems –comparison with Decimal system-Conversion of a given decimal number into Binary, Octal, and Hexadecimal numbers and vice versa- Conversion of a given binary number into octal and hexadecimal number system and vice versa- binary addition, subtraction, Multiplication and Division- 1’s complement and 2’s complement numbers of a binary number- subtraction of binary numbers in 2’s complement method- Use of weighted and Un-weighted codes- Binary equivalent number for a number in 8421, Excess-3 and Gray Code and vice-versa- Use of alphanumeric codes (ASCII & EBCDIC)- importance of parity Bit- Different postulates in Boolean algebra- Basic logic gates AND, OR, NOT gates with truth table- universal logic gates (NAND, NOR gates) - exclusive – OR gate with truth table- De-Morgan’s theorems- AND, OR, NOT operations using NAND, NOR gates- De-Morgan’s theorems related postulates to simplify Boolean expressions (up to three variables)- standard representations for logical functions (SOP and POS form)- Boolean expressions from the given truth table- Karnaugh map to simplify Boolean Expression (up to 4 variables only)

**2.0 Different logic families.**

Classification of digital logic families- Important characteristics of Digital ICs-Logic levels and Voltage requirements of TTL and CMOS ICs - Propagation delay and Noise margin- Fan-in and Fan-out capacity- Power dissipation- Figure of merit of a logic family- explain TTL NAND gate with open collector- TTL NAND gate with Totem pole output- CMOS NAND gate circuit –Compare TTL, CMOS and ECL logic families- IC numbers of two input Digital IC Logic gates.

**REFERENCE BOOKS:**

1. Digital Computer Electronics by Malvino and leach. 3rdedition Tata McGraw-Hill Education

2. Modern Digital Electronics By RP JAIN TMH

|  |
| --- |
| 3Digital Electronics: Principles & Applications by Roger L. Tokheim -McGraw-Hill Education, 2008 |

4. Digital Electronics by GK Kharate, Oxford University Press.

EC-306 Electronic Measuring Instruments.

Subject title : Electronic Measuring Instruments.

Subject code : EC-306

Periods/week : 05

Periods/semester : 75

Rationale: Electronic Measuring Instruments is introduced in III semester to

make the students understand the principles of Electronic

measurements which is essential for Instrumentation industry and

also to provide necessary cognitive inputs to handle equipment in the

laboratory/Industry.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SNo | Major Topics | No. of periods | Weightage of marks | Short Answer Questions | Essay Questions |
| 1. | Analog Instruments | 15 | 26 | 2 | 2 |
| 2 | Digital Instruments | 15 | 21 | 2 | 1 |
| 3 | Cathode Ray Oscilloscope | 15 | 26 | 2 | 2 |
| 4 | Signal generators | 15 | 21 | 2 | 1 |
| 5 | Testing Instruments | 15 | 16 | 2 | 1 |
|  | Total | 75 | 110 | 10 | 8 |

**Objectives:**On completion of the study of the subject a student shoud be able to comprehend the following.

* 1. **Understand the working of analog instruments.**
  2. List the characteristics of ideal volt meter and ideal ammeter.
  3. Explain the construction and principle of operation of PMMC instrument.
  4. Explain the principle of extending range of DC ammeter.
  5. Explain the principle of extending range of DC voltmeter.
  6. Explain the principle & working of rectifier type voltmeter.
  7. Explain the principle of series & shunt type ohmmeters.
  8. Explain the use of Megger for measuring the insulation resistance.
  9. Explain loading effect of voltmeter with an example circuit
  10. Explain the need for high input impedance for voltmeters.
  11. Explain the working of FET input voltmeter with a circuit diagram.
  12. Explain the drift problems in FET voltmeters.
  13. Explain the working of differential voltmeters.
  14. Explain the use of high voltage probe & clamp-on current probe.
  15. Explain the construction of AC bridge.
  16. State the conditions for AC bridge balance.
  17. List 4 types of AC bridges.
  18. Mention the use of above bridges.
  19. Explain the resistance measurement using Wheatstone Bridge.
  20. Explain the inductance measurement using Maxwell’s Bridge.
  21. Explain the capacitance measurement using Schering Bridge.
  22. List 4 important errors and their prevention in bridge measurements.

2.0 **Understand the working of Digital Instruments.**

2.1 List 4 advantages of digital instruments over analog instruments.

2.2 Explain the working of RAMP type digital voltmeter with block diagram.

2.3 Explain the working of Successive approximation type digital voltmeter with

block diagram.

2.4 List 4 important specifications of digital voltmeter.

2.5 Explain the working of digital frequency meter with block diagram.

2.6 List 4 important specifications of digital frequency meter.

2.7 Define accuracy and resolution of a meter.

2.8 Explain factors effecting the accuracy and resolution of a frequency meter.

2.9 Explain the working of digital LCR meter with block diagram.

2.10 List 4 specifications of digital LCR meter.

**COURSE CONTENT**

**1.0 Analogue instruments**

Characteristics of ideal Voltmeter and ideal Ammeter- Construction and principle of operation of PMMC instrument- Principle of extending the range of DC ammeter- Principle of extending the range of DC voltmeter- Principle and working rectifier type voltmeter - Construction and principle of series and shunt type ohmmeters- Use of Megger for measuring the insulation resistance- loading effect with an example- Need for high input impedance for Voltmeters- working of FET input voltmeter with a circuit diagram- Drift problem in FET Voltmeters- Working of differential voltmeters- Use of high voltage probe and clamp-on current probe- Construction of AC Bridge- Conditions for bridge balance- Types of AC bridges- Use of above bridges- Resistance measurement using Wheat Stone Bridge- Inductance measurement using Maxwell’s Bridge- capacitance measurement using Schering Bridge- important errors and their prevention in bridge measurements

**2.0 Digital instruments**

Advantages of digital instruments over Analogue instruments- Working of Ramp type digital voltmeter with block diagram- Successive approximation type digital voltmeters with block diagram- Specifications of digital voltmeters- Working of digital frequency meter with block diagram- Important specifications of digital frequency meter- Accuracy and Resolution of a meter- Factors effecting the accuracy and Resolution of a frequency meter- Working of digital LCR meter with block diagram- specifications of digital LCR meter.

**REFERENCE BOOKS:**

1. Modern Electronic  Instrumentation and Measurement techniques - Albert D. Helfrick William David Cooper-PHI Publications
2. Electrical and Electronics Measurements and Instrumentation - A.K. Sawhney , Puneet SawhneyDhanpat Rai & Company, 2010

**Electronic Instrumentation** - HS Kalsi ,-Tata McGraw Hill

**Electronic Devices and Circuits Lab**

**Subject title : ElectronicDevices and CircuitsLab**

**Subject code : EC-307**

**Periods per week : 3**

**Periods / Semester : 45**

|  |  |  |
| --- | --- | --- |
| **S.No** | **Major Topics** | **No. of Periods** |
| **I.** | **Semiconductor Diodes and Rectifiers** | **9** |
| **II.** | **Transistors & Field Effect transistors** | **12** |
| **III.** | **Transistor Amplifiers and Oscillators** | **12** |
| **IV.** | **Special Devices** | **12** |
|  | **Total** | **45** |

**Rationale:** Electronic Devices &Circuits lab is a core lab as the student is expected to understand and demonstrate practical skills in handling, identify and using different instruments and various Electronic components with ease .Emphasis is laid on imparting essential skills that are required for subsequent learning.

**Note : Student should complete any 15 Exercises (Sub exercises are optional)**

**List of Exercises :**

**Semiconductor Diodes and Rectifiers**

1. Draw the forward & reverse characteristics of Silicon diode

i) a) Determine Knee voltage, b) Identify Cutoff, and Linear regions

ii) Test the diode with DMM & Analogue multimeter and identify the Terminals

iii) Connect a 6V lamp in series with diode and observe the behaviour a) under forward and Reverse biased conditions. b) On low voltage AC supply

iv) Observe the effect of temperature on diode reverse current by heating the diode with a soldering Iron

2. Draw the forward & reverse characteristics of Zener diode and determine Breakdown Voltage

i) Test the Zener diode with DMM & Analogue multimeter and identify the Terminals

ii) Produce different reference voltages by using a 12V Zener diode and Resistance ladder network

iii) Produce higher reference voltage by connecting two Zener diodes in series

3. Implement Rectifier circuits using Diodes and observe the effect of Filtering

a) Implement Half wave rectifier with and without filter

b) Implement Full wave rectifier with and without filter

4. Implement Bridge rectifier with and without filter

a) Implement Voltage Doubler circuit

b) Connect a diode IN4007 in series with a 60W 230V Lamp and test it.(Record your observations)

5. Build a Regulated power supply and draw the regulation characteristics

a. i) using Zener diode ii) using 3 Terminal +ve Regulator

b. i) implement a –ve 3 Terminal Regula r ii) Implement a Dual regulated power supply using both +ve and –ve 3 terminal regulators

6. Build an adjustable +ve Regulated power supply using LM 317 and Test

II. Transistors & Field Effect transistors

7. Draw Input and output characteristics of NPN Transistor and determine Beta of the transistor

a) Plot Input & Output characteristics for CB configuration

b) Plot Input & Output characteristics for CE configuration

c) Test the Transistor with DMM & Analogue multimeter and identify the Terminals and Type of transistor and find the β

8. Use Transistor as a Switch

a) Turn on and turn off a relay using Transistor ( BC148 as a switch.)

b) Connect a 6v lamp in series with BD139 and observe the effect of base current variation on lamp brightness .

9. Determine the effective current gain of a Darlington Pair

a) Connect two BC148 transistors in a Darlington pair and calculate the effective Beta

b) Find out the device specifications of TIP 120 from the data sheets and compare the hfe with that of BD 139.

c) Connect a 6V lamp in the collector circuit of TIP120 transistor and apply few micro amperes current at the base and observe the effect.

10. Draw the input and output characteristics of JFET and determine pinchoff voltage and transconductance.

a) Test the JFET with DMM &Analogue multimeter and identify the Terminals

11. Use JFET as a current source

a) Implement a constant current source with a FET by applying appropriate gate bias

b) Practically Verify High input impedance characteristic of the gate circuit.

12. Plot the frequency response characteristics of a RC coupled Amplifier.

a) Observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion.

b) Observe the effect of emitter bypass capacitor Ce on voltage across Emitter Resistance using CRO.

c) Measure the output power using ac power meter

13. Implement a) Colpitt’s oscillator b) Hartley oscillator and verify the effect of Vary the tank circuit component values and observe output waveforms on CRO.

14. Implement transistor Astable multivibrator circuit and observe the waveforms on CRO.

IV. Special Semiconductor Devices

15. Plot the characteristics of a) Photodiode b) photo transistor

16. Implement a Twilight switch using a Phototransistor and a Relay

a) Replace Phototransistor with LDR and Test

17. Plot the VI characteristics of different color LEDs & determine the Vf (forward voltage drop)

a) Test the above devices with DMM & Analogue multimeter and identify the Terminals

18. plot the characteristics of i) LDR ii) Thermistor iii) VDR

a) Test the above devices with DMM & Analogue multimeter

b) Implement a simple Temperature controller using Thermistor and a Relay

c) Use a VDR /Trigistor for protection against high voltage surges and verify

19. Plot the characteristics of optocoupler MCT2E

a) Test the given optocoupler and identify its terminals

b) Use MCT 2E to switch on a 6V lamp connected to RPS by applying a Low voltage 1.5 V signal from a cell at input

20. Implement a simple timer using 1 M Ω Resistor , 1000 mfd capacitor ,Transistor BC148 and a Relay

**Competencies and Key Competencies to be achieved**

|  |  |  |  |
| --- | --- | --- | --- |
| **Exp No.** | **Name of the Experiment**  **(No of Periods)** | **Competencies** | **Key Competencies** |
| 1 | To draw the forward & reverse characteristics of Silicon diode and i) Determine Knee voltage, (3)  ii) Identify Cutoff, and Linear regions  a) To test the diode with DMM & Analogue multimeter and identify the Terminals  b) To Connect a 6V lamp in series with diode and test it on DC power supply  c) To Heat the diode with a soldering Iron and observe the effect on reverse current | * Identify meters and equipment * Use DRB, DIB, DCB and measure Voltage and current * Interpret diode datasheets and find the specifications of components used in the experiment | * Assemble the circuit as per the circuit diagram * Identify Diode terminals by observation and also with DMM & Analogue Multimeter |
| 2 | To draw the forward & reverse characteristics of Zener diode and determine Breakdown Voltage (3)  a) To test the Zener diode with DMM & Analogue multimeter and identify the Terminals  b) To produce different reference voltages by using a 12V Zener diode and Resistance ladder network  c) To produce higher reference voltage by connecting two Zener diodes in series | * Test the Zener diode using DMM * identify Zener Diode terminals by observation and with DMM * Prepare Resistor ladder network. * Connect Zener diodes in series * Rig up the circuit * Find the specifications of Zener diode from datasheets | * Assemble the circuit as per the circuit diagram * identify Zener Diode terminals by observation and with DMM & Analogue Multimeter |
| 3. | To implement Half wave rectifier with & without filter circuits and observe the ripple on CRO (3)  b) To implement Full wave rectifier with and without filter and observe the ripple on CRO | * Draw the symbols of Transformer , Diode , Inductor and Capacitor * Read the circuit Diagram * Identify Diode terminals * select meters and equipment * Observe the polarity of capacitors. * Interpret diode datasheets | * Assemble the circuit as per the circuit diagram * Use the CRO to observe the waveforms * Assess the Power supply performance in terms of ripple and % Regulation |
| 4 | To Implement Bridge rectifier with and without filter (3)  a) To Implement Voltage Doubler circuit  b) To Connect a diode IN4007 in series with a 60W 230V Lamp and test it | * Read the circuit Diagram * Identify Diode terminals * Select meters and equipment * Rig up the circuit * . Observe the polarity of capacitors. * Measure & Observe the ripple on CRO | * Select meters and equipment * Rig up the circuit * Observe the polarity of capacitors. * Measure & Observe the ripple on CRO |
| 5 | To build a Regulated power supply and draw the regulation characteristics (3)  A. i) Using Zener diode ii) using 3 Terminal +ve Regulator  B. i) Implement a –ve 3 Terminal Regulator ii) Implement a Dual regulated power supply using both +ve ad –ve 3 terminal regulators  C) i) Obtain a voltage above 30V using Dual RPS in the laboratory and measure | * Identify Regulator terminals * Find the output voltage and type from the IC Regulator number * select meters and equipment * Measure Voltage and current. * Observe the polarity of capacitors. * Use the CRO to observe the waveforms * Interpret IC Regulator datasheets | * Identify 3 terminal Regulator and its package &pin Configuration * Find the output voltage and type from the IC Regulator number * 4. Use the CRO to observe the waveforms * 5. Assess the Power supply performance in terms of ripple and %Regulation |
| 6 | To build an adjustable +ve Regulated power supply using LM 317 and Test  (3) | * Identify Regulator terminals * Select meters and equipment * Rig up the circuit * Measure Voltage and current. * Observe the polarity of capacitors. * Use the CRO to observe the waveforms * Interpret IC Regulator datasheets | * select meters and equipment * Measure Voltage and current. * Observe the polarity of capacitors. * Use the CRO to observe the waveforms |
| 7 | To draw Input and output characteristics of NPN Transistor and determine Beta of the transistor (3)  a) To plot Input & Output characteristics for CB configuration  b) To plot Input & Output characteristics for CB configuration CE configuration  b) To test the Transistor with DMM & Analogue multimeter and identify the Terminals and Type of transistor and find the β | * Identify Transistor type & terminals with DMM * Select meters and equipment * Rig up the circuit * Measure Voltage and current. * Note the package &differences between BC148A, 148B, 148C and BF194 from the data sheets. | * Identify Transistor type& terminals with DMM * Select meters and equipment * Rig up the circuit * Measure Voltage and current. |
| 8 | To use Transistor as a Switch &Test  a) To Turn on and turn off a relay using Transistor ( BC148 as a switch.) (3)  b) To Connect a 6v lamp in series with BD139 and observe the effect of base current variation on lamp brightness . | * Identify Transistor type & terminals with DMM * Rig up the circuit * Measure Voltage and current. * Test the circuit * Note the package of BD139 & specifications from datasheets | * Rig up the circuit * Measure Voltage and current. * Test the circuit |
| 9 | To determine the effective current gain of a Darlington Pair (3)  a) To Connect two BC148 transistors in a Darlington pair and calculate the effective Beta  b) To find out the device specifications of TIP 120 from the data sheets and compare the hfe with that of BD 139.  c) To Connect a 6V lamp in the collector circuit of TIP120 transistor and apply few micro amperes current at the base and observe the effect. | * Identify Transistor type & terminals with DMM * Rig up the circuit * Measure Voltage and current. * Test the circuit * Note the package of BD139 & TIP120 * specifications from datasheets | * Identify Transistor type & terminals with DMM * Rig up the circuit * Measure Voltage and current. * Test the circuit |
| 10 | To Draw the input and output characteristics of JFET and determine pinchoff voltage and transconductance. (3)  a) To test the JFET with DMM &Analogue multimeter and identify the Terminals | * Draw the symbols of FET, * Identify the JFET terminals using DMM and multimeter * Rig up the circuit * Interpret the JFET characteristics and determine the pinch off voltage * Interpret JFET datasheets and finding the specifications. | * 1.Determine the pinch off voltage * Identify the ground, drain, gate and source terminals using multimeter (DMM and Analogue) also by physical observation |
| 11 | To use JFET as a current source  a) To Implement a constant current source with a FET by applying appropriate gate bias (3)  b) To practically Verify High input impedance characteristic of the gate circuit. | * Identify the JFET terminals using DMM and multimeter * Rig up the circuit * Measure voltage & current * finding JFET current rating from data sheets | * Rig up the circuit &Test * Measure voltage & current |
| 12 | To Plot the frequency response characteristics of a RC coupled Amplifier. (3)  a) To observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion.  b) To observe the effect of emitter bypass capacitor Ce on voltage across Emitter Resistance using CRO.  c) To Measure the output power using ac power meter | * 1.Identify the coupling and bypass capacitors and noting their values * Measure the amplitude and frequency on CRO * Observe the 3db points * Apply correct level of input signal to produce the distortion less output | * Assemble the circuit as per the circuit diagram * Identify the coupling and bypass capacitors(types, values) * Observe the distortion(clipping ) of signal on CRO and adjusting the input for distortion less output |
| 13 | To implement a) Colpitt’s oscillator b) Hartley oscillator and verify the effect of Varying the tank circuit component values and observe output waveforms on CRO. (3) | * Identify Tuned circuit * Identify the active component and amplifier circuit . * Identify feed back circuit * Observe the waveforms on CRO. * Vary the core of inductor & observe the effect on o/p frequency Identify the crystal in the circuit & note the component number | * Identify different sections in the Oscillator circuit Identify the Type of oscillator * Measure amplitude and frequency of waveforms on CRO |
| 14 | To implement transistor Astable multivibrator circuit and observe the waveforms on CRO. (3) | * Identify transistor type & Terminals with DMM * Select correct values for components * Rig up the circuit * Change R & C values & observe the effect on output frequency on CRO | * Select correct values for components * Rig up the circuit * Change R & C values & observe the effect on output frequency on CRO |
| 15 | To plot the characteristics of  a) Photodiode b) photo transistor (3) | * 1.Identify the devices * 2 Draw the symbols * 3.Note down the component values * 4.Identify photo diode terminals with DMM/multimeter 5.Assemble the circuit * 6.Measure Voltage &Current * 7.Note the specifications | * Plotting the characteristics of the Photo diode, Photo transistor and LED Identify the device from the characteristics. * Test the devices with DMM/multimeter * Assemble the circuit * Measure Voltage &Current |
| 16 | To Implement a Twilight switch using a Phototransistor , BC 148 ,12V Relay & Test  a) Replace Phototransistor with LDR and Test (3) | * Select the devices * Identify the Photo diode and Relay terminals with DMM/multimeter * Assemble the circuit * Test the circuit | * Identify the Photo diode and Relay terminals with DMM/multimeter * Assemble the circuit * Test the circuit |
| 17 | a) To Plot the VI characteristics of different color LEDs & determine the Vf (forward voltage drop)  b)To test the above devices with DMM & Analogue multimeter and identify the Terminals (3) | * .Identify the devices * 2 Draw the symbols * 3.Identify LED terminals with DMM/multimeter * 4. Determination of series Resistance * 5.Assemble the circuit * Measure voltage &Current * 7.Note the specifications from the datasheets | * 1.Identify LED terminals with DMM/multimeter * Determination of series Resistance 3.Assemble the circuit * Measure voltage &Current |
| 18 | To plot the characteristics of a) LDR b) Thermistor c) VDR  a) To test the above devices with DMM & Analogue multimeter  b) To use a VDR /Trigistor for protection against high voltage surges and verify (3) | * Identify LDR , Thermistor & VDR * Test the devices with DMM(Resistance Test) * Rig up the circuit * Measure Voltage & Current * Note the device specifications from data sheets | * Test the devices with DMM(Resistance Test) * Rig up the circuit * Measure Voltage & Current |
| 19 | To plot the characteristics of optocoupler MCT2E (3)  a) To use MCT 2E to switch on a 6V lamp connected to RPS by applying a Low voltage 1.5 V signal from a cell at input | * Identify the terminals of Optocoupler MCT2E with DMM * Rig up the circuit &Test * Measure the voltage and Current | * Identify the terminals of Optocoupler MCT2E with DMM * Rig up the circuit &Test * Measure the voltage and Current |
| 20 | To implement a simple timer using 1 M Ω Resistor ,Transistor and a Relay | * Identify the components * Observe polarity * Rig up the circuit * Test the circuit | * Identify the components * Observe polarity * Rig up the circuit * Test the circuit |

**Communication Skills and Life Skills**

(Common to all the branches)

**Subject Title : Communication Skills and Life Skills**

**Subject Code : EC - 308**

**No. of periods per week : 4**

**No. of periods per semester : 60**

# TIME SCHEDULE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S. No** | **Major Topics** | **No. of Periods** | **Weightage of Marks** | **No. Of Questions** |
| **I** | **Communications Skills** | | | |
| 1. | Listening (Unit-1 & 2) | 10 | 10 | 1 |
| 2. | Speaking (Unit- 3 to 6) | 10 | 10 | 1 |
| 3. | Group Discussion (Unit-7) | 5 | 10 | 1 |
| 4. | Interview Skills (Unit-8) | 5 | 10 | 1 |
| **II** | **Life Skills** | | | |
| 5 | Unit-1 to 4 | 15 | 30 | 1 |
| 6 | Unit-5 to 8 | 15 | 30 | 1 |
| **Total** | | **60** | **100** | **6** |

**Communication Skills**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No** | **Unit** | **Objectives** | **Key Competencies** |
| **1** | Listening- I | * Listen for the main idea * Listen for specific details | * Learn to listen for main idea * Listen for specific details * Listen and understand varied material * Make inferences * Know appropriate vocabulary |
| **2** | Listening-II | * Listen for and identify the main idea * Listen for and identify specific details | * Learn to listen for main idea * Listen for specific details * Listen and understand varied material * Make inferences * Know appropriate vocabulary |
| **3** | Introducing |Oneself | * Introduce oneself * Learn vocabulary relevant to making introductions * Learn the difference between an informal and formal introduction | * Use formal and informal introduction appropriately * Know relevant vocabulary to talk about skills, hobbies, strengths and weaknesses |
| **4** | Describing Objects | * Learn vocabulary and expressions useful for describing objects * Describe objects | * Learn to describe an object * Use relevant vocabulary |
| **5** | Reporting Past Incidents | * Report past incidents * Use appropriate grammar and vocabulary for reporting | * Use appropriate tense * Learn appropriate vocabulary * Know how to express past incidents |
| **6** | Just A Minute | * Speaking fluently and accurately for a minute | * Learn to speak on any given topic * Sequencing ideas organizing thoughts * Know how to introduce a given topic * Learn how to give a good closure * Know and avoid common mistakes |
| **7** | Group Discussion | * Understand the concept of a group discussion * Participate in a group discussion * Learn the do’s and don’ts of group discussion | * Participate in a group discussion * Learn appropriate vocabulary and expressions * Use good body language * Know group dynamics * Be aware of do’s and don’ts in a group discussion * Know appropriate etiquette |
| **8** | Interview Skills | * Prepare for an interview * Face an interview | * Get the confidence to face an interview * Learn good body language * Know frequently asked questions and answer them appropriately * Learn to dress properly for an interview * Know the do’s and don’ts |

**Life Skills**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No** | **Unit** | **Objectives** | **Key Competencies** |
| **1** | Positive Attitude | Concept of positive attitude | * Learn to think positively * Become confident |
| **2** | Goal Setting | Importance of setting goals | * Learn to set goals * Know how to achieve goals * Know about personal and professional goals |
| **3** | Time Management | To manage time in an efficient manner | * Know about time wasters * Learn to plan, prioritize, schedule * Learn to become productive * Learn to manage time productively |
| **4** | Problem Solving and Decision Making | Learn to solve problems and take appropriate decisions | * Learn the steps in problem solving * To think out of the box * Learn to solve the problems rationally |
| **5** | Creativity | To become creative | * Think innovatively * Learn to think out of the box * Learn to look at old things in a new way * Think differently |
| **6** | Managing Emotions | Understand different emotions | * Learn to manage stress * Know about anger management * Understand and manage emotions |
| **7** | Teamwork | Importance of teamwork | * Learn to be a team player * Know the importance of teamwork * Learn the traits of a good team * Know the stages in a team formation |
| **8** | Leadership Skills | Concept of leadership | * Learn leadership traits * Know leadership styles * Be a future leader |

**Total Marks: 100**

**Internal: 40 marks**

**External: 60 marks**

**End Examination:**

* Listening skill: **10 marks**
* Speaking Skill: **10 marks**

(Describing Objects, Reporting past incidents, JAM)

* Interview Skills or Group Discussion: **10 marks**
* Life Skills: **30 marks**

**Internal Assessment:**

* Attendance, Discipline: **5 marks**
* Lab manual Submission: **15 marks**
* Classroom presentations: **20 marks**

#### DIGITAL ELECTRONICS&ECAD TOOLS LAB

**Subject Title : Digital Electronics & eCAD Tools Lab**

**Subject Code : EC-309**

**Periods/Week : 04**

**Periods/Semester : 60**

Rationale: This is a core lab . student is expected to understand and demonstrate practical skills in handling , identify and using different instruments and various Digital ICs with ease .Emphasis is laid on imparting practical skills useful in the industry. CAD tools part is also included to enable the students learn latest software tools used in the industry .

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | | **Major Topics** | **No. of Periods** |
| **A** | **I** | **Basic Gates and Logic Families** | **6** |
| **II.** | **Realization of Boolean Functions using Gates** | **9** |
| **III.** | **Realization of Boolean Functions using Multiplexers and DeMultiplexers** | **9** |
| **IV.** | **Flip Flops & Timing Circuits** | **9** |
| **V.** | **Counters & Shift Registers** | **12** |
| **B** | **VI** | **Digital Circuit simulation using eCAD tools** | **15** |
|  | |  | **60** |

Note : Student should complete any 15 exercises from Part A and any 5 Exercises from Part B (sub exercises are optional)

#### LIST OF EXPERIMENTS

**PART A**

**I. Basic Gates and Logic Families**

**1. Identify Digital ICs and noting down pin details from data sheets**

a) Identify the given digital ICs and draw the pin diagrams. ( use TTL and CMOS ICs of

AND, OR,NOT, NAND, NOR and XOR gates with two and three inputs)

b) Realize basic gate functions using toggle switches and a bulb

2. Verify the truth tables of AND, OR,NOT, NAND, NOR Gates

a) Measure threshold voltages resulting in change of a state of a NAND gate

b) Verify the truth table of 7403 IC (open collector quad 2input NAND gate).

c) Verify the Truth table of 4073 IC

3. Realize AND, OR, NOT, functions using 2 input NAND and NOR TTL Gates

**a)** Implement Wire AND & Wire OR circuit and verify the truth table

b) From the data sheets find out CMOS Equivalent of above ICs

**II. Realizing Boolean Functions**

**4. Implement XOR Logic using 2 input Nand Gates and NOR Gates and verify the truth table**

5. a) Implement the given logic function with 3 variables using 2 input CMOS NAND Gates only

b)Implement given logic function with 3 variables using 2 Input CMOS NOR Gates only.

**6. Implement Half adder and full adder circuits using TTL/CMOS gates and verify the truth tables**.

a) Verify the truth table of BCD to 7 segment Decoder 7448 IC

**7. a) Verify the Truth table of Decoder and Explore the Features of 74138 Decoder IC**

b) Combine two 3 to 8 decoder to realize a 4 to 16 Decoder

**8 . Verify the Truth table of 74148 Encoder IC**

a) Verify the function of 74148 Encoder and write the truth table

b) Combine two 74148 Encoder and Verify the truth table

**III. Realization of Boolean Functions using Multiplexers and Demultiplexers**

**9. Verify the Truth table and Function of Multiplexer IC 74153**

a) Verify the truth table of IC 74153

b) Combine two 74153 Multiplexers ICs to realize 8:1 multiplexer

c) Implement the given function using IC 74150 16:1 line multiplexer

**10. Verify the Truth table and Functions of De multiplexers (Using IC 74154)**

**11. Verify the function of 4-bit magnitude comparator 7485IC.**

a) Verify the effect of giving different logic inputs to pins 2,3,4 of IC

b) Realize a simple 2bit comparator using XOR Gate

**IV. Flip Flops & Timing Circuits**

**12. Construct and verify the truth tables of NAND & NOR latches**

a) Realize a Bistable element with two NOT gates and a Feedback Resistor

b) Implement a bounce Elimination switch using the above Gates

c) Realize a clock circuit using 4093 CMOS Nand Gate , Resistor and capacitor and observe the waveform on CRO

**13. Construct clocked RS FF using NAND gates and Verify its truth table.**

a)Verify the truth table of CD 4013 Dual D flip Flop

b)Verify the functionality and truth table of 74L71 RS flip flop with Preset and Clear

c) Verify the Truth table of JK FF using 7476 IC.

d) Construct D and T flip flops using 7476 and verify the truth tables.

**V . Counters and Shift Registers**

**14. Construct and verify the function of decade counter using 7490 ICs.**

a) change the modulus of the counter

b)Cascade two 7490 decade counter ICs to count up to 99 or any other modulus

c) Display decimal number using 7447

d) Cascade two 7447 ICs to count up to 99

**15. Verify the function of up/down counter using 74190, 74193**

a) change the modulus of the counter and verify

b) Verify the Functionality of CD4029 up/down counter

c) Load the Preset inputs of CD4029 Counter with a binary number

**16. Verify the function of shift register (ICs like 7495, 74194 etc.)**

**17. Verify the function of Johnson counter using CD 4017 IC**

a) Change the modulus of the counter

b) Design a Frequency divider circuit using 4017 IC

c) Implement running LED circuit with 4017 IC

**18. Identify Various Memory ICs and Note their pin Configuration from the datasheets**

a) RAM b) ROM c) EPROM d) EEPROM

**Part 2:eCAD TOOLS LAB PRACTICE (15 Periods)**

19.Familiarization of usage of ORCAD suite /or any other software tools for the design and layout of printed circuit boards (PCBs).(3)

20. Simulate a Full wave bridge rectifier with 7805 Regulator

21. Simulate a single stage RC coupled transistor amplifier

22.Simulate a 4 bit full adder /subtractor and test.

23.Design and simulate code converters using logic gates

(i) BCD to excess-3 code and vice versa

(ii) Binary to gray and vice-versa

24.Design and simulate 16 bit odd/even parity checker /generator using IC74180

25.Design and Simulate 4 bit ripple counter with Mod-10 and Mod- 12

**Competencies and Key competencies :**

|  |  |  |  |
| --- | --- | --- | --- |
| **Exp No** | **Name of the Experiment** | **Competencies** | **Key competencies** |
| 1 | To Identify Digital ICs and noting down pin details from data sheets(3)  a) Identify the given digital ICs and draw the pin diagrams. ( use TTL and CMOS ICs of  AND, OR,NOT, NAND, NOR and XOR gates with two and three inputs)  b) Realize basic gate functions using toggle switches and a bulb | * Identify digital IC from the number printed   Give Pin out diagram  Identify +ve and -ve Power supply pins  Insert and remove the iC into and from the socket by observing starting (1) pin  Make switch connections | * Identify digital IC from the number printed * Identify +ve and -ve Power supply pins * Insert and remove the iC into and from the socket by observing starting (1) pin |
| 2 | To Verify the truth tables of AND, OR,NOT, NAND, NOR Gates(3)  a) Verify the Functionality of Different logic gates and Write the corresponding truth table  b) Measure threshold voltages resulting in change of a state of a NAND gate  c) Verify the truth table of 7403 IC and give your observations  d) Verify the Truth table of 4073 IC | * Write the truth table for any Logic gate * Apply correct Logic level Voltages * Find out IC details from the datasheets * Test the IC for its correct functionality by verifying the truth table * Test the IC by feeling the heat by touching | * Apply correct Logic level Voltages * Test the IC for its correct functionality by verifying the truth table * Test the IC by feeling the heat by touching |
| 3 | To Realize AND , OR , NOT , functions using 2 input NAND and NOR TTL Gates(3)  a) Implement Wire AND & Wire OR circuit and verify the truth table  a) From the data sheets find out CMOS Equivalent of above ICs | * Substitute 2 input NAND or NOR gates to obtain the functionality of any logic gate with any number of inputs * Use open collector logic gates with pull up resistor * Read the data sheets | * Substitute 2 input NAND or NOR gates to obtain the functionality of any logic gate with any number of inputs * Use open collector logic gates with pull up resistor |
| 4 | To Implement XOR Logic using 2 input Nand Gates and NOR Gates and verify the truth table(3) | * Realize simple Boolean functions using NAND &NOR gates * Verify truth table by observing inputs and outputs | * Verify truth table by observing inputs and outputs * Use XOR gate in simple logic circuits |
| 5 | a)To Implement the given logic function with 3 variables using 2 input CMOS NAND Gates only(3)  b)Implement given logic function with 3 variables using 2 Input CMOS NOR Gates only. | * Realize simple Boolean functions using karanaugh maps method * Applying correct logic voltages to CMOS ICs * Follow precautions * Read data sheets to check Fan-in and Fan-out capacity | * Realize simple Boolean functions using karanaugh maps method * .Applying correct logic voltages to CMOS ICs * Follow precautions |
| 6 | To Implement Half adder and full adder circuits using TTL/CMOS gates and verify the truth tables.(3)  b) Verify the truth table of BCD to 7 segment Decoder 7448 IC | * Realize simple Boolean functions using karanaugh maps method * Design Half adder/Full adder circuit * Use 7448 IC in the circuits | * Design Half adder/Full adder circuit * Use 7448 IC in the circuits |
| 7 | To Verify the Truth table of 74138 Decoder IC(3)  a) Verify the function of 74138 decoder IC.  b) Combine two 3 to 8 decoder to realize a 4 to 16 Decoder | * Develop logic for Decoder Circuit * Use 74138 in digital circuits * Combine Decoder ICs to handle more bits | * Use 74138 in digital circuits * Combine Decoder ICs to handle more bits |
| 8 | To Explore the Features of 74148 Encoder IC(3)  a) Verify the function of 74148 Encoder  b) Combine two 74148 Encoder | * Develop logic for Encoder Circuit * Use 74148 in digital circuits * Combine Decoder ICs to handle more bits | * Use 74148 in digital circuits * Combine Encoder ICs to handle more bits |
| 9 | To Verify the Function of Multiplexer IC 74153(3)  a) Verify the truth table of IC 74153  b) Combine two sections of 74153 Multiplexers ICs to realize 8:1 multiplexer  c) Implement the given function using IC 74150 16:1 line multiplexer | * Develop logic for Multiplexer * Use 74153 in digital circuits * Combine Multiplexer ICs to handle more bits * Use Multiplxer ICs to realize given function | * Combine Multiplexer ICs to handle more bits * Use Multiplxer ICs to realize given function |
| 10 | To Verify the Truth table and Functions of De multiplexers (  a) Verify the truth table of IC 74154(3)  b) Combine two sections of 74155 DeMultiplexers ICs to realize 1:8 Demultiplexer  c) Implement the given function using IC 74154 16:1 line multiplexer | * Develop logic for DeMultiplexer * Use 74154 in digital circuits * Combine DeMultiplexer ICs * Use DeMultiplxer ICs to realize given function | * Combine DeMultiplexer ICs Use DeMultiplxer ICs to realize given function |
| 11. | To Verify the function of 4-bit magnitude comparator 7485IC.(3)  a) Verify the effect of giving different logic inputs to pins 2,3,4 of IC  b) Realize a simple 2bit comparator using XOR Gate | * Develop logic for magnitude comparator * Verify the function of Magnitude comparator * Use 7485IC in digital circuits | * Verify the function of Magnitude comparator * Use 7485IC in digital circuits |
| 12 | To Construct and verify the truth tables of NAND & NOR latches(3)  a) Implement Latch circuits with 7400 and 7402 Ics  b) Realize a Bistable element with two NOT gates and a Feedback Resistor  c) Implement a bounce Elimination switch using the above Gates  c) Realize a clock circuit using 4093 CMOS Nand Gate , Resistor and capacitor and observe the waveform on CRO  b) Interpret the specifications of 4093 IC from data sheets | * Develop logic for Latch circuits * Use Not gates for Latch circuit applications * Use latch circuits for de bouncing application * Use Schmitt trigger NAND gate for clock circuits | * Use Not gates for Latch circuit applications * Use latch circuits for de bouncing application * Use Schmitt trigger NAND gate for clock circuits |
| 13 | To Construct clocked RS FF using NAND gates and Verify its truth table.(3)  a)Verify the truth table of CD 4013 Dual D flip Flop  b)Verify the functionality and truth table of 74L71 RS flip flop with Preset and Clear  c) Verify the Truth table of JK FF using 7476 IC.  d) Construct D and T flip flops using 7476 and verify the truth tables.  e) Verify the function of octal latch 74LS373 | * Develop logic circuit for Clocked RS flip Flop using 7400 IC * Verify the truth tables of CD4013 and 74L71 IC * Use Preset and Clear Inputs * Verify the Truth table of 7476 IC * Modify 7476 to function as D flip Flop and T Flip Flop * Use octal latch 74LS373 | * Verify the truth tables of CD4013 and 74L71 IC * Use Preset and Clear Inputs * Verify the Truth table of 7476 IC * Modify 7476 to function as D flip Flop and T Flip Flop * Use octal latch 74LS373 |
| 14. | To Construct and verify the function of decade counter using 7490 ICs.(3)  a) change the modulus of the counter  b)Cascade two 7490 decade counter ICs to count up to 99 or any other modulus  b) display decimal number using 7447  c) cascade two 7447 ICs to count up to 99 | * .Develop logic for implementing Up/down counter * Change the modulus of the counter * Connect Counter IC 7447 IC to display the count * Cascade Counter ICs | * Change the modulus of the counter * Connect Counter IC 7447 IC to display the count * Cascade Counter ICs |
| 15 | To Verify the function of up/down counter (3)  a) Verify the truth table of 74190  a) change the modulus of the counter and verify  b) Verify the Functionality of CD4029 up/down counter  c) Load the Preset inputs of CD4029 Counter with a binary number | * Develop logic for implementing Up/down counter * change the modulus of the counter * Load the Preset inputs of CD4029 | * Change the modulus of the counter * Load the Preset inputs of CD4029 |
| 16 | To Verify the function of shift register (3)  a) Verify the truth table of 7495  b)Verify the truth table of 74194 Universal shift register in all modes | * Develop logic for implementing shift Registers * Verify the truth table of 7495Ic in all modes * Verify the truth table of 74194 Universal shift register in all modes | * Verify the truth table of 7495Ic in all modes * Verify the truth table of 74194 Universal shift register in all modes |
| 17. | To Verify the function of Johnson counter using CD 4017 IC(3)  a) Change the modulus of the counter  b) Design a Frequency divider circuit using 4017 IC  c) Implement running LED circuit with 4017 IC | * Develop logic for implementing * Verify the truth table of Johnson counter * Set the modulus of counter to required value * Use 4017 in frequency divider circuits and other digital circuits | * Set the modulus of counter to required value * Use 4017 in frequency divider circuits and other digital circuits |
| 18. | To Identify Various Memory ICs and Note their pin Configuration from the datasheets(3)  a) RAM b) ROM c) EPROM d)EEPROM | * Identify memory chips from other Integrated circuits by observation and IC number * Find out the memory capacity from the IC number * Identify different memory chips | * Find out the memory capacity from the IC number * .Identify different memory chips |
| 19 | Familiarization of usage of ORCAD /kiCad suite of tools for the design and layout of printed circuit boards (PCBs).(3) | * Use ORCAD suite/similar software and its features * Select Components , * Draw the circuit &simulate * Debug the errors | * Select Components * Draw the circuit & simulate * Debug the errors |
| 20 | . Simulate a Full wave bridge rectifier with 7805 Regulator | * Use ORCAD suite/similar software and its features * Select Components , * Draw the circuit &simulate * Debug the errors | * Select Components * Draw the circuit & simulate * Debug the errors |
| 21 | Simulate a single stage RC coupled transistor amplifier | * Use ORCAD suite/similar software and its features * Select Components , * Draw the circuit &simulate * Debug the errors | * Select Components * Draw the circuit & simulate * Debug the errors |
| 22 | Simulate a 4 bit full adder /subtractor and test.(3) | * Develop logic for implementing 4 bit full adder /subtractor * Select Components , * Draw the circuit & simulate * Debug the errors | * Select Components * Draw the circuit & simulate * Debug the errors |
| 23 | Design and simulate code converters using logic gates (3)  (i) BCD to excess-3 code and vice versa  (ii) Binary to gray and vice-versa | * Develop logic for implementing 4 bit full adder /subtractor * Select Components , * Draw the circuit & simulate * Debug the errors | * Select Components * Draw the circuit & simulate * Debug the errors |
| 24 | Design and simulate 16 bit odd/even parity checker /generator using IC74180 (3) | * Develop logic for implementing 4 bit full adder /subtractor * 2.Select Components , * Draw the circuit & simulate * Debug the errors | * Select Components * Draw the circuit & simulate * Debug the errors |
| 25 | Design and Simulate 4 bit ripple counter with Mod-10 and Mod- 12 (3) | * Develop logic for implementing 4 bit full adder / subtractor * Select Components * Draw the circuit & simulate * Debug the errors | * Select Components * Draw the circuit & simulate * Debug the errors |

**ANALOG COMMUNICATION LAB**

### Subject Title : Analog Communication Lab

**Subject Code : EC-310**

**Periods/Week : 03**

**Periods/Semester : 45**

Rationale:

Analogue communication lab is included to comprehend the concepts of Analogue communications , Network theorems and also to impart skills of using software tools

|  |  |  |
| --- | --- | --- |
| **S. No.** | **Major Topics** | **No. of Periods** |
| **I.** | **Verification of Network theorems** | **6** |
| **II.** | **Electronic measuring equipment** | **3** |
| **III.** | **Measurements using CRO** | **12** |
| **IV.** | **Modulation , Demodulation Techniques &Antennas** | **6** |
| **V.** | **Pulse and wave shaping circuits** | **9** |
| **VI** | **Resonance & Filters** | **6** |
|  | **Total** | **45** |

#### LIST OF EXPERIMENTS

1. **Verification of Network theorems**
2. a) Verify Thevenin’s theorem.

B) Determine the Thevenin’s Resistance of a Potential divider network

C) Verify Norton’s theorem

1. A) Verify Super position theorem.

B) Verify Maximum power transfer theorem.

C) Connect Four 4 ohms speakers to obtain 4 Ohms Impedance and test for maximum power output by Audio amplifier at 4 ohms output terminals

1. **Electronic measuring equipment**
2. Measure the component values using special equipment

A) Use DMM/ Multimeter to measure DC current , AC Current ,Beta of transistor

B) Use the AC bridge/Digital LCR meter to measure Resistance , Inductance , Capacitance and Q

C) Measure the Distortion factor using Distortion Factor Meter.

**III. Measurements using CRO**

1. Familiarize with CRO front panel controls and observe the effect of different settings

A) Set intensity , Astigmatism and Focus controls to display i) Medium frequency ii) Low frequency iii) High frequency.

B) Apply different waveforms using function generator and produce flicker free waveforms

C) Set the output of function generator to desired amplitude and frequency (say 20 milli volts and 1.5 khz) by observing on CRO.

1. Determine Vertical and Horizontal deflection sensitivity of CRO by applying standard signal provided on CRO

A) Observe the effect of Trigger control on the waveform and display the waveform from the set point

B) Measure signal amplitude using x10 CRO probe.

1. Use dual mode for simultaneous observation of two signals .

A) Use ADD mode observe the resultant wave form

B) Measure the Time period and frequency of a signal in Time base multiplier mode

1. A) work with various controls on Digital CRO

B) Practice with i) Manual measurements ii) Cursor measurements iii) Automatic measurements By repeating sub experiments in experiment number 4& 5 .

C) Observe charging and discharging curves of a capacitor using digital CRO and determine time constant of given RC circuit

**IV. Modulation & Demodulation Techniques &Antennas**

1. A) implement and observe AM signal and determine Modulation index using CRO

I) Using Envelop method

Ii) Trapezoidal Pattern method

Iii) observe the effect of Over modulation and under modulation

B) Implement diode demodulator circuit and observe the detected waveform

1. Identify different sections in AM/FM radio receiver

B) Observe the different types of inductors used in the radio tuned circuits.(Local oscillator coils, IFT coils, Ferrite cored)

1. Generate FM signal and determine Modulation index

A) Demodulate F.M signal and compare the output signal with original modulating signal .

**IV. Pulse and wave shaping circuits**

1. A) Measure the Rise time, Fall time , duty cycle, Pulse width, Pulse amplitude , Overshoot of Pulse on CRO

B) observe the effect of Offset control on function generator on output waveform

1. A) Design and implement RC integrator circuit

B) apply a square wave and observe the output waveform on CRO.

C) use a differentiator circuit to convert a long Push button trigger signal into a pulse for use in Timer circuits

D) Use integrator circuit for producing triangular wave / Ramp

E) Design a Low pass filter Using Integrator circuit for a given cut off frequency

F) Design a High pass filter Using Differentiator circuit for a given cut off frequency

1. Realize Clipper and Clamper circuits and observe the waveforms on CRO

A) Realize Series and Parallel clippers

B)Assemble Positive and negative clipper circuits with and without bias

C) Connect a Zener diode in place of diode and measure the output voltage with DMM and also observe waveform on CRO

D) Realize a Clamper circuit and observe the input and output waveforms on CRO

**V. Resonance &Filters**

1. Plot resonant curves of a tuned circuit

A)Series Resonance., b)Parallel Resonance. C) Wind a small coil and determine its inductance

1. Design and construct constant K filters of 1st order

A) Design and implement a Low pass filter with a cut off frequency of 10 khz(or any other frequency) and evaluate the performance

B) Design and implement a High pass filter with a cut off frequency of 10 khz (or any other frequency) and evaluate the performance

**Competencies & Key Competencies**

|  |  |  |  |
| --- | --- | --- | --- |
| **Exp No** | **Name of the Experiment**  **(No of Periods)** | **Competencies** | **Key competencies** |
| 1 | a) To Verify Thevenin’s theorem. (3)  b) To Determine the Thevenin’s Resistance of a Potential divider network  c) To Verify Norton’s theorem | * Assemble the circuit * Observe the polarity of sources and meters * Use voltmeter and ammeter correctly * Choose correct Ranges * Follow the sequence of procedure * Verify theoretical & Practical results * Troubleshoot any faults | * + Select meters and components   + Open and short the   + Circuit terminals with care   + Use voltmeter and ammeter correctly |
| 2 | a) To Verify Super position theorem.(3)  b) To Verify Maximum power transfer theorem.  c) To Connect Four 4 ohms speakers to obtain 4 Ohms Impedance and test for maximum power output by Audio amplifier at 4 ohms output terminals | * Assemble the circuit * Observe the polarity of sources and meters * Use voltmeter and ammeter correctly * Choose correct Ranges * Troubleshoot any faults | * + Use voltmeter and ammeter correctly   + Observe Polarity   + Find out correct series parallel combination to obtain desired impedance |
| 3 | To measure the component values using special equipment(3)  a) Use DMM/ Multimeter to measure DC current , AC Current ,Beta of transistor  b) To Use the AC bridge /Digital LCR meter to measure Resistance , Inductance , Capacitance and Q  c) To measure the Distortion factor using Distortion Factor Meter. | * Identify the RLC bridge/Digital RLC meter and note the front panel controls. * Measure component values by selecting the proper mode and range * Use distortion factor meter for measure percentage of distortion * Use AF power meter * Use function Generator * Use AC voltmeter in dB scale | * + Identify RLC meters   + Use the RLC meter and Distortion factor meter   + Use AF power meter   + Use AC voltmeter in dB scale |
| 4 | To familiarize with CRO front panel controls and observe the effect of different settings(3)  a)To set intensity , Astigmatism and Focus controls to display i) Medium frequency ii) Low frequency iii) High frequency.  b) To apply different waveforms using function generator and produce flicker free waveforms  c) To set the output of function generator to desired amplitude and frequency (say 20 milli volts and 1.5 KHz) by observing on CRO. | * Use Function Generator * Use various controls and select appropriate ranges on Analogue CRO * Connect BNC Probe * Test the BNC Cable before applying the signal * Observe Positive and Negative peaks of a wave form. | * + Use Function generator   + Use CRO controls and selecting Correct Ranges   + Produce flicker free waveform and measure the amplitude , Time period and frequency of signal |
| 5 | To determine Vertical and Horizontal deflection sensitivity of CRO by applying standard signal provided on CRO (3)  a) To observe the effect of Trigger control on the waveform and display the waveform from the set point  b) To measure signal amplitude using x10 CRO probe. | * Apply standard signal & calibrate * Display the waveform from set point using Trigger control * Determine Vertical and Horizontal deflection sensitivities and carryout accurate measurements * Measure the amplitude and frequencies of small and high level signals using CRO Probes | * + Apply standard signal & calibrate   + Display the waveform from set point using Trigger control   + Determine Vertical and Horizontal deflection sensitivities and carryout accurate measurements |
| 6 | To use dual mode for simultaneous observation of two signals (3)  a) To use ADD &INVERT modes observe the resultant wave form  b) To use XY mode to measure phase angle and compare frequencies using Lissajous patterns method | * Select XY mode in CRO * Apply signals to correct channels * Measure phase angle by lissajous pattern method and interpret them * Compare frequencies by Lissajous pattern method | * + Select XY Mode in CRO   + Measure phase angles by Lissajous pattern method   + Compare frequencies by interpret Lissajous pattern |
| 7 | a) To work with various controls on Digital CRO (3)  b) To practice with i) Manual measurements ii) Cursor measurements iii) Automatic measurements by repeating sub experiments in experiment number4& 5.  c) To observe charging and discharging curves of a capacitor using digital CRO and determine time constant of given RC circuit | * Use Controls on Digital CRO * Use different modes of measurement * Use storage function of Digital CRO to capture transient characteristics | * + Use Controls on Digital CRO   + Use different modes of measurement   + Use storage function of Digital CRO to capture transient characteristics |
| 8 | To implement and observe AM signal and determine Modulation index using CRO(3)  i) Using Envelop method  ii) Trapezoidal Pattern method  iii) To observe the effect of Over modulation and under modulation  b) To implement diode demodulator circuit and observe the detected waveform | * implement AM Circuit and Test * Identify maxima and minima on the displayed waveform * Overmodulate and under modulate the AM signal * Use CRO in XY mode to determine modulation index * Identify diode demodulator circuit components | * + Perform the Experiment as per procedure and calculate modulation index.   + Identify maxima and minima on the displayed waveform   + Use CRO in XY mode to determine modulation index |
| 9 | Identify different sections in AM/FM radio receiver  a) identify the different types of inductors used in the radio tuned circuits.(Local oscillator coils, IFT coils, Ferrite core(3) | * Note down the Radio frequency Bands by observe the Dial. * Identify the tuned circuits corresponding to different bands * Observe Band selection switch connections in AM receiver * Identify different sections in Radio receiver . * Measure the Voltages at Test points with multimeter | * + Identify different sections n Radio receiver and measure the signal at test points |
| 10 | a)To generate FM signal and determine Modulation index  b)To Demodulate F.M signal and compare the output signal with original modulating signal (3) | * Observe the FM signal on CRO * Measure the amplitude and frequencies of carrier and Modulating Signal * Measure the Frequency Deviation * Identify FM Detector circuit and note down the IC numbers * Identify the amplitude limiter section on FM detector | * + Identify FM signal, on CRO   + Measure the amplitude &Frequency of baseband & Carrier on CRO   + Measure frequency deviation |
| 11 | To Measure the Rise time, Fall time , duty cycle, Pulse width, Pulse amplitude , Overshoot of Pulse on CRO(3)  b)To observe the effect of Offset control on function generator on output waveform | * Identify the Pulse waveform * Measure pulse parameters using CRO by selecting correct Timebase and Volts/Div | * + Identify the Pulse waveform   + Measure pulse parameters using CRO by selecting correct Timebase and Volts/Div |
| 12 | To Design and implement RC integrator/Differentiator circuit (3)  a) To apply a square wave and observe the output waveform on CRO.  b) To use a differentiator circuit to convert a long Push button trigger signal into a pulse for use in Timer circuits  c) To Use integrator circuit for producing triangular wave / Ramp  d) To Design a Low pass RC filter Using Integrator circuit for a given cut off frequency  e) To Design a High pass RC filter Using Differentiator circuit for a given cut off frequency | * Identify Passive Differentiator and integrator circuits. * Choose correct values for components * Vary the Time constant * Use the Differentiator and integrator circuits for wave shaping applications | * + Choose correct values for components   + Rig up the circuit   + Observe input /Output waveforms on CRO |
| 13 | To Realize Clipper and Clamper circuits and observe the waveforms on CRO(3)  a)To Realize Series and Parallel clippers  b) To Assemble Positive and negative clipper circuits with and without bias  c) To Connect a Zener diode in place of diode and measure the output voltage with DMM and also observe waveform on CRO  d) To Realize a Clamper circuit and observe the input and output waveforms on CRO | * Choose correct values for components * Rig up the circuit * Observe & Measure Input/Output waveforms * Vary the Time constant * Use clipper and Power clamper circuits for protection | * + Rig up the circuit   + Observe & Measure Input/Output waveforms   + Vary the Time constant |
| 14 | To plot resonant curves of a tuned circuit (3)  a)Series Resonance.,  b)Parallel Resonance.  c) To observe the effect of change in RLC Values | * To identify the TUNED circuit components * connect L and C to form a series and parallel resonant circuit * Identify the resonant frequency by observing waveform peak on CRO * Determine theoretical Resonant frequency | * + Identify tank circuit components   + Identify the resonant frequency by observing waveform peak on CRO |
| 15 | Design and construct constant K filters of 1st order (3)  A) Design and implement a Low pass filter with a cut off frequency of 10 KHz(or any other frequency) and evaluate the performance  B) Design and implement a High pass filter with a cut off frequency of 10 KHz(or any other frequency) and evaluate the performance | * Identify the Filter circuit components * Design the Low pass & high pass Filter for a given cut off frequency * Observe and locate 3db points on the response curve | * + Design the Low pass & high pass Filter for a given cut off frequency |