

ELECTRONIC COMPONENTS AND DEVICES

Subject Title : Electronic Components and Devices

Subject Code : EC-105

Periods/Week : 04

Periods/Year : 120

TIME SCHEDULE

Sl. No	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Basic Electricity Work power and energy	24	13	1	1
2	Magnetism	10	8	1	1/2
3	Electrostatics & Capacitance	16	13	1	1
4	Chemical effects of electric current & Batteries	6	8	1	1/2
5	AC Fundamentals	10	13	1	1
6	Passive components	18	13	1	1
7	Switches and Relays	10	13	1	1
8	PCBs	8	8	1	1/2
9	Semiconductor Diode	6	8	1	1/2
10	Power supplies	12	13	1	1
Total		120	110	10	8

OBJECTIVES

On completion of the course the student should be able to

1.0 Comprehend the basic Principles of Electricity

- 1.1 Explain the concept of Electric current , Potential difference , Voltage and emf.
- 1.2 Distinguish between conductor, insulator and semi-conductor with respect
- 1.3 to valence electrons.
- 1.4 Explain the concept of a circuit State Ohm's Law
- 1.5 Explain ohms law and its limitations.
- 1.6 Give the concept of Resistance to flow of electrons,
- 1.7 Define the terms specific resistance and conductivity.
- 1.8 Deduce the relation $R = (\rho l) / a$
- 1.9 Solve simple problems based upon the above formula.
- 1.10 Explain the effects of temperature on resistance
- 1.11 Define temperature co- efficient of resistance.
- 1.12 Derive the formula $R_t = R_o (1 + \alpha_{os}t)$ to find resistance at any given temperature
- 1.13 Solve Simple problems using the above formula.
- 1.14 Explain series and parallel connections of Resistances
- 1.15 Derive the expressions for equivalent resistance for series and parallel connections.
- 1.16 Solve simple problems on series and parallel circuits
- 1.17 Explain the division of current in parallel circuits
- 1.18 Solve simple problems on the above.
- 1.19 List the effects of Electric current
- 1.20 Explain the Heating effect of Electric current
- 1.21 Derive expression for conversion of Electrical energy into equivalent heat energy in kilo Calories (joules Law)
- 1.22 Define thermal efficiency
- 1.23 Solve problems on Electrical heating
- 1.24 Mention the practical applications of Electric heating like, Water heater, Electric Iron etc.

2.0 Know the magnetic effects of Electric Current

- 2.1 State coulombs laws of magnetism.
- 2.2 Define the terms Absolute and relative permeability of medium.
- 2.3 Explain the concept of lines of force & magnetic Field.
- 2.4 Define field intensity, Magnetic potential, Flux , Flux density .
- 2.5 Give the relation between Absolute and relative permeability
- 2.6 Draw and explain the field patterns due to
 - a. Straight current carrying conductor
 - b. Solenoid and
 - c. Toroid.
- 2.7 Explain Work law and its applications
- 2.8 State Laplace law (Biot-Savart's Law)
- 2.9 Give expressions for field strength,
- 2.10 Develop the expression for magnitude of the force on a conductor in a magnetic field
- 2.11 State the Flemming's left hand rule
- 2.12 Give the expression for the force between two

- 2.13 parallel current carrying conductors
- 2.14 State the nature of the force with different directions of the currents
- 2.15 Define ampere
- 2.16 Develop the concept of the Magnetic circuits
- 2.17 Define magneto motive force (mmf), permeability, flux and Reluctance
- 2.18 Solve problems on simple magnetic circuits
- 2.19 Compare magnetic circuit with electric circuit
- 2.20 Explain the terms leakage flux and leakage co-efficient
- 2.21 **State** Faraday's laws of electro - magnetic induction
- 2.22 Explain dynamically and statically induced E.M.F.
- 2.23 State Lenz's law and explain Flemming's right hand rule
- 2.24 Develop the concept of self and mutual inductance
- 2.25 Derive the expressions for self and mutual inductances
- 2.26 State co-efficient of coupling
- 2.27 Explain the total inductance with series connections
- 2.28 with reference to direction of flux.
- 2.29 Give the equation for the energy stored per unit volume in a magnetic field.
- 2.30 Calculate energy stored per unit volume
- 2.31 Give the expression for lifting power of a magnet.
- 2.32 Solve problems on the above.

3.0 Understand Electric Charge and Electrostatic Field

- 3.1 State Coulomb's law of electrostatics and define unit charge
- 3.2 Define absolute and relative permittivity.
- 3.3 Solve problems on the above
- 3.4 Explain electrostatic field.
- 3.5 Compare electrostatic and magnetic fields
- 3.6 State field intensity
- 3.7 State Gauss theorem
- 3.8 Explain electric potential and potential difference
- 3.9 Explain di-electric strength and di-electric constant
- 3.10 Give the Permittivity of commonly used die- electric materials
- 3.11 State unit of capacitance
- 3.12 Derive the formula for capacitance of a parallel plate capacitor
- 3.13 Explain equivalent capacitance of
- 3.14 Capacitors connected in series;
- 3.15 Capacitors connected in parallel
- 3.16 Explain charging and discharging of capacitor.
- 3.17 Give the expression for energy stored in a capacitor
- 3.18 Solve simple problems on the above

4.0 Chemical effects of Current and Batteries

- 4.1 Explain Faradays laws of Electrolysis
- 4.2 Explain Polarisation or Back emf
- 4.3 Explain how the value of Back emf can be determined

- 4.4 Define Primary and Secondary Cells.
- 4.5 Explain the constructional details of a Lead acid Battery
- 4.6 List the active materials used in the construction of lead acid Battery
- 4.7 Explain the chemical reactions that take place during Charging and discharging
- 4.8 Explain the significance of internal resistance of a Battery
- 4.9 Define the two Efficiencies of the cell.
- 4.10 Draw the Electrical characteristics of Lead acid cell and explain.
- 4.11 Explain the condition of a Fully charged cell.
- 4.12 List the six important applications of Lead acid batteries
- 4.13 Explain constant current and Constant Voltage methods of Charging Lead acid batteries.
- 4.14 Solve simple problems to find charging current requirements
- 4.15 Explain the need for Trickle charging
- 4.16 Explain the sulphation and prevention
- 4.17 List the precautions to be observed to maintain the lead acid batteries.
- 4.18 List other types of Batteries used in Electronic Industry
- 4.19 Mention their applications
- 4.20 Compare Primary and Secondary cells.

5.0 Comprehend Vector representation of Alternating quantities.

- 5.1 Represent vector diagrams of sine waves of same frequency.
- 5.2 Perform addition and subtraction of alternating quantities using vector method.
- 5.3 Solve problems to find resultant vector of several alternating quantities.
- 5.4 Explain the effect of AC flowing through Pure Resistance, Inductance and Capacitance with vector diagrams.
- 5.5 Explain mathematical representation of vectors in a) symbolic notation, b) trigonometric c) exponential and polar forms
- 5.6 Solve simple problems using J notation.
- 5.7 Define the terms Inductive reactance, Impedance, admittance, conductance and Power Factor
- 5.8 Explain Active and Reactive components of AC current
- 5.9 Explain Active and Reactive and apparent power in a AC circuit.
- 5.10 Define **Q factor** of a coil.
- 5.11 Explain power in an iron cored choking coil.
- 5.12 Explain AC through Resistance and capacitance connected in series.
- 5.13 Solve problems on RC series circuits.
- 5.14 Explain dielectric loss and Q factor of a Capacitor.

6.0 Understand passive components

- 6.1 Classify types of resistors.
- 6.2 List the specifications of a resistor, and state their importance.
- 6.3 Explain the necessity of preferred values in resistor.
- 6.4 Identify Resistance Value by using Colour Code.
- 6.5 Compare the features of carbon film metal film (thick and thin) and wire wound resistors with respect to size, power rating, tolerance, temperature coefficient (PTC, NTC) and applications
- 6.6 Describe constructional details of carbon and wire wound potentiometers.
- 6.7 Compare the features of carbon and wire wound potentiometers
- 6.8 Mention the need for tapering in potentiometers.
- 6.9 Describe the working of rheostat and mention its application.
- 6.10 Explain the effects of temperature on resistance and define temperature co-efficient of resistance.

- 6.11 Understand the formula for resistance at any temperature
- 6.12 $R_t = R_0 (1 + \alpha_0 t)$
- 6.13 Solve problems based on the above formula.
- 6.14 Describe the working of thermistor and sensistor and mention their applications.
- 6.15 List the common faults in resistors.

Familiarise with different types of inductors used in electronic circuit and their applications

- 6.16 Classify inductors.
- 6.17 Draw the symbol of different types of inductors
- 6.18 List the specifications of inductors.
- 6.19 List and Explain the important parameters of Air cored inductors
- 6.20 Explain the terms Stray inductance and stray capacitance
- 6.21 List various core materials used in the construction of inductors
- 6.22 Describe the constructional features
- 6.23 List the applications of A.F. and R.F chokes.
- 6.24 List the common faults in inductors
- 6.25 Explain the use of Ferrites in the construction of high frequency inductors

Familiarise with different types of capacitors used in electronic circuits and their applications

- 6.26 Define the term capacitance.
- 6.27 Classify the types of capacitors.
- 6.28 List the specifications of a capacitor and state their importance.
- 6.29 Identify capacitor value by using colour code.
- 6.30 State the factors affecting the capacitance of a capacitor.
- 6.31 Define Di-electric constant and Di-electric strength of a material.
- 6.32 State the properties, range of values and applications of paper, mica, glass, polyester, polystyrene, ceramic (different types) and electrolytic (different types) capacitors.
- 6.33 State different types of variable capacitors and mention their applications.
- 6.34 State losses in capacitors.
- 6.35 List the common faults in capacitors.

7.0 Familiarise with different types of switches, Connectors and Relays.

- 7.1 Explain the working of a switch.
- 7.2 Classify switches according to poles and throws (SPST, SPDT, DPST, DPDT, Multi-pole multi-throw)
- 7.3 Explain the working of toggle, push button, rotary, slider, keyboard, and thumb wheel switches with a mention to their ratings and applications.
- 7.4 Sketch the I.S.I symbols of various switches.
- 7.5 State the need of fuse in electronic equipment.
- 7.6 Mention different types of fuses.
- 7.7 Mention significance of ratings of fuse.
- 7.8 Explain the necessity of connectors in electronic circuits.
- 7.9 List different types of connectors.
- 7.10 Mention the use of MCB.
- 7.11 Define a relay.
- 7.12 Classify different relays based on principle of operation, polarization and application.
- 7.13 Mention specifications and applications of relays.
- 7.14 Explain the construction & working of general-purpose electromagnetic relay.
- 7.15 Explain the performance characteristics of relay.

- 7.16 List the contact materials used in relays and list their characteristics.

8.0 Comprehend PCB materials and their fabrication

- 8.1 Explain the need of PCB in electronic equipment.
- 8.2 Classify PCBs.
- 8.3 List types of laminates used in PCBs.
- 8.4 Mention the methods of layout preparation of PCB.
- 8.5 List the methods of transferring layout on the copper clad sheet.
- 8.6 List the steps involved in screen-printing for making PCBs.
- 8.7 List the materials used in screen-printing.
- 8.8 Describe the photo processing techniques for PCB preparation.
- 8.9 Mention the methods of etching, cleaning and drilling of PCB.
- 8.10 Describe the steps involved in making double-sided PCB.
- 8.11 List the materials used in soldering.
- 8.12 List the soldering methods of PCBs.
- 8.13 State the standard PCB specification.
- 8.14 Prepare a simple layout for a given circuit

9.0 Semiconductor Diodes

- 9.1 State the electrical properties of solid Semiconductor materials.
- 9.2 Sketch energy level diagrams for conductors, Semiconductors, Insulators.
- 9.3 Distinguish between Intrinsic and extrinsic Semiconductors.
- 9.4 Describe the formation of P type and N type materials and sketch the energy band diagrams.
- 9.5 Identify Majority and Minority carriers in P and N Type materials.
- 9.6 Distinguish between Drift and Diffusion current.
- 9.7 Explain the formation of PN junction diode.
- 9.8 Describe the working of PN junction Diode with various biasing voltages.
- 9.9 Sketch the forward/Reverse Bias Voltage characteristics of diode.
- 9.10 Interpret the manufacturer specifications of a given diode from data sheet.
- 9.11 Describe the formation and working of Zener diode.
- 9.12 Sketch the characteristics of Zener breakdown and Avalanche breakdown.
- 9.13 Distinguish between Zener breakdown and Avalanche breakdown.

10.0 DC Power Supplies

- 10.1 Explain the necessity of D.C. power supply for Electronic circuits.
- 10.2 Describe the working of HW, FW and Bridge section circuits with wave forms
- 10.3 Give the equations for RMS value, average DC value; ripple factor and efficiency for the above circuits.
- 10.4 Define Voltage Regulation.
- 10.5 Explain the need for a filter circuit in power supplies.
- 10.6 Explain the operation of a rectifier circuit using RC, CRC, CLC filters.
- 10.7 State the need for a regulated power supply and list its specifications.
- 10.8 Explain the working of a simple Zener regulated DC Power supply.

Note: *Emphasis to be given to practice drawing Component symbols and circuits.*

COURSE CONTENTS

1. Concept of DC Voltage and Current , - Conductor, Insulators -- Ohm's law – Resistance – Specific Resistance – Conductivity – Temperature coefficient of Resistance – Resistance in series, parallel and series - parallel combinations – star/ delta equivalence

Units - Work - Power - Energy

Units of work, power and energy. – Conversion of Units **Heating Effects of Electrical Current**

Mechanical Equivalent of Heat - Heat produced due to flow of current in resistance- applications

2.Magnetic Effects of Electric Current

Magnetic materials.- Soft & Hard - Magnetic materials classification- Lines of force - Field pattern due to long straight current carrying conductor-Field pattern of solenoid and Toroid -Work Law and its applications -Biot Savart Law(Laplace Law) -Field strength at centre and any point on the axis of a circular current carrying conductor- Field Strength around a straight current carrying conductor-Fleming's left hand rule -Force between two parallel current carrying conductors – Ampere - Magnetic circuit- Magnetising force – permeability - flux - reluctance - Magnetisation of Magnetic materials Comparison of Magnetic circuit with electric circuit

Electro Magnetic Induction

Faraday's laws - Dynamically and statically induced E.M.F -Lenz's Law & Fleming's right hand rule - Self and mutual inductance - Co-efficient of coupling - Inductances in series -Energy stored in a magnetic field - Energy stored per unit volume - Lifting power of magnet .

3.Electrostatics

Atom,Ion,positive and Negative charges -Laws of Electrostatics – coulomb - Permittivity - Electrostatic induction -Electrostatic field - lines of force -Comparison of electrostatic and magnetic lines of force - Strength of electric field- Flux density -Gauss theorem - Electric potential - potential difference – Polarisation - Dielectric Loss - Applications of Dielectrics –

Dielectric strength - dielectric constant - Capacitance -Capacitor - types - Capacitors in series and parallel

4.Chemical effects of electric current

Faradays laws of electrolysis- Polarisation –Construction of lead acid batteries- Charging and Discharging of lead acid battery-Internal Resistance- AH efficiency & WH efficiency-Lead acid battery characteristics-Charging of lead acid battery –trickle charging – Maintenance –Battery types - Applications

5 AC Fundamentals : AC current Frequency , Time Period , Amplitude , RMS value and phase angle
AC through Resistance , Inductance , capacitance - concept reactance , impedance and admittance,

6. Passive components

Resistors: Classification of resistors, colour code, Specifications, preferred values of resistors, their properties and uses – Carbon film metal film wire wound resistors, characteristics and applications. Constructional details of carbon and wire wound Potentiometers - tapering. Effect of temperature on resistance. Thermistors, sensistors, faults in resistors.

Capacitors: Classification, specifications of capacitors, colour code, dielectric constant, dielectric strength, properties and applications of paper, mica, ceramic polyester, polyesterene, glass and electrolytic capacitors. Variable capacitors and applications, capacitor connected in series and parallel. Energy stored in capacitors.

Inductors and Transformers: Self Inductance, mutual inductance, coefficient of coupling, A.F. and R.F. chokes, transformers, auto transformers and specifications.

7. Switches, connectors and Relays: Different types of switches and connectors used in Electronic circuits, their specifications, constructional details and ratings. Fuses. Types of relays-Relay contacts, constructional features of relays.

8. PCBs: Classification of PCBs, screen-printing of PCBs, photo processing, double sided PCBs, soldering methods of PCBs, standard PCB specifications.

9. Semiconductor diodes: Electrical properties of semiconductor materials, energy level diagrams of conductor, semi conductor and Insulator. Formation of P-Type and N-Type materials and their properties. Drift and diffusion current. Formation and behaviour of PN junction diode.- Zener diode-zener breakdown and avalanche breakdown

10. DC Power supplies

Need of DC power supply, half wave, full wave and bridge rectifiers. RMS value, ripple factor, voltage

regulation. Filters – RC, CRC, and CLC. Zener regulator – series and shunt. IC regulators and specifications of RPS

TEXTBOOKS

1. Electronic devices and applications by B. Somanathan Nair, PHI.
2. Electronic components by Dr.K.Padmanabham.
3. Electronic Instruments and Systems by B.P Gupta TMH

REFERENCE BOOKS

1. P.C.Bs by Boshart TMH
2. Basic Electronics by Grob. TMH
3. Electronic devices & Circuits by Millman & Halkias TMH
4. Fundamentals of Accoustics by Lawrence & Frag.
5. Electronic Components by F.J. Waters.

EC-106 ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS AND PRACTICES

Subject Title:Electrical and Electronics Engineering Materials & Practices

Subject Code: EC-106

Periods/Week: 04

Periods/year: 120

Time Shedule

S No	Major topics	No of periods	Weightage of marks	Short answer questions	Essay questions
1	Classification of materials and properties of conductors	20	16	2	1
2	Properties and applications of Insulating materials	20	16	2	1
3	Properties and applications of	20	13	1	1

	magnetic materials				
4	Properties and applications of Special materials	12	13	1	1
5	Introduction to Workshop processes	12	13	1	1
6	Important machines used in the workshops	12	13	1	1
7	Fastening	12	13	1	1
8	Soldering Brazing and Welding				
9	Heat treatment				
10	Electrical hazards- First Aid and safety	12	13	1	1
	total	120	110	10	8

OBJECTIVES.

On completion of the study the student will be able to

1.0 Classification of Materials

Explain the atomic structure of the atom
Explain the electronic structure of the atom
Explain energy band diagram

- 1.1 Classify the material into conducting, semi conducting and insulating materials energy bands
- 1.2 Explain how the resistance of a conductor is affected by presence of impurities
- 1.3 Classify the conducting material as low resistivity and high resistivity materials
List the 4 Metals commonly used in Electrical and Electronics fields .
- 1.4 Define Mechanical properties density, stress, strain, strength, ductility, hardness, wear impact resistance, fracture toughness, fatigue of conductors
- 1.5 List the Electrical properties of Copper (conductivity, resistivity, temperature coefficient) of copper.
Explain the mechanical properties of copper
- 1.6 Explain general properties like conductivity, resistivity, temperature coefficient, solderability, contact resistance of aluminium and mechanical properties of hard and annealed aluminium.
- 1.7 Explain general properties like conductivity, resistivity, corrosion, temperature Coefficient and mechanical properties of Steel.
- 1.8 Application of different conductors in electronics engineering, .
- 1.9
- 1.12 Define corrosion, list four methods to prevent corrosion of conductors.
- 1.13 Define superconductivity.
- 1.14 List two types of super conductors.
- 1.15 List applications of super conductors.

2.0 Insulating materials; General Properties:

2.1 8.0 Insulating Materials.

- 8.1 State the important electrical properties of Insulating materials.
(a) Insulating resistance

- (b) Volume and Surface resistance
- 8.2 Explain factors affecting insulating resistance.
- 8.3 State the classification of Insulating materials on the basis of temperature like Y,A,E,B,F,H and C class.
- 8.4 State the classification of insulating materials.
- 8.5 Mention the properties & applications of Impregnated paper, Wood, Cardboard, Asbestos, Mica, Ceramics and Glass.
- 8.6 Explain Thermoplastic & Thermosetting resins with examples.
- 8.7 Explain the properties & applications of PVC
- 8.8 State the effects of the following on P.V.C
(a) Filler (b) Stabilizer (c) Plasticizer (d) Additives.
- 8.10 State the Properties and application of following gasses.

Air (b) Nitrogen (c) Hydrogen (d) Sulphur – HexaFluoride

3.0 Magnetic Materials

Classify the magnetic Materials

List the important magnetic materials used in the industry

- 3.2 Explain Soft Magnetic Materials like Alloyed steels with silicon, high silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines.
- 3.3 Explain Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine
- 3.4 Describe about Nickel-iron alloys, Soft ferrites
- 3.5 Explain about Hard magnetic materials like Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications

4.0 Special Materials

- 4.1 List various Thermocouple, Bimetals, lead soldering and fuse material, mention their Applications

Explain about low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), and their practical applications with reasons for the same.

Applications of special metals e.g. Silver, Gold, Platinum .

- 1.11 Explain about high resistivity materials and their applications e.g., manganin, constantin, Nichrome, mercury, platinum, carbon and tungsten

5.Introduction to Workshop practices and Hand Tools

Explain the use of Engineers Files

Show the parts of a file with a sketch.

list various Files used in the workshop

Know their usage.

Explain the precautions to be taken in handling and maintenance of files.

Explain the use of Hacksaw

Show the parts of hacksaw with a sketch.

List the types of Hacksaw blades .

Explain the applications of above blades.

Explain the use of Cold Chisels

List the types of cold chisels

List the types of hammers.
Explain the parts of Ballpein hammer with a sketch.
Explain the use of Screwdrivers .
List the types of Screw Drivers used in the workshop.
Explain the use of Taps and Dies

Cutting tools and Cutting Fluids

List the 3 important properties a) Red hardness b) Abrasion Resistance, c) Toughness of cutting tools.

Explain the above properties.

List the 6 important types of Cutting tool materials.

Explain the use of 1. High speed steels 2. Stellite 3. Cemented carbide 4. Ceramic 5. Cubic Boron nitride 6. Diamond. For cutting tools.

Explain the need for cutting fluids

List the 5 types of cutting fluids

Mention the precautions to be taken while handling cutting fluids.

6. Machines Used in the workshop

List the % important Operations Used in the workshop . 1. Drilling 2. Turning . 3. Grinding . 4. Milling

Name the machines used to carry out the above operations.

Name the various parts of a drilling machine and mention their purpose.

With a sketch explain the Drill chuck and safety chuck key

List the cutting tools used with drilling machine.

Explain the use of twist drill and Reamer.

Explain Countersunk and Counterbore operations

.Explain how sheetmetal drilling is carried out.

Explain How Plastic drilling is carried out.

Explain the process of Turning.

List the parts of Centre Lathe machine.

Explain the parts of Centre Lathe machine and their functions.

Explain the constructional details of 3 jaw self centring and 4 Jaw Independent chuck

Explain the use of Face plate.

List the 6 important operations of lathe machine .

Explain the operations 1. Turning 2. Drilling 3. Reaming 4. Boring 5. Taper turning. 6. Thread cutting

Explain the purpose of grinding.

List the parts of surface grinding machine

Explain the functions of above.

Explain how Grinding wheels are made.

Explain the terms Dressing ,Balancing and Guarding with respect to Grinding wheels.

Mention the two Abrasive materials used for grinding wheels and explain the importance of grain size and grade.

Explain the milling operation.

List the Three types of Milling machines.

List the parts of Milling machines with a sketch.
Mention the purpose of above parts.

7.Mechanical Fasteners

List the Four types of Mechanical Fasteners 1. Screws Bolts , Nuts and Rivets.

Classify machine screws based on the types of screw Head

Explain the use of Socket screws and Self tapping screws

Explain the use of Bolts and Nuts

List different types of Nuts used in the industry.

Explain the Purpose of washers

List different types of screw threads

Explain the use of Self locking screws and Bolts.

Explain the use of locking Nuts

Explain threadlocking.

Explain the use of Locking washers.

Mention the 4 types of Locking washers. And circlips.

Explain the process of Riveting

Mention any 4 advantages of Riveting

Mention the applications of Rivets.

List the metals used for riveting

Explain solid Rivets , Tubular rivets and self piercing rivets

Explain the use of Blind rivets.

Explain how electrical connections are secured using mechanical fastening devices

Explain the use of Bullet connector for Automobile Electrical connections.

Explain the use of Adhesives for joining

Explain the advantages of joining parts by using adhesives

Mention the demerits of adhesives.

Classify adhesives

Explain the use of Thermoplastic Resins.

Explain the use of cyanoacrylate (Superglue)

Explain Thermosetting Resins

Explain the use of Epoxys

8.Soldering , Brazing and Welding

Explain the process of soft soldering.

Explain the use of flux in soldering

Explain the Heating requirements in the soldering process.

List three types of soldering joints for joining Electrical conductors.

Explain the metals and their mix ratios used in producing solder alloys.

Explain Eutectic point of metals.

Mention the Tin Lead ratios for a) general purpose Electrical soldering b) Plumber solder and dipping baths.

Explain the process of Brazing.

Explain alloys used for brazing. brass and Silver Brazing

Explain the purpose of flux in Brazing.

Name the Fluxes used in Brazing

Mention heat sources suitable for brazing

With a sketch explain the joint designs suitable for brazing
List any 4 applications of Brazing.

Explain the process of welding
Mention the two types of Welding
Explain the process of Arc Welding
Explain the Process of Gas welding.
Mention the applications of Arc and Gas welding.

9. Heat treatment of Steel

Explain the Process of Heat treatment.
List the desirable mechanical properties of steel
Explain the properties, Hardness, Brittleness, Strength, Ductility, Malleability
Elasticity and toughness
With a Graph explain the relation between Critical temperature and carbon content
Explain the process of annealing
Explain the process of Normalizing
Explain the process of Hardening
Explain the process of Tempering.
Give the table showing Tempering temperatures and oxide colours.

10.0 Electrical Hazards – First aid and Safety

Explain the importance of safety in the industry.

- 8.1 Explain the major hazards which may arise from the use of electrical equipment
- 8.2 Explain the precautions to be taken to prevent accidents while using Machines
Explain how human body may act as a part of the circuit and cause Electrical shock
- 8.3 Explain method of first aid treatment for someone suffering from electric shock.
- 8.4 State general electrical safety rules

Explain the safety signs and colours
Show various safety symbols and Explain their meaning.
Explain the causes of fire and fire accidents in industry.
Explain Fire prevention measures.
List 6 types of Portable fire extinguishers
Explain the choice of above extinguishers.
Explain the First aid treatment in the case of burns

Course Content

1 Classification of materials

Classification of materials into conducting, semiconducting and insulating materials. Conducting Materials: Resistivity and factors affecting resistivity, such as temperature, alloying. Low resistivity

materials e.g. copper, aluminum and steel, their general properties as conductor e.g. resistivity, temperature co-efficient, mechanical properties, corrosion, solar ability, contact resistance and practical application. High resistivity materials. Super conductors.

2 Insulating Materials

Properties of insulating material:- Electrical properties, Mechanical properties, Physical properties, Thermal properties, Chemical properties, Insulating materials and their application-Definition and classification of Thermo setting materials e.g. Phenol Formaldehyde, Resins (i.e. Bakelite), Thermo Plastic materials e.g. Polyvinyl Chloride (P.V.C.), ,Natural Insulating Materials- Mica and Asbestos ,Gaseous Materials e.g. Air, Hydrogen and SF6. (8 Lectures

3 Magnetic Materials:

B-H curve of magnetic materials, Classification of magnetic materials into soft and hard magnetic materials. Soft magnetic materials - high silicon alloy steel for transformers and low silicon alloy steel, for electric rotating machine cold rolled grain oriented and non-oriented steel, Nickel iron alloy, soft ferrites, their properties and uses. Hard magnetic materials - tungsten steel, chrome steel, cobalt steel, alnico, hard ferrites, their properties and applications. (8 Lectures)

4 Special Purpose Materials:

Thermocouple, bimetals, leads soldering and fuses material, mention their applications, Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc.

6. Tools and their uses

Different files,hacksaw,hammers,screwdrivers,drillers and grinders used in electronic industry

7.Joining Methods:

Mechanical fasteners,soldering,brazing,welding,adhesive bonding. Application of each method. Comparison of different methods.

8. Electrical hazards - first aid and safety

Electric shock,electric burn,fire,arcing,explosion .Double insulation , earthing,use of safe voltages

Electric shock and treatment, General electrical safety rules.

RECOMMENDED BOOKS

1. Material science for Electrical and Electronic engineers by Ian p. Jones
2. Workshop processes, practices and Materials by Bruce J. Black
3. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
4. Electronic Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi
5. Electrical Engineering Materials by Sahdev, Unique International Publications
6. Electronic Components and Materials by SM Dhir, Tata Mc Graw Hill, New Delhi
7. Electronic Engineering Materials by ML Gupta, Dhanpat Rai & Sons, New Delhi
8. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
9. Electrical & Electronics Engineering Materials by BR Sharma and Others, Satya Parkashan,

ENGINEERING DRAWING

Subject Title : **Engineering Drawing**

Subject Code : **EC – 107**

Periods/Week : **06**

Periods Per Year : **180**

TIME SCHEDULE

S.No	Major Topics	No. of Drawing plates	Periods	Weightage	Short Questions	Essay Questions
1	Importance of Engineering Drawing	--	03	-	-	-
2	Engineering Drawing Instruments	01	03	-	-	-
3	Free hand lettering & Numbering	01	06	5	1	-
4	Dimensioning Practice	01	09	5	1	-
5	Geometrical constructions	03	21	15	1	1
6	Projection of points, Lines, Planes &	03	21	10	-	1
7	Auxiliary views	01	06	5	1	-
8	Sectional views	04	27	10	-	1
9	Orthographic Projection	04	33	10	-	1
10	Pictorial drawing	04	30	10	-	1
11	Development of surfaces	03	21	10	-	1
Total		25	180	80	04	06

The Course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation

Pre-Requisite: Clear visualization and sound pictorial intelligence

OBJECTIVES

Upon completion of this subject the student shall be able to

1. Understand the basic concepts of Engineering Drawing

- 1.1 State the importance of drawing as an engineering communication medium.
- 1.2 State the necessity of I.S. Code of practice for Engineering Drawing.
- 1.3 Explain the linkages between Engineering drawing and other subjects of study in diploma course.

2.0 Use of Engineering Drawing Instruments (No. of drawing plates: 01)

- 2.1 Select the correct instruments and draw lines of different orientation.
- 2.2 Select the correct instruments and draw small and large Circles.
- 2.3 Select the correct instruments for measuring distances on the drawing.
- 2.4 Use correct grade of pencil for different types of lines, thickness and given function.
- 2.5 Select and use appropriate scales for a given application.
- 2.6 Identify different drawing sheet sizes as per I.S. and Standard Lay-outs.
- 2.7 Prepare Title block as per I.S. Specifications.
- 2.8 Identify the steps to be taken to keep the drawing clean and tidy.

Drawing Plate 1: (Having two exercises)

3.0 Write Free Hand Lettering and Numbers (No. of drawing plates: 01)

- 3.1 Write titles using sloping lettering and numerals as per B.I.S (Bureau of Indian standards)
- 3.2 Write titles using vertical lettering and numerals as per B.I.S.
- 3.3 Select suitable sizes of lettering for different layouts and applications.
- 3.4 Practice the use of lettering stencils.

Drawing plate 2: (Having 5 to 6 exercises)

4.0 Understand Dimensioning Practice (No. of drawing plates: 01)

- 4.1 State the need of dimensioning the drawing according to accepted standard.
- 4.2 Define "Dimensioning".
- 4.3 Identify notations of Dimensioning used in dimensioned drawing.
- 4.4 Identify the system of placement of dimensions in the given dimensioned drawing.
- 4.5 Dimension a given drawing using standard notations and desired system of dimensioning.
- 4.6 Dimension standard features applying necessary rules.
- 4.7 Arrange dimensions in a desired method given in a drawing.
- 4.8 Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly.

Drawing Plate 3: (Having 08 to 10 exercises)

5.0 Apply Principles of Geometric Constructions

(No. of drawing plates: 03)

- 5.1 Divide a given line into desired number of equal parts internally.
- 5.2 Draw tangent lines and arcs.
- 5.3 General method to construct any polygon.
- 5.4 Introduction to conics
- 5.5 Construction of ellipse, parabola and hyperbola by general method
- 5.5 Construct ellipse by concentric circles method
- 5.6 Construct parabola by rectangle method, rectangular hyperbola, involute, cycloid and helix from the given data.

5.7 State the applications of the above constructions in engineering practice.

Drawing Plate -4: Draw one plate having problems up to construction polygon

Drawing Plate -5: Draw one plate having problems of construction of conics

Drawing Plate -6: Draw one plate having problems of construction of involute, cycloid and helix

6.0 Apply Principles of Projection of points, lines, planes & solids

(No. of Drawing Plate: 03)

6.1 Visualize the objects

6.2 Introduction to I-angle and III-angle projections

6.3 Draw the projection of a point with respect to reference planes (HP & VP)

6.4 Draw the projections of straight lines with respect to two references
Planes (up to lines parallel to one plane and inclined to other plane)

6.5 Draw the projections of planes (up to planes perpendicular to one plane and inclined to other plane)

6.6 Draw the projections of solids (up to axis of solids parallel to one plane and inclined to other plane)

Drawing Plate -7: Draw one plate having problems up to projection of points and
Lines (15 exercises)

Drawing Plate -8: Draw one plate having problems of projection of planes
(6 exercises)

Drawing Plate -9&10: Draw Two plates having problems of projection of solids
(total 10 exercises)

7.0 Understand the need for auxiliary views

- 7.1 State the need of Auxiliary views for a given engineering drawing.
- 7.2 Draw the auxiliary views of a given engineering component
- 7.3 Differentiate between auxiliary view and apparent view

Drawing plate No.11: (Having 4 exercises)

8.0 Appreciate the need of Sectional Views

- 8.1 Explain the need to draw sectional views.
- 8.2 Select the section plane for a given component to reveal maximum information.
- 8.3 Explain the positions of section plane with reference planes
- 8.4 Differentiate between true shape and apparent shape of section
- 8.5 Draw sectional views and true sections of regular solids discussed in 6.0
- 8.6 Apply principles of hatching.

Drawing Plate – 12: Draw one plate having problems of section of solids

(6 exercises)

9.0 Apply principles of orthographic projection (No. of plates: 04)

- 9.1 Explain the principles of orthographic projection with simple sketches.
- 9.2 Prepare an Engineering drawing of a given simple engineering part in first angle projection.
- 9.3 Draw the orthographic view of an object from its pictorial drawing.
- 9.4 Draw the minimum number of views needed to represent a given object fully.

Drawing Plate 13 : (Having 10 to 12 exercises)

10.0 Prepare pictorial drawings

- 10.1 State the need of pictorial drawings.
- 10.2 Differentiate between isometric scale and true scale.
- 10.3 Prepare Isometric views for the given orthographic drawings.

Drawing plate 14: (Having 10 to 12 exercises)

11.0 Interpret Development of surfaces of different solids

- 11.1 State the need for preparing development drawing.
- 11.2 Prepare development of simple engineering objects using parallel line and radial line method.
- 11.3 Prepare development of surface of engineering components like trays, funnel, 90° elbow & rectangular duct.

Drawing plate No. 15: (Having 10 exercises)

KEY competencies to be achieved by the student

S.No	List of Practical	Key Competency
1.	Importance of Engineering Drawing	<ul style="list-style-type: none"> Explain the linkages between Engineering drawing and other subjects of study in Diploma course.
2.	Engineering Drawing Instruments	<ul style="list-style-type: none"> Select the correct instruments to draw various entities in different orientation
3.	Free hand lettering & Numbering	<ul style="list-style-type: none"> Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)
4.	Dimensioning Practice	<ul style="list-style-type: none"> Dimension a given drawing using standard notations and desired system of dimensioning
5.	Geometrical construction	<ul style="list-style-type: none"> Construct ellipse, parabola, rectangular hyperbola, involute, cycloid and helix from the given data.
6.	Projection of points, Lines, Planes & Solids	<ul style="list-style-type: none"> Draw the projection of a point, straight lines, planes & solids with respect to reference planes (HP& VP)
7.	Auxiliary views	<ul style="list-style-type: none"> Draw the auxiliary views of a given Engineering component Differentiate between Auxiliary view and apparent view
8.	Sectional views	<ul style="list-style-type: none"> Differentiate between true shape and apparent shape of section Use conventional representation of Engineering materials as per latest B.I.S. Code. Apply principles of hatching. Draw simple sections of regular solids
9.	Orthographic Projection	<ul style="list-style-type: none"> Draw the minimum number of views needed to represent a given object fully
10.	Pictorial drawing	<ul style="list-style-type: none"> Differentiate between isometric scale and true scale. Draw the isometric views of given objects,.
11.	Development of surfaces	<ul style="list-style-type: none"> Prepare development of Surface of Engineering components like trays, funnel, 90⁰ elbow & rectangular duct.

COURSE CONTENT

NOTE

- 1. I.S. / B.S Latest Specification should invariably be followed in all the topics.**
- 2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.**

1.0 The importance of Engineering Drawing

Explanation of the scope and objectives of the subject of Engineering Drawing Its importance as a graphic communication -Need for preparing drawing as per standards – SP-46 –1988 – Mention of I.S.O and B.I.S-Role of drawing in -engineering education – Link between Engineering drawing and other subjects of study.

2.0 Engineering drawing Instruments

Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mentioning of names under each classification and their brief description -Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils -Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet, Drawing plate:

Lay out of sheet – as per SP-46-1988 to a suitable scale.

Simple Exercises on the use of Drawing Instruments. Importance of Title Block.

3.0 Free hand lettering & numbering

Importance of lettering – Types of lettering -Guide Lines for Lettering

Recommended sizes of letters & numbers - Advantages of single stroke or simple style of lettering - Use of lettering stencils

4.0 Dimensioning practice

Purpose of engineering Drawing, need of I.S.I code in dimensioning -Shape description of an Engineering object -Definition of Dimensioning size

description -Location of features, surface finish, fully dimensioned Drawing -
Notations or tools of dimensioning, dimension line extension line, leader line,
arrows, symbols, number and notes, rules to be observed in the use of above
tools -Placing dimensions: Aligned system and unidirectional system (SP-46-
1988)-Arrangement of dimensions Chain, parallel, combined progressive, and
dimensioning by co-ordinate methods-The rules for dimensioning standard,
features "Circles (holes) arcs, angles, tapers, chamfers, and dimension of
narrow spaces.

5.0 Geometric Construction

Division of a line: to divide a straight line into given number of equal parts
internally examples in engineering application.

Construction of tangent lines: to draw tangent lines touching circles
internally and externally.

Construction of tangent arcs

- i) To draw tangent arc of given radius to touch two lines inclined at given
angle (acute, right and obtuse angles).
- ii)Tangent arc of given radius touching a circle or an arc and a given line.
- iii)Tangent arcs of radius R, touching two given circles internally and externally.

Construction of polygon: construction of any regular polygon of given side length
using general method

Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a
double cone and a loci of a moving point, Eccentricity of above curves – Their
Engg. application viz. Projectiles, reflectors, P-V Diagram of a Hyperbolic process,

Construction of any conic section of given eccentricity by general method

Construction of ellipse by concentric circles method

Construction of parabola by rectangle method

Construction of rectangular hyperbola

General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering application, viz, Gear tooth profile, screw threads, springs etc. – their construction

6.0 Projection of points, lines and planes & solids

Projecting a point on two planes of projection -Projecting a point on three planes of projection -Projection of straight line.

- (a) Parallel to both the planes.
- (b) Perpendicular to one of the planes.
- (c) inclined to one plane and parallel to other planes

Projection of regular planes

- (a) Plane perpendicular to HP and parallel to VP and vice versa.
- (c) Plane perpendicular to HP and inclined to VP and vice versa.

Projection of regular solids

- (a) Axis perpendicular to one of the planes
- (b) Axis parallel to VP and inclined to HP and vice versa.

7.0 Auxiliary views

Need for drawing auxiliary views -Explanation of the basic principles of drawing an auxiliary views explanation of reference plane and auxiliary plane - Partial auxiliary view.

8.0 Sectional views

Need for drawing sectional views – what is a sectional view - Location of cutting plane – Purpose of cutting plane line – Selection of cutting plane to give maximum information (vertical and offset planes) - Hatching – Section of regular solids inclined to one plane and parallel to other plane

9.0 Orthographic Projections

Meaning of orthographic projection -Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object -Concept of front view, top view, and side view sketching these views for a number of engg objects -Explanation of first angle projection. – Positioning of three views in First angle projection - Projection of points as a means of locating the corners of the surfaces of an object – Use of miter line in drawing a third view when other two views are given -Method of representing hidden lines -Selection of minimum number of views to describe an object fully.

10.0 Pictorial Drawings

Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Iso axis, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale, and ordinary scale difference between Isometric view and Isometric projection - Isometric and non-Isometric lines -Isometric drawing of common features like rectangles, circular - shapes, non-isometric lines - Use of box and offset methods

11.0 Development of Surfaces

Need for preparing development of surface with reference to sheet metal work

-Concept of true length of a line with reference to its orthographic

projection when the line is (i) parallel to the plane of projection (ii) inclined to one principal and parallel to the other -Development of simple solids like cubes, prisms, cylinders, cones, pyramid (sketches only) -Types of development: Parallel line and radial line development -Procedure of drawing development, drawings of trays funnels, 90° elbow pipes and rectangular ducts.

REFERENCES

1. Engineering Graphics by P I Varghese – (McGraw-hill)
2. Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
3. Engineering Drawing by N.D.Bhatt.
4. T.S.M. & S.S.M on “ Technical Drawing” prepared by T.T.T.I., Madras.
5. SP-46-1998 – Bureau of Indian Standards.

Electronic workshop

Subject title : Electronic workshop

Subject code : EC-108

Periods per week : 6

Periods / Semester : 180

TIME SCHEDULE

SI NO	Major Topics	Periods
1	Identification of different Tools and Materials and their working	20
2	Identification of different wires, cables and House wiring	40
3	Soldering practice & Preparation of PCB	40
4	Study and use of Electronic equipment	40
5	Testing of Electronic components & characteristics	40
	Total Periods	180

List of the Experiments

Exp No	Name of the Experiment	Objectives	Key competencies
1	Know the safety precautions and first aid	a) Precautions to be followed in the laboratory ,(starting and Stopping of equipment / Machinery) b) symbols and their meaning c) Clear understanding of emergencies , b) Sequence of actions to be carried out c) basic first aid procedure	a) Take precautions to prevent accidents in the laboratory b) Alerting under emergency situations c) Basic first aid.
2	Cleaning the equipment and Work Tables including Visual inspection -reporting any physical damage (3)	Keeping work area clean Familiarization with equipment Procedure for cleaning Use of Detergents, Shampoos and solvents. Precautions to be taken (use of masks, Gloves etc) Precautions to be taken a) Handling the equipment b) Personal (Washing hands with soda after cleaning the equipment)	Should be able to clean the equipment with appropriate cleaning agent. Report any damage to the power cords , missing fuses , Low battery in DMMS etc.
3	Identifying and practicing with Measuring and Marking Tools (3)	1Measuring Tape 2. Steel rule 3.Trysquare 4. Center Punch 5. Plumb A) Handling the equipment	

		<p>B) Use the measuring tape to measure a distance of 6 feet and above accurately and mark.</p> <p>B) Use the steel rule to measure an odd length given in inches and in millimeters accurately and mark.</p> <p>c) Use the Try square to mark perpendicular lines by selecting a finished edge.</p> <p>d) Use the centre punch to mark centre points as per the drawing</p> <p>e) Use the plumb to observe 1) inclination of wall ii) mark two horizontal points on a wall at a given height and at a given distance.</p>	
4	<p>Working with different type of screw Drivers .</p> <p>(3)</p> <p>a) Identifying 1. Screw Driver a) b) Flat Head Screwdrivers c) Ratcheting Screwdrivers</p> <p>b) Use the Screw Driver to Remove and Fix wooden Screws</p> <p>C) Fixing and Removing screws of Metal cabinets using correct screw Driver</p>		
5	<p>.Working With Basic tools</p> <p>(6)</p> <p>a) Identify 1. Hacksaw frame/Blade 2. Ball peen hammers 3. Sledge hammer. 4 Claw hammer 5 Anvil 6 Chisels 7. Bench vice</p> <p>b) Fix the Hacksaw blade in the frame and use it to cut a) Conduit pipe b) Cut the Wooden piece with hacksaw frame by fixing it in the bench vice.</p> <p>c) Use a cold chisel to cut the 6mm Rod to required length.</p>	<p>a) to identify and know the usage b) To develop skills in using the above instruments</p>	<p>Select Right tool for a particular situation b) Use the above tool with skill</p>

	<p>d) Use the sledge hammer to bend a 6mm Rod into a ring by striking it on the Anvil</p> <p>e) Drive nails in to a wooden piece with ball peen hammer.</p> <p>f) Remove the Nails using claw hammer</p>		
6	<p>.Working with Tools used in Electrical Wiring (3)</p> <p>A) Identifying 1. wire stripper . 2. Insulation remover 3. Pocket knife 5.Electrical Tester 4.Phillips Head Screwdrivers 5. Mallet 6. Rawl plug jumper 7 .Standard wire Gauge</p> <p>b) Use the above tools to remove the insulation.</p> <p>c) Use the mallet to straighten the cable/ Conductor</p> <p>d) Measure the gauge of wire using Standard Wire Gauge.</p> <p>e) Make a hole in the wall for fixing a Screw/ Nail using Raw plug Jumper and ball peen Hammer.</p>	Identification of above tools, know their purpose and usage	<p>identifying the tools by their shape and size</p> <p>b) Identifying the tool by their name . Select correct tool for a particular operation c) measure the wire Gauge d) Fix a screw in the wall.</p>
7	<p>Working with different fastening devices, spanners, wrenches and Allen/ Hex keys (3)</p> <p>1. Identification of different types of fastening devices like Screws, Bolts and Nuts, Rivets, and know their specifications</p> <p>b) Tightening the bolts and nuts using correct type and number of spanner a) Normal b) Ring type , c) Use the Monkey Wrench and Pie wrench to Tighten GI pipe coupling</p>	<p>To identify various fastening devices by their name and shape</p> <p>Know the usage and selection of the tools</p>	<p>Use the fastening devices</p> <p>Use the tools.</p>
8	<p>Identifying and Working with Pliers (3)</p> <p>a) Identify and Know the various functions of cutting pliers, Nose pliers, Pipe pliers, Flush cutter, top</p>	<p>To identify various types of {Pliers by their name and shape</p> <p>Know the usage and selection of the tools</p>	<p>Use the suitable pliers</p> <p>For a given job</p>

	cutting pliers, Electronics pliers, Insulated cutting pliers b) perform the following operations 1. Holding 2. Wire cutting 3. Component bending 4. Twisting the wire		
9	Working with Drilling Machine . (3) 1. Identify the parts of Drilling Machine and drill bits used with hand drilling machine b) Use the Hand drill to make holes in the wood c) use Electrical hand held hammer drill to make holes in the wall. C . Identify Electrical drilling machine and observe how holes are made in Mild steel Plates	Know the purpose and types of drilling machines Fix the drilling bit in the chuck Safety precautions to be taken	Use the drilling machine to make holes
10	Identification of Grinding machine 3. Lathe machine 4. Milling machine 5. Blower. (3) a) Identify Grinding machines and observe its usage to sharpen cutting tools and Drill bits and for cutting operation on metals. b) Identify Lathe machine and observe various operations like turning , taper turning , Knurling , Boring Etc c) Identify the milling machine and Know its usage. d) identify the Electric Blower and use it for Removing dust and cleaning	Identification of different machines and their use in the workshop	Identify the machine and its function.
11	Working with Adhesives (3) a) Practice the use of adhesives like Araldite , Feviquick, Fevicol, Mseal, to join Non metals b Using PVC cement to join PVC Pipes	To know and practice joining using different adhesives Know the use of adhesives in Fixing components on PCBs	Join the parts using Araldite, Mseal etc.
12	Identifying conductors	Identify the Copper , aluminum	To identify conductors

	insulating materials semiconductors and magnetic materials like (1 ½) 1. Copper , Aluminum , Tin ,Solder Metal . 2. Plastics, Teflon, PVC, glass, porcelain, ceramic Bakelite, Mica, Paper, Cotton sleeves, Prespahn sheet, Transformer Oil. Etc 3. Carbon rods 4. Iron , Steel, Ferrites	, iron and other metals by physical observation Identify the Insulating materials by their name and physical observation	and Insulators
13	. Identification of different wires and cables (1 ½) a) Identifying different wires and cables used in the industry 1.Hookup wires a. PVC wire b. Teflon wires c.single strand d. multi strand B) .Wires used for electrical wiring a) Service wire b.. TRS wires /PVC Wires (Al and Cu) c .single strand d. Multi strand e. twisted Flexible pair wires f. Enameled copper wire B) 1. Power cord. 2. UTP cables 4.Co axial cables 5. Flat ribbon cable for antennas 6. 9.Telephone cable 10.Ethernet cable 11. Ribbon cables 12 . Optical fiber	Knowing the technical names of the wires Knowing the gauge of the wire Knowing the insulation used and its purpose Identifying the difference between single strand and Multistrand wire Selecting a wire for a particular application Finding the current carrying capacity from the gauge of wire (refer to the standard tables)	Identifying the type of wire and its current carrying capacity
14	Practice of wire joints 6 To perform the following wire joints operations a) Twisting b) Splicing c) Insulating d) Western union joint e) Married joint f) Britania (straight Joint) g) Tee joint h) Joining running cables ,Pigtail or rat tail joint	To know the types of joints and their purpose. Removing the insulation Taping the joint	Make the joint professionally and tape
15	.Practice Termination of wires 3	Know the usage of terminal blocks	Use the terminal Block

	a) Using lugs Using screws , nuts Terminal blocks Fixing Fuse wire	Making connections	
16	Identifying the Electrical accessories a) SPST Switch ,SPDT switch , Two pin and 3pin Sockets and plugs ,Power Socket and Power plugs Lamp holders, Ceiling rose, Mains Switch,MCB ,Kitkat Fuse – Fuse wire ratings	Know the names of different electrical accessories Identify the item by its shape Know the purpose of electrical accessories	Connect the Electrical accessories.
17	. Know the mains supply Phase ,Neutral ,Ground Voltage and frequency specifications, Precautions Identification of socket phase and neutral by observation (standard Practices) Standard wire colours Testing phase, neutral and ground with Electrical tester &Test lamp b) Repairing /preparing 2pin and 3pin power cords	Knowledge of mains supply- Precautions to be taken Identification Phase and Neutral terminals in mains supply Know the purpose of earthing 2pin and 3pin Plug connections	Identifying phase and Neutral terminals in mains supply with tester Identifying Earth connections with Test lamp
18	Understand the difference between AC and DC by demonstration 1. Experiment with 12 V battery 2. Demonstrate unidirectional current flow 3. Importance of polarity 4. Determination of polarity using a Voltmeter /LED 5. Demonstrate reversal of current using battery and DPDT switch 6. Demonstrate AC using a Low voltage Transformer 7. Show AC waveform on CRO	To understand the behaviour of Direct Current To Check the polarity of DC voltage source Know the importance of polarity in DC circuits Observing the AC signal on CRO	Distinguish between AC and DC Know the importance of polarity in DC circuits
19	. Know the electrical symbols	Identify the physical	Identify the physical

	And identify the corresponding component /item	component from the symbol	component from the symbol
20	<p>Make simple switch connections using low voltage transformer</p> <ol style="list-style-type: none"> 1. Connecting a 6V lamp to a switch (toggle) 2. 2 way switch connections 3. Series and parallel connection of lamps 	<p>To understand Switch connections</p> <p>To know the use of two way switch for stair case wiring</p> <p>Series and parallel connection of lamps</p>	<p>Know the switch connections</p> <p>Make stair case wiring</p>
21	<p>..Making either of a lamp glow by two way switch</p> <p>5. Bright and Dim light arrangement (using a series lamp / using a Diode)</p> <p>6.either two lamps bright or two lamps dim</p>	<p>To understand Switch connections</p> <p>To know the use of two way switch for controlling lamps.</p>	<p>Know the usage of two way switch</p>
22	<p>Tube light connections (To be done in the presence of Instructor)</p> <p>Make the tube light connections as per the circuit and Test</p> <ol style="list-style-type: none"> a) Investigate the reason for the flickering in tube light b) Effect of Low Voltage On tube light (Instructor applies low voltage With an auto Transformer) c) Observe whether tubelight goes off when starter is removed. d) check whether the tube light will light up without starter e) Short the terminals of starter and insert in the starter holder and check whether the tube light will work f) Remove the starter and repeatedly open and short the starter terminals with a short wire and check whether you can make the tube light 	<p>Identifying the parts of tube light set</p> <p>To understand tube light connections</p> <p>Know the purpose of Choke and starter</p> <p>Observe the behavior of tubelight under low voltage conditions</p> <p>Study the construction of choke</p> <p>Know the purpose of starter</p> <p>Observe the CFL lamp</p>	<p>Make tube light connections</p>

	<p>glow. Open the choke cover and observe the construction . Know the type of laminations b) observe the small airgap c) Observe the Winding h) connect a CFL Lamp and draw comparison</p>		
23	<p>Troubleshooting/wiring electrical / a) Electric Iron b) heating coil c) Electric Heater d) Air cooler</p>	<p>Identify the problem in Electrical gadgets by testing it with a) physical observation b) Using tester c) Using test Lamp</p>	<p>Identifying and rectifying the problem in Electrical Gadgets</p>
24	<p>Identifying and drawing Electronic circuit Symbols . Identification of meters and equipment 1. DMM 2. Analog Multimeter 3. DC Voltmeters/Ammeters 4. DC Power supply 5. DRB 6. DCB 7. DIB 8. CRO 9. Function Generator etc</p>	<p>To know the symbols used in Electronic Circuits Identifying the meters and equipment Know their purpose</p>	<p>To know the symbols used in Electronic Circuits Identifying the meters and equipment</p>
25	<p>Working with Multimeter a) Measuring the resistance using multimeter b) Testing the wire continuity with multimeter c) Measurement of Battery Voltage using Voltmeter and Multimeter</p>	<p>Identifying analog and Digital multimeters Selecting the correct Range Measuring Voltage , Current and Resistance with Multimeter</p>	<p>Use the Multimeter</p>
26	<p>Connecting batteries in series and parallel and observing the output voltage using DMM</p>	<p>To reinforce the practice of DMM To practice Series and Parallel connection of Cells Observe the polarity To observe the effect on Terminal Voltage</p>	<p>Make series and parallel connection of batteries Use DMM to measure Voltage</p>
27	<p>Working with Resistors Identify different types of resistors Resistance colour code Connecting resistors in series and parallel and measuring the resistance using multimeter</p>	<p>Identify different types of resistors Find the value of Resistance from colour code of CFR and MFR types Identifying the terminals on Rheostat Setting the Rheostat to</p>	<p>Identifying resistance type by observation Finding the value of Resistance from colour code of CFR and MFR types Setting the Rheostat</p>

	Rheostat connections	Minimum and Maximum positions Observing Resistance change using DMM	to Minimum and Maximum positions
28	Measurement of DC Voltage and DC current	Connecting Voltmeter and Ammeter to measure DC Voltage and Current using Voltmeter and Ammeter	measure DC Voltage and Current using Voltmeter and Ammeter
29	Verification of Ohms Law	To verify ohms law and establish relation between Voltage current and Resistance	Perform experiment as per procedure and draw inference
30	Measurement of Resistance using Voltmeter and DRB	Learn to Use the DRB Applying Ohms law in practical situations	Measure the Resistance using Voltmeter and DRB
31	To Verify the laws of Resistance using a nichrome wire and Multimeter	To understand the laws of Resistance by experimental verification Reinforce the skills of using Multimeter	Use the multimeter to measure Resistance
32	Verify the effect of temperature on Resistance Using electric lamp and Multimeter, Voltmeter and Ammeter	Observing the difference between Cold Resistance and Hot Resistance	Measuring Voltage current and resistance
33	Investigate voltage and current relationship in series and parallel resistive circuits	Observing branch currents in series Parallel circuits Verifying current division in parallel circuits with calculated values	Measuring currents and Voltages and drawing inferences
34	Winding coils using winding machine .a) Making an Electromagnet and testing it on a DC power supply.	To use Coil winding Machine and wind a coil of required number of turns Making an electromagnet Observing the relation between Current , Number of turns and Power of magnet	Wind the coil and Test it
35	Experimenting with transformer a) Identify the transformer type based on tapings i. Center tapped ii. Multi tapped iii. Normal b) Test the given transformer using a multimeter identify the windings c) Find the Transformation ratio d) Demonstrate that transformer can step up or step down the voltage	a) Identify the transformer type based on tapings i. Center tapped ii. Multi tapped iii. Normal b) Test the given transformer using a multimeter identify the windings c) Find the Transformation ratio d) Demonstrate that transformer can step up or step down the voltage	Identifying the type of transformer Testing the transformer

36	<p>. Identify different types of capacitors</p> <p>a) Find the value/specifications of capacitor from Value printed ,and from Color code</p>	<p>Identifying different types of capacitors by their name</p> <p>Know the specifications and Ratings</p> <p>Find the value of capacitor from the colour code</p>	
37	<p>Demonstrate that capacitor can hold charge ,charging and discharging require a specific time using an LED</p> <p>a) Investigate the effect of connecting capacitors in series and parallel</p> <p>b) Testing the capacitor Using multimeter, AC source (Transformer / Function generator) and headphones</p>	<p>Learn the behavior of capacitor by experimentation</p> <p>Connecting Capacitors in series and parallel and observing the effect on total capacitance</p> <p>Testing the capacitor using multimeter and other methods</p>	<p>Understand the behavior of capacitors</p> <p>Testing the capacitors</p>
38	<p>Black box testing</p> <p>a) identify the given component concealed in a box with two terminals available for testing using multimeter</p>	<p>Identifying a given component only by testing</p> <p>Develop cognitive and Motor skills</p>	<p>Test the given component using Multimeter</p>
39	<p>Identifying different switches</p> <p>a) Identify different types of switches and their symbols</p> <p>b) Toggle switches Rotary switches, Push button switches, DIP switches</p> <p>b). Controlling a small Tape - recorder motor with a DPDT switch to run in forward and Reverse Directions.</p>	<p>Identifying different types of switches by observation , By name and symbol</p> <p>Using DPDT switch to reverse the Direction Tape recorder motor</p> <p>Observing the constructional details and ratings of tape recorder motor</p>	<p>Identify the type of switch and its name</p> <p>Use DPDT switch</p>
40	<p>. Connect a Fan regulator to ceiling fan and observe the rotary switch connections and power Resistors</p>	<p>Identifying and Using the Rotary switch</p> <p>Know the Fan Regulator connections</p> <p>Understand the working of Fan Regulator</p> <p>Identify the type of Resistors used in the Fan Regulator</p>	<p>Know the Fan Regulator connections</p>
41	<p>Testing the relay</p> <p>a) Use of NO and NC Contacts</p> <p>b) Using the relay to control a lamp load</p> <p>c) Using the double pole relay to control a fan motor</p> <p>d) Making a simple relay motor control using double</p>	<p>Know the constructional details of Relay</p> <p>Testing/identifying the coil connections with Multimeter</p> <p>Understand the purpose of Relay experimentally</p> <p>Use the relay in practical circuits</p>	<p>Testing and using the relay</p>

	pole relay and push button switches		
42	<p>Identify the Bimetallic strip (used in Iron box) and observe its construction</p> <p>a) Open the tube light starter and observe its construction.</p> <p>b) Connect a tubelight starter in series with an incandescent lamp and observe the operation of bimetallic strip</p>	<p>Identification of Bimetallic Strip</p> <p>Understanding the behavior of Bimetallic strip</p> <p>Know the constructional details of tube light starter</p> <p>Application of bimetallic strip in practical circuits</p>	<p>Identifying Bimetallic strips</p> <p>Use the Bimetallic strips in applications.</p>
43	<p>. Soldering practice</p> <p>a. Making wire tips</p> <p>b. joining wires</p> <p>c. joining components</p> <p>d. populating simple circuits like, Audio amplifier) on a breadboard</p> <p>e. testing the soldered connections using multimeter</p>	<p>Know the metals which can be soldered</p> <p>Know the solder specifications</p> <p>Know the use of Flux in soldering Practice the soldering</p> <p>Practice Desoldering using Desoldering Wick and Desoldering Pump</p>	<p>Practicing soldering and Desoldering</p> <p>Populating PCBs</p>
44	Practice Desoldering using Desoldering Wick and Desoldering Pump		
45	<p>Using General purpose PCB</p> <p>a) Populating the circuits</p> <p>b) Making necessary cuts and joints</p> <p>c) Use of jumper wires</p> <p>d) Terminating all end connections near an edge.</p> <p>e) Following the colour code for connecting wires.</p> <p>f) Using solderless bread board</p>	<p>Bending the components</p> <p>Designing the component lay out</p> <p>Use of common Ground</p> <p>Populating the circuit</p> <p>Cutting and joining the tracks wherever necessary</p> <p>Knowing the colour code for wires</p> <p>Using solderless bread board</p>	<p>Solder the circuit on a general purpose PCB and Testing</p> <p>Using solderless Bread board</p>
46	<p>Identifying different types of connectors</p> <p>a) Identifying power connectors</p> <p>b) Molex connectors</p> <p>c) Edge connectors</p> <p>d) Terminal blocks</p> <p>e) Wire to Board, Board to Board , Flat cable connectors</p> <p>Keyed connectors for microphone Male and Female types</p>	<p>Identifying different types of connectors used in electronic circuits by their name</p> <p>Know the choice of connector based on the requirements</p>	<p>Identifying different types of connectors used in electronic circuits by their name and use them in the circuits</p>

	f) Lugs , Blade connectors, Ring and spade terminals etc		
47	Amplifier- Speaker and microphone connections	To know the amplifier and speaker connections Impedance matching Knowing the various front panel and back panel controls	Connect the amplifier , microphone and speakers
48	Connecting audio video equipment and LCD projector Tuning TV a) Identifying user controls on the equipment b) Setting up the projector using menu control/ Remote control c) Identifying audio video sockets on LCD projector /TV monitor/DVD player d) Connecting audio video cable to the Monitor/ Projector to the DVD / Settop box and testing	Connecting LCD Projector/TV monitor to the DVD player Identifying audio video cable Tuning the TV receiver/ settop box	Connect Audio video Equipment
49	Connecting computer keyboard mouse etc a) Identifying Computer Power switch b) Identifying various ports on CPU c) Identifying computer cables Connecting mouse d) Connecting keyboard e) Connecting headphones/speakers/ Microphone f) Identifying the volume Control g) Connecting the monitor/ LCD Projector using VGA /HDMI cable	Know the basic computer Hardware and their connections CPU , Keyboard , Mouse etc Know the names of the ports on CPU Connect Speakers to the computer	Connect external hardware to the CPU
50	Group Project: Assemble and test a small 0 to 12V , 500mA DC Power supply using Multi tapped transformer and a Rotary switch with enclosure	To reinforce the skills of a. Reading the circuit diagram b. Using the Electronic components c. Populating on General purpose PCB d. Reinforce mechanical skills e. Learn testing skills f. Building creativity	Complete the project and Test it

ELECTRONIC DEVICES & CIRCUITS

Subject Title : **Electronic Devices & Circuits**
Subject Code : **EC-302**
Periods/Week : **04**
Periods/Semester : **60**

Rationale: Electronic devices and circuits is a core subject since Semi Conductor 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 also. 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

SI	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Transistors & Field Effect Transistors	12	13	1	1
2	Biasing and Small signal Model of BJT and FET.	14	29	3	2
3	Feedback Amplifiers , Power Amplifiers, Oscillators	14	29	3	2
4	Special Semiconductor Devices	12	26	2	2
5	Practical Applications	10	13	1	1
	TOTAL	60	110	10	8

1.0 Understand the working principle of BJT and FET

- 1.1 Explain the formation of transistor
- 1.2 Draw the symbol of transistor.
- 1.3 Explain the working of PNP and NPN Transistors.
- 1.4 Describe working of transistor as an amplifier (CB configuration)
- 1.5 Draw the different transistor configurations.
- 1.6 Know cut off, saturation and active regions.
- 1.7 Sketch the input/output characteristics of CB, CC and CE configurations.
- 1.8 Define alpha, beta and gamma Factors.
- 1.9 Relate alpha, beta and gamma Factors.
- 1.10 Write collector current expression in CB and CE modes of transistors in terms of α , β , γ , I_B , I_C and I_{CBO} , I_{CEO}
- 1.11 Compare the performance characteristics of CB, CE and CC configurations
- 1.12 Classify different types of FETs
- 1.13 Describe the construction and principle of operation of n channel JFET.

- 1.14 Draw and explain the drain characteristics of JFET.
- 1.15 Draw and explain the mutual characteristics of JFET.
- 1.16 Define the parameters of JFET and obtain the relation among them.
- 1.17 List the advantages of JFET over BJT.
- 1.18 List applications of FETs of a communication system with block diagram.

2.0 Understand transistor biasing and working of small signal amplifiers

- 2.1 Explain the basic amplifier concept using BJT–CE mode.
- 2.2 Explain the reasons for wide use of CE amplifier .
- 2.3 Explain the concept of DC and AC load lines.
- 2.4 Explain the selection of operating point on the DC load line with wave forms.
- 2.5 Explain the need for proper biasing in amplifier circuits and List the types of biasing circuits.
- 2.6 Explain the need for stabilization.
- 2.7 Define stability factor and derive an expression for stability factor of CE configuration.
- 2.8 Explain collector to base resistor method of biasing and explain its advantages and disadvantages.
- 2.9 Explain potential divider method of biasing and explain its advantages.
- 2.10 Draw the practical transistor CE amplifier and explain the function of each component(such as C_{in} , C_c , C_e , R_1 , R_2 and R_e)
- 2.11 Define h parameters of a transistor
- 2.12 Classify the amplifiers based on frequency, period of conduction, and coupling.
- 2.13 Need for Multistage amplifier (Cascading of amplifiers).
- 2.14 Define gain, frequency response and bandwidth of an amplifier.
- 2.15 Explain the principle of operation of two-stage RC coupled amplifier with circuit diagram.
- 2.16 Draw and explain the frequency response of RC coupled amplifier.
- 2.17 Draw and explain the circuit of common source FET amplifier.
- 2.18 Explain the principle of operation of two-stage transformer coupled amplifier with circuit diagram.
- 2.19 Draw and explain the frequency response of transformer-coupled amplifier.
- 2.20 Explain the working of direct coupled amplifier with circuit diagram.
- 2.21 Explain the operation of Darlington pair With the help of circuit diagram.
- 2.22 Draw and explain the frequency response of tuned amplifier(single, double tuned)
- 2.23 Compare different types of couplings.

3.0 Understand working of Feedback amplifiers, Power Amplifier and oscillators

- 3.1 Explain the concept of feedback
- 3.2 Explain the two types of feedbacks
- 3.3 Compare Negative and Positive feedback.
- 3.4 Draw the block diagram of negative feedback amplifier and explain
- 3.5 List the types of negative feedback amplifiers
- 3.6 Draw the block diagrams of voltage series ,current series, current shunt and voltage Shunt feedback amplifiers
- 3.7 Derive the expression for the gain of negative feedback amplifiers
- 3.8 Explain the effect of negative feedback on gain, bandwidth, input and output impedances.
- 3.9 List the advantages of negative feedback amplifiers.
- 3.10 Need for Power Amplifier
- 3.11 Different classifications of power amplifier.
- 3.12 State the condition for an amplifier to work as an oscillator.
- 3.13 State the requisites of an Oscillator
- 3.14 Explain the Barkhausen criteria in oscillators.

- 3.15 Classify oscillator circuits.
- 3.16 Draw and Explain the working of an RC phase shift oscillator
- 3.17 Draw and Explain the working of tuned collector oscillator
- 3.18 Draw and explain the working of Hartley oscillator.
- 3.19 Draw and Explain the working of Colpitts oscillator
- 3.20 Write the expressions for frequency of oscillation and condition for sustained oscillations of the above circuits
- 3.21 Explain the disadvantages of RC and LC oscillators.

4.0 Understand working of special semiconductor devices

- 4.1 Explain the operation of simple Zener regulator
- 4.2 Explain the construction and principle of operation of depletion type n channel MOSFET.
- 4.3 Explain the construction and principle of operation of enhancement type n channel MOSFET.
- 4.4 Compare JFET and MOSFET.
- 4.5 Explain the principle of operation of CMOSFET.
- 4.6 Explain the working principle of Varactor diode and draw its characteristics.
- 4.7 List the applications of varactor diode.
- 4.8 Explain the construction, working principle and characteristics of LED
- 4.9 Explain the construction and working principle of LCD.
- 4.10 Explain the applications of LED and LCD in discrete displays, dot-matrix and seven segment displays.
- 4.11 Explain the construction, operation and characteristics of photo diode.
- 4.12 Explain the construction, operation and characteristics of photo transistor.
- 4.13 List the applications of photo diode and photo transistor
- 4.14 Explain the working of opto-coupler

5.0 Practical Applications

- 5.1 Explain the operation of transistor series voltage regulator.
- 5.2 Explain the operation of transistor shunt voltage regulator
- 5.3 Explain how a transistor works as a switch in CE model.
- 5.4 State the reasons for instability in oscillator circuits over other types
- 5.5 List the advantages of crystal oscillators
- 5.6 Suggest the remedies for instability in oscillator.
- 5.7 Draw the equivalent circuit of crystal and explain.
- 5.8 Draw and explain the working of transistor crystal oscillator
- 5.9 Transistor circuit driving a relay
- 5.10 Twilight Switch using LDR/Photo Diode
- 5.11 Mains operated lamp using Opto-Coupler and relay.

COURSE CONTENT:

1. Formation and properties of PNP and NPN Transistor, Transistor configurations, input and output characteristics. α , β , and γ factors. Comparison of CB, CE, and CC configurations. Transistor as an amplifier. Classification of FETs, N-channel JFET construction, Working principle, characteristics, applications, FET parameters, MOSFET – types, working principle.
2. Transistor biasing and small signal amplifiers Transistor CE amplifier, DC and A.C load lines, operating point, stabilization, stability factor, proper biasing, types of biasing- collector to base biasing, potential divider biasing, practical transistor CE amplifier,

definition of h parameters of a transistor , Classification of amplifiers, need of multi stage amplifier, working and frequency response of two-stage RC coupled amplifier, transformer coupled amplifier, direct coupled amplifier, emitter follower, Darlington pair, Common Source Amplifier.

3. Feedback , Power amplifiers and Oscillators, Principle of negative and positive feedback. Feedback amplifiers, block diagram, types, expression for gain, effects on gain, bandwidth, input and output impedances, advantages, power amplifier - classification amplifier. Requisites of an oscillator. Classification of oscillators. RC phase shift oscillator, Colpitts,
4. Opto Electronic Devices, Classification of optoelectronic devices, LDR- working principle, characteristics. LED & LCD–construction, working principle, characteristics, photo diode and phototransistor – working principle characteristics, applications. photovoltaic cell
5. Practical applications Transistor works as a switch, crystal oscillators, Transistor circuit driving a relay Twilight Switch using LDR/Photo Diode, Mains operated lamp using Opto coupler and relay.

REFERENCE BOOKS:

1. Principles of Electronics by V.K. Mehta.
2. Electronic Devices and Circuits by David A Bell, PHI
3. Pulse digital and switching circuits by Millman and Taub TMH
4. Basic Electronic Principles by Malvino. TMH
5. Basic Electronics by B.L. Theraja S Chand
6. Integrated Electronics Millman & Halkias TMH
7. Electronic Circuits by Schilling & Belove
8. Electronic devices and circuits by Sanjeev Gupta
9. Electronic Devices and Circuits by .David A.Bell 4th edition PHI
10. Basic Electronic Principles by Malvino. TMH

DIGITAL ELECTRONICS

Subject Title	:	DIGITAL ELECTRONICS
Subject Code :	:	303
Periods/Week	:	4
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 behavior of various devices and circuits including practical applications. This course serves as a foundation for other advanced courses.

TIME SCHEDULE

SI	Major topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Basics of Digital Electronics	12	16	2	1
2	Logic Families	15	29	3	2
3	Combinational Logic circuits	15	29	2	2
4	Sequential Logic Circuits	10	26	2	2
5	Registers and Semiconductor Memories	8	10	1	1
	Total	60	110	10	8

OBJECTIVES

On completion of this unit the student shall be able to

1.0 Understand the basics of Digital Electronics

- 1.1 Explain Binary, Octal, Hexadecimal number systems and compare with Decimal system.
- 1.2 Convert a given decimal number into Binary, Octal, and Hexadecimal numbers and vice versa.
- 1.3 Convert a given binary number into octal and hexadecimal number system and vice versa.
- 1.4 Perform binary addition, subtraction, Multiplication and Division.
- 1.5 Write 1's complement and 2's complement numbers for a given binary number.
- 1.6 Perform subtraction of binary numbers in 2's complement method.
- 1.7 Explain the use of weighted and Un-weighted codes.
- 1.8 Write Binary equivalent number for a number in 8421, Excess-3 and Gray Code and vice-versa.
- 1.9 Explain the use of alphanumeric codes (ASCII & EBCDIC)
- 1.10 Explain the importance of parity Bit.
- 1.11 State different postulates in Boolean algebra.
- 1.12 Explain the basic logic gates AND, OR, NOT gates with truth table.
- 1.13 Explain the working of universal logic gates (NAND, NOR gates) using truth tables.
- 1.14 Explain the working of an exclusive – OR gate with truth table.
- 1.15 State and explain De-Morgan's theorems.

- 1.16 Realize AND, OR, NOT operations using NAND, NOR gates.
- 1.17 Apply De-Morgan's theorems related postulates to simplify Boolean expressions (up to three variables).
- 1.18 Explain standard representations for logical functions (SOP and POS form)
- 1.19 Write Boolean expressions from the given truth table.
- 1.20** Use Karnaugh map to simplify Boolean Expression (up to 4 variables only)

2.0 Understand different logic families.

- 2.1 Know the classification of digital logic families.
- 2.2 Explain the characteristics of digital ICs such as logic levels, propagation delay, Noise margin, Fan-in, Fan-out, and Power dissipation.
- 2.3 Draw and explain TTL NAND gate with open collector.
- 2.4 Draw and explain TTL NAND gate with Totem pole output.
- 2.5 Draw CMOS NAND gate circuit and explain its operation.
- 2.6 Draw and explain the basic emitter coupled logic OR/NOR gate.
- 2.7 Compare the TTL, CMOS and ECL logic families.
- 2.8 List the numbers of two input Digital IC Logic gates.

3.0 Understand the working of combinational logic circuits

- 3.1 Give the concept of combinational logic circuits.
- 3.2 Draw the Half adder circuit and verify its functionality using truth table.
- 3.3 Realize a Half-adder using NAND gates only and NOR gates only.
- 3.4 Draw the full adder circuit and explain its operation with truth table.
- 3.5 Realize full-adder using two Half-adders and an OR – gate and write truth table
- 3.6 Draw and explain a 4 Bit parallel adder using full – adders.
- 3.7 Draw and Explain 2's complement parallel adder/ subtractor circuit.
- 3.8 Explain the working of a serial adder with a Block diagram.
- 3.9 Compare the performance of serial and parallel adder.
- 3.10 Draw and explain the operation of 4 X 1 Multiplexers
- 3.11 Draw and explain the operation of 1 to 4 demultiplexer.
- 3.12 Draw and explain 3 X 8 decoder.
- 3.13 Draw and explain BCD to decimal decoder.
- 3.14 List any three applications of multiplexers and decoders.
- 3.15 Draw and explain Decimal to BCD encoder.
- 3.16 State the need for a tri-state buffer and list the four types of tri-state buffers.
- 3.17 Draw and explain One bit digital comparator.

4.0 Understand the working of Sequential logic circuits

- 4.1 Give the idea of Sequential logic circuits.
- 4.2 Explain NAND and NOR latches with truth tables
- 4.3 State the necessity of clock and give the concept of level clocking and edge triggering,
- 4.4 Draw and explain clocked SR flip flop using NAND gates.
- 4.5 Study the need for preset and clear inputs .
- 4.6 Construct level clocked JK flip flop using S-R flip-flop and explain with truth table
- 4.7 Analyze the race around condition.
- 4.8 Draw and explain master slave JK flip flop.
- 4.9 Explain the level clocked D and T flip flops with the help of truth table and circuit diagram.
- 4.10 Know the truth tables of edge triggered D and T flip flops and draw their symbols.
- 4.11 List any four applications of flip flops.
- 4.12 Define modulus of a counter
- 4.13 Draw and explain 4-bit asynchronous counter and also draw its timing diagram.

- 4.14 Draw and explain asynchronous decade counter.
- 4.15 Draw and explain 4-bit synchronous counter.
- 4.16 Distinguish between synchronous and asynchronous counters.
- 4.17 Draw and explain asynchronous 3 bit up-down counter.
- 4.18 List any six commonly used IC numbers of flip flops, registers and counters.

5.0 Understand working of Registers and memories

- 5.1 State the need for a Register and list the four types of registers.
- 5.2 Draw and explain the working of 4 bit shift left and shift right registers
- 5.3 Draw and explain the working of 4-bit bi-directional shift register.
- 5.4 Draw and explain parallel in parallel out shift register
- 5.5 Explain the working of Universal shift register (74194)
- 5.6 Explain the working of ring counter and list its applications
- 5.7 List the four common applications of shift registers.
- 5.8 State memory read operation, write operation, access time, memory capacity, address lines and word length.
- 5.9 Classify various types of memories based on principle of operation, physical characteristics, accessing modes and fabrication technology..
- 5.10 Differentiate between ROM and RAM
- 5.11 Explain basic principle of working of diode ROM
- 5.12 Distinguish between EEPROM and UVROM.
- 5.13 List six types of ROM and RAM ICs
- 5.14 Explain the working of basic dynamic MOS RAM cell.
- 5.15 Compare static RAM and dynamic RAM
- 5.16 Explain the working principle of NVRAM
- 5.17 State the difference between Flash ROM and NV RAM
- 5.18 Know the memory modules used in computers.

COURSE CONTENT

1 Basics of Digital Electronics

Binary, Octal, Hexadecimal number systems. Conversion from one number system to another number system. Binary codes, excess-3 and gray codes. Logic gates :AND, OR, NOT, NAND, NOR, Exclusive-OR. Logic symbols. Boolean algebra, Boolean expressions. Demorgan's Theorems. Implementation of logic expressions, SOP and POS forms, Karnaugh map application.

5. Logic families

Characteristics of digital circuits: logic levels, propagation delay, Noise margin, Fan-in, Fan-Out, power dissipation, TTL NAND gate: open collector, totem pole output, CMOS NAND gate, ECL OR/NOR gate, comparison of TTL, CMOS and ECL logic families.

2 Combinational logic circuits

Implementation of arithmetic circuits, Half adder, Full adder, Serial and parallel Binary adder. Parallel adder/subtractor, Multiplexer, demultiplexer, decoder, encoder, tri-state buffer, 2-bit Digital comparator.

3 Sequential logic circuits

Principle of flip-flops operation, Concept of edge triggering, level triggering, RS, D, JK, T, JK Master Slave flip-flops., synchronous and asynchronous inputs and their use. Applications of flip flops,. Binary counter- ripple counter, synchronous counter, up-down counter.

4. Registers and Memories

Shift Registers- Types, shift left ,shift right, bidirectional, Parallel in parallel out ,universal shift registers, ring counter and its applications, Memories-terminology related to memories, RAM, ROM, EEPROM, UVEPROM, static RAM, dynamic RAM, Flash ROM, NVRAM, memory modules used in computers .

REFERENCE BOOKS

1. Digital Computer Electronics by Malvino and leach., TMH
2. Modern Digital Electronics By RP JAIN TMH
3. Digital Electronics Tokhem TMH
4. Digital Electronics Puri TMH
5. Digital Computer Fundamentals by Thomas Bartee.
6. Digital Electronics by GK Kharate, Oxford University Press.

ANALOG COMMUNICATIONS

Subject Title : ANALOG COMMUNICATIONS
Subject Code : EC-304
Periods/Week : 04
Periods/Semester : 60

Rationale: Analog communications is another core subject which forms the basis for Analogue Communication. Hence the understanding of Analogue 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 study of fundamentals. This course serves as a foundation for other advanced courses.

TIME SCHEDULE

SI	Major topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Introduction to Communication System & Noise	10	16	2	1
2	Analog modulation techniques	14	26	2	2
3	Transmitters & Receivers	12	26	2	2
4	Antennas	14	26	2	2
5	Wave propagation	10	16	2	1
Total		60	110	10	8

OBJECTIVES

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

1.0 Understand communication systems.

- 1.1 Describe the basic elements of a communication system with block diagram.
- 1.2 Explain frequency spectrum and mention the usage of frequencies for different applications
- 1.3 Define modulation
- 1.4 State the need for modulation in communication systems.
- 1.5 Define amplitude modulation and draw the wave form
- 1.6 Define Frequency modulation and draw the waveform
- 1.7 Define phase modulation
- 1.8 Distinguish between baseband, carrier, and modulated signals and give examples.
- 1.9 Explain the relationship between channel bandwidth, baseband bandwidth and transmission time.
- 1.10 List causes of distortion in transmission and measures for distortion less transmission.
- 1.11 Know the terms time domain and frequency domain.

- 1.12 List the types of noise
- 1.13 Describe internal and external Noise
- 1.14 Define signal to noise ratio, noise figure and noise temperature

2.0 Understand the principles of Analog Modulation Techniques

- 2.1 Derive the time-domain equation for an AM signal.
- 2.2 Define the modulation index of an AM signal.
- 2.3 Draw the frequency spectrum of an AM signal.
- 2.4 Determine the modulation index using CRO
- 2.5 Describe the effects of over modulation.
- 2.6 Calculate the bandwidth of an AM signal.
- 2.7 Derive the relation between total power and carrier power in AM
- 2.8 Explain the need for DSBSC and SSB modulation
- 2.9 List the advantages and disadvantages of SSB
- 2.10 List applications of SSB.
- 2.11 Explain Vestigial side band transmission
- 2.12 Examples on power calculations.
- 2.13 State the need for angle modulation
- 2.14 List the two types of angle modulation
- 2.15 Derive the time domain equation for FM signal
- 2.16 Define the modulation index of an FM signal
- 2.17 Explain noise triangle in FM
- 2.18 Compare AM and FM
- 2.19 Compare FM and PM
- 2.20 Explain narrow band and wide band FM
- 2.21 Define pre-emphasis and de-emphasis
- 2.22 State the need for pre-emphasis and de-emphasis in FM

3.0 Understand transmitters and receivers.

- 3.1 List the requirements and specifications of transmitters.
- 3.2 Draw the block diagram for high level modulated transmitter and explain
- 3.3 Draw the low level modulated Transmitter and explain.
- 3.4 Distinguish between low level and high level modulation
- 3.5 Draw the block diagram of basic SSB transmitter and briefly explain.
- 3.6 Draw the block diagram of FM transmitter using PLL and explain its working.
- 3.7 Draw the block diagram of indirect FM transmitter and explain (Arm strong method).
- 3.8 Draw the block diagram of TRF receiver and explain.
- 3.9 Explain the need for super heterodyning in radio receiver.
- 3.10 Draw the block diagram of super heterodyne receiver and explain.
- 3.11 Explain the choice of IF.
- 3.12 Define sensitivity, selectivity and fidelity, image rejection ratio
- 3.13 Explain the need for AVC (AGC).
- 3.14 Explain the process of demodulation in AM receivers.
- 3.15 Draw the block diagram of FM receiver and explain
- 3.16 Explain Foster-seely discriminator.

4.0 Understand the working Principles of antennas

- 4.1 State the principle of an antenna
- 4.2 Define radiation pattern
- 4.3 Define isotropic antenna and draw its radiation pattern
- 4.4 Explain an elementary doublet

- 4.5 Explain half wave dipole and give its radiation pattern
- 4.6 Define the terms power gain, directivity, beam width, radiation resistance
- 4.7 and front to back ratio of an antenna..
- 4.8 Explain the terms antenna impedance and polarization.
- 4.9 Explain the concept of grounding.
- 4.10 State the need for folded dipole.
- 4.11 State the need of antenna array.
- 4.12 Explain the operation of broadside and end fire arrays.
- 4.13 Define resonant and non-resonant antennas
- 4.14 Explain the construction and working of Rhombic antenna.
- 4.15 Describe the working of Yagi-Uda antenna.
- 4.16 Explain turnstile antenna
- 4.17 State the need for binomial array
- 4.18 Explain the principle of parabolic reflector.
- 4.19 Explain the working of Horn and Loop antennas
- 4.20 Explain the working of Helical and Log periodic antenna
- 4.21 List the applications of dish in VSAT.

- 5.0 Understand the methods of wave propagation**
- 5.1 Describe electromagnetic spectrum.
- 5.2 Describe the properties of electromagnetic waves (Absorption, attenuation)
- 5.3 Define power density and electric field intensity
- 5.4 Calculate power density and electric field intensity for waves propagating in free space.
- 5.5 Define Decibel and Neper
- 5.6 Define polarization of EM waves
- 5.7 Describe vertical, horizontal, circular and elliptical polarization.
- 5.8 Know the characteristic impedance of free space.
- 5.9 Describe reflection, refraction, diffraction and interference of EM waves.
- 5.10 List 4 types of wave propagation methods
- 5.11 Explain ground wave propagation
- 5.12 Explain sky wave propagation
- 5.13 Explain different layers in ionosphere
- 5.14 Define the terms critical frequency, MUF, skip distance and virtual height in sky wave propagation.
- 5.15 Explain space wave propagation
- 5.16 Define the term line of sight and give the expression for LOS
- 5.17 Define fading
- 5.18 Explain the methods of diversity to reduce fading effects
- 5.19 Explain duct propagation
- 5.20 Explain tropospheric scatter propagation.

COURSE CONTENTS

- 1. Introduction to communication system.**
Elements of communication system, need for modulation, types of modulation, Noise, Signal to noise ratio, noise figure, noise temperature.

- 2. Analog modulation techniques.**
AM-Modulation index in AM, effects of over modulation, bandwidth, power and voltage of AM signal. DSBSC-SSB-VSB-advantages and disadvantages of angle modulation,

Modulation index in FM, bandwidth, side bands, frequency deviation, pre-emphasis, de-emphasis

3. Transmitters and Receivers.

Requirements and specifications of transmitters, low level modulated, high level modulated, SSB transmitter, FM transmitters. TRF receiver, super heterodyne receiver, selection of IF, AVC, sensitivity, selectivity, fidelity- IMRR, AM detector, FM receiver-FM detector.

4. Antennas

Isotropic antenna-elementary doublet-half wave dipole – radiation resistance-efficiency,- gain, directivity- beam width-front to back ratio-radiation pattern-polarisation-effect of ground on antennas-folded dipole-non resonant antennas-antenna arrays – broadside & end-fire arrays- binomial-Yagi-turnstile-parabolic reflectors-Loop antenna-log periodic-helical antenna-horn antenna

5. Wave Propagation

Electromagnetic waves-reflection- refraction-diffraction-ground wave propagation-ionosphere propagation- space wave propagation-LOS-duct propagation- tropospheric scatter-propagation

REFERENCE BOOKS

1. Electronic communications systems by Roy Blake, Thomson Delmar
2. Electronic Communication System by George Kennedy.
3. Communication Electronics Frenzel TMH
4. Electronic Communication Modulation and Transmiission 2nd Edition-Schoenbeck
Publisher PHI
5. Communication Systems By Simon Haykin-John Wiley
6. Modern analog and digital communications by B.P.Lathi –Oxford university press
7. Radio communication by G.K.Mithal- khanna publishers
8. Radio engg by Terman- McGrawhill
9. Antennas and Wave propagation by K.D.Prasad- Sathya Prakasahan Publications

ELECTRONIC MEASURING INSTRUMENTS

Subject Title	:	ELECTRONIC MEASURING INSTRUMENTS
Subject Code	:	EC-305
Periods/Week	:	04
Periods/Semester	:	60

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.

TIME SCHEDULE

SI	Major Topics	No. of periods	Weightage of Marks	Short Answer Questions	Essay Questions
1	Analog instruments	12	32	2	2
2	Digital instruments	12	26	2	1 ½
3	Cathode Ray Oscilloscope	12	32	2	2
4	Signal generators	12	26	2	1 ½
5	Testing Instruments	12	20	2	1
	Total	60	136	10	8

OBJECTIVES

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

0.0 Understand the working Analog instruments

1. 1 Explain the construction and principle of operation of PMMC instrument.
1. 2 Explain the principle of extending the range of DC ammeter
1. 3 Explain the principle of extending the range of DC voltmeter.
1. 4 Explain the principle and working rectifier type voltmeter and ammeter.
1. 5 Explain the construction and principle of series and shunt type ohmmeters.
1. 6 Describe and calculate meter-loading with example.
1. 7 Explain the working of FET input voltmeter with necessary circuit (DC/AC) and emitter follower voltmeter.
1. 8 Explain the working of differential voltmeters.
1. 9 Explain the use of high voltage probe and clamp on current probe.
1. 10 Explain the resistance measurement using Wheat Stone Bridge.
1. 11 Explain the inductance measurement using Maxwell's Bridge
1. 12 Explain the capacitance measurement using Schering Bridge with block diagram.

1.0 Understand working of Digital instruments

- 2.1 List the advantages of digital instruments over analog instruments.

- 2.2 Explain the working of digital voltmeters (Ramp type, dual slope integration type, successive approximation type) with block diagrams.
- 2.3 List the specifications of digital voltmeters.
- 2.4 Explain the working of Digital Multimeter with block diagram.
- 2.5 List the specifications of Digital Multimeter.
- 2.6 Explain the working of digital frequency meter with block diagram.
- 2.7 List the specifications of digital frequency meter.
- 2.8 Explain the accuracy of a frequency meter.
- 2.9 Explain the working of digital LCR meter with block diagram
- 2.10 List the specifications of digital LCR meter.

2.0 Understand construction, working principle and use of CRO

- 3.1 Draw block diagram of general purpose CRO and describe the function of each block.
- 3.2 Sketch CRT and describe the function of different parts.
- 3.3 Explain the necessity of time base, deflection amplifiers.
- 3.4 Write the expression for deflection sensitivity.
- 3.5 Solve simple problems on above.
- 3.6 List the conditions for stationary waveforms.
- 3.7 List the conditions for flicker free waveforms.
- 3.8 Explain the function of each stage in a CRO with block diagram.
- 3.9 Explain triggered sweep with necessary circuit, mention its advantages.
- 3.10 Identify the function and use of various controls and terminals of CRO and list its specifications.
- 3.11 Explain the procedure for measurement of voltage (DC & AC) frequency, phase, time interval, depth of modulation, pulse parameters, rise time, fall time, delay time with CRO.
- 3.12 Explain the method of conversion of single trace CRO into dual trace CRO with block diagram.
- 3.13 Give basic principle of sampling oscilloscope.
- 3.14 List different types of probes used in oscilloscopes.
- 3.15 Explain sensitivity, frequency response, voltage measurement and accuracy.

4.0. Understand the construction, working principle of AF, RF signal generators and power meters

4. 1 Explain the working of AF Oscillator (sine & square) with block diagram.
4. 2 List the front panel controls and specifications of AF Oscillator.
4. 3 Explain the working of function generator with block diagram.
4. 4 List the applications of AF oscillators and function generators.
4. 5 Explain the working of RF signal generator.
4. 6 List the specifications and applications of RF signal generator.
4. 7 Explain the importance of shielding in RF generators.
4. 8 Explain the working of AF power meter.
4. 9 Explain the working of bolometer type RF power meters.
4. 10 List the applications of power meters.

5.0 Understand the construction and working of test instruments

5. 1 Explain the working of Q meter diagram.
5. 2 Explain the working of Distortion Factor Meter with block diagram.
5. 3 Explain the working of digital IC tester with block diagram.
5. 4 Explain the working of logic analyser with block diagram.
5. 5 Explain the basic working principle of spectrum analyser and state its use.

- 5.6 State the necessity of plotter and recorders.
- 5.7 Explain the working of XY recorders.
- 5.8 Explain the working of plotter.

COURSE CONTENTS

1. Analog instruments:

PMMC Instrument, extending the range of instruments, series and shunt type ohmmeter, FET input voltmeter, differential voltmeter, Wheatstone, Maxwell, Schering Bridge.

2. Digital Instruments:

Digital voltmeter, Digital Multimeter. Digital frequency meter, Digital LCR Meter.

3. Cathode Ray Oscilloscope:

Block diagram of general purpose CRO, study of different blocks (in detail) sweep circuits, triggered sweep circuit, controls, specifications, applications, single trace CRO, dual trace CRO, sampling CRO.

4. Signal Generators & Power meters

AF oscillator, function generator, RF signal generator and specifications, AF and RF power meters.

5. Test instruments:

Q meter, Distortion Factor Meter, Plotter and Recorders. digital IC tester, Logic analyser, spectrum analyser.

REFERENCE

- 1. Electronic measurements by A K Sawhaney
- 2. Electronic Measurements & Instruments by William David Cooper PHI
- 3. Modern Electronic Equipment by Khandpur
- 4. Electrical, Electronic Measurements and Instruments by Sahney
- 5. Electronic Measuring Instruments Gupta TMH
- 6. Electronic instrumentation and measurements by David A Bell, PHI
- 7. Electronic Instrumentation by H S Khalsi, TMH

ELECTRICAL TECHNOLOGY

Subject Title	:	ELECTRICAL TECHNOLOGY
Subject Code	:	EC-306
Periods/Week	:	05
Periods/Semester	:	60

Rationale: Electrical Machines subject is reintroduced in the iii semester as the Knowledge of electrical machines is essential for the student to survive in the industry and also understand subjects like Industrial electronics as per the suggestions of industrial experts. Emphasis is laid on Fundamental concepts.

TIME SCHEDULE

Sl	Major topics	No of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	AC Circuits	22	26	2	2
2	DC machines	12	26	2	2
3	Polyphase Circuits	6	13	1	1
4	Transformers	8	16	2	1
5	AC machines	6	16	2	1
6	Special Motors	6	13	1	1
	Total	60	110	10	8

After completing this unit the learner will be able to

1.0 Working Of AC Circuits

- 1.1 Explain series RLC circuits
- 1.2 Solve problems on Series RLC circuits
- 1.3 Explain resonance in RLC series circuit
- 1.4 Explain the principle and working rectifier type voltmeter and ammeter.
- 1.5 Explain the construction and principle of series and shunt type ohmmeters.
- 1.6 Derive the formula for series resonance
- 1.7 State the conditions for series resonance
- 1.8 Draw the characteristic curves for series resonance.
- 1.9 Define bandwidth of a resonant circuit
- 1.10 Define lower cut off and upper cut off frequencies
- 1.11 Give formula for lower cut off and upper cut off frequencies
- 1.12 Solve simple problems on series Resonance.
- 1.13 Explain Parallel AC circuit containing RLC
- 1.14 List the 3 methods a) Vector or phasor method b) Admittance method c) Vector algebra method.for solving AC parallel circuits.
- 1.15 Solve problems using above 3 methods
- 1.16 Explain Resonance in parallel circuits

- 1.17 State the conditions required for parallel resonance
- 1.18 Derive Equation for resonant frequency.
- 1.19 Give graphical representation of parallel resonance.
- 1.20 Compare Series and parallel resonance
- 1.21 Solve problems on Resonance
- 1.22 Explain effect of Resistance on Bandwidth.

2.0 Understand the working of DC Machines

- 2.1 Explain the principle of DC Generators.
- 2.2 Explain the constructional features of DC generator with a sketch.
- 2.3 Explain the function of commutator and brushes
- 2.4 List the two types of windings used in DC generators and state their use.
- 2.5 Classify DC generators based on the type of excitation and field winding connections
- 2.6 Write the emf equation of DC generator.
- 2.7 Explain the characteristics of DC shunt Generator
- 2.8 Explain the principle of DC Motor.
- 2.9 Explain the significance of back EMF
- 2.10 Derive voltage equation of DC motor and condition for maximum power.
- 2.11 Derive equation for armature torque of dc motor
- 2.12 Derive equation for speed of a) DC series motor b) DC shunt motor
- 2.13 Define speed regulation of DC motor
- 2.14 Explain torque-speed behaviour of DC motor
- 2.15 Explain DC motor characteristics a) DC series motor b) DC shunt motor
- 2.16 Compare DC series motor and DC shunt motor
- 2.17 Explain power stages in DC motor
- 2.18 Explain speed control of DC motors and factors affecting the speed.
- 2.19 Explain speed control of DC shunt motor by armature, field control and armature resistance control
- 2.20 Solve simple problems related to DC motors
- 2.21 Compare the above methods
- 2.22 Explain electrical braking. List 3 methods of braking
- 2.23 Explain the need for starter.
- 2.24 Explain with a circuit the working of a 3 point starter
- 2.25 List important specifications of a motor and explain
- 2.26 List the various applications and choice of particular motor for a given application.

3.0 Comprehend the POLYPHASE CIRCUITS

- 3.1 Explain generation of 3 phase voltages.
- 3.2 List the merits of 3 phase system over single phase.
- 3.3 Write the emf equations for R, Y, B phases and draw the vector diagram.
- 3.4 Explain the concept of phase sequence.
- 3.5 Explain star Delta configurations with diagrams.
- 3.6 Give the relation between Line Voltages, Phase voltages and Line currents & Phase currents in Star configuration
- 3.7 Explain the formation of Neutral at the junction in Star connections

- 3.8 Give the relation between Line Voltages, Phase voltages and Line currents &Phase currents in Delta configuration
- 3.9 Solve simple problems in 3 phase circuits

4.0 Understand the working of Transformers

- 4.1 Explain the working principle of transformer
- 4.2 Give constructional details of a) Core type transformer b) Shell type transformer
- 4.3 Give reasons for using laminations in transformer core
- 4.4 Derive the emf equation of a transformer
- 4.5 Explain voltage transformation ratio
- 4.6 Explain the operation of transformer on NO load and write the equation for no load current
- 4.7 Explain the operation of transformer on LOAD with the help of vector diagram under leading lagging and unity power factor
- 4.8 Solve problems on the above
- 4.9 Explain the losses in a transformer
- 4.10 Explain open circuit and short circuit tests and their purpose.
- 4.11 Define efficiency and regulation of transformer
- 4.12 Solve problems on the above
- 4.13 Classify transformer based on power rating, construction and applications
- 4.14 Explain the construction and working of an auto transformer
- 4.15 Explain the three phase connections of transformer, star-star, star-delta, delta-delta, delta star
- 4.16 Explain the applications of a transformer a)potential transformer b) current transformer c) impedance matching transformer d) isolation transformer
- 4.17 List important specifications of a transformer and explain
- 4.18 List the various applications and choice of particular transformer for a given application

5.0 Understand the working of AC Machines

- 5.1 Classify ac motors based on the principle of operation type of current and structural features
- 5.2 Explain the principle of induction motors
- 5.3 Explain the production of rotating magnetic field
- 5.4 Explain the constructional features of squirrel cage motor
- 5.5 Define slip, synchronous speed of an induction motor and give the relation
- 5.6 Write the equation for the frequency of rotor current
- 5.7 Draw the torque speed characteristics and explain
- 5.8 Explain the principle of Alternator
- 5.9 Mention various parts of an alternator and explain
- 5.10 Give equation of induced emf
- 5.11 Explain the principle of synchronous motor
- 5.12 Explain the effect of excitation
- 5.13 Give applications of synchronous motors
- 5.14 List important specifications of an ac motor and explain
- 5.15 List the various applications and choice of particular ac motor for a given application

6.0 Understand the working Special motors

- 6.1 Explain the working principle capacitor start single phase induction motor.
- 6.2 Explain the principle of universal motor

- 6.3 Explain the working principle and constructional features of a) stepper motors b) Servo motors
- 6.4 Explain the choice of selecting a motor for a particular application
- 6.5 List 5 applications for each of above.

COURSE CONTENT

1.0 AC CIRCUITS

Representation of AC Series – parallel AC circuits - Problems - Resonance in A.C. Circuits & Coupled circuits - Series and parallel resonance. Condition for resonance, resonance curves, effect of resistance on Q factor selectivity and bandwidth,

2.0 DC MACHINES

Construction of D.C generators, simple lap and wave winding E.M.F., equation, classification of D.C machines on the basis of excitation, write voltage equations, elementary study characteristics of series shunt and compound generators. Losses and efficiency, principles of D.C. motors back E.M.F., speed torque equations, characteristics of series,, shunt and compound motors, motor starters, speed control

3.0 POLYPHASE CIRCUITS

Generation of polyphase voltages and currents. Advantages of 3-phase system, 1-phase system, 3– phase star and 3–phase delta circuits-solving simple problems

4.0 TRANSFORMERS

Principle of transformer- Core type transformer-Shell type transformer-Laminations-transformation ratio- transformer on NO load- vector diagram-unity power factor-losses in a transformer-open circuit and short circuit tests-efficiency and regulation of transformer - auto transformer- three phase connections of transformer, star-star, star-delta, delta-delta, delta star- applications of a transformers

5.0 AC MACHINES

Principle and construction of alternator, types of alternator, e.m.f. equation and frequency, Production of rotating magnetic fields, principle and construction of 3 – phase induction motors, slip ring and squirrel cage, DOL, Star / delta starters, applications, Single phase induction motors, split phase, Capacitor start,.

6.0 SPECIAL MOTORS

Capacitor start single phase induction motor - universal motor- features of stepper motors, Servo motors - choice of selecting a motor-applications for each of above

REFERENCE

1. Electrical Technology by B L Theraja,

Electronic Devices and Circuits Lab Practice

Subject title : **Electronic Devices and Circuits Lab Practice**
Subject code : **EC-307**
Periods per week : **6**
Periods / Semester : **90**

Rationale: Electronic Devices & Circuits lab is a core lab as the student is expected to understand and demonstrate practical skills in handling, identifying and using different instruments and various Electronic components with ease. Emphasis is laid on imparting

S. No.	Major Topics	No. of Periods
I.	Semiconductor Diodes and Rectifiers	12
II.	Transistors & Field Effect transistors	12
III.	Transistor Amplifiers	12
IV.	Oscillators	12
V.	Special Devices	12
VI	Circuit simulation using Pspice or equivalent	30

List of Experiments:

1. To draw the forward & reverse characteristics of Silicon diode and a) determine Knee voltage, b) identify Cutoff, and Linear regions

- a) Connect a 6V lamp in series with diode and test it on DC power supply
- b) Using the CRO & Curve tracer to observe the Characteristics.
- c) Heat the diode with a soldering Iron and observe the effect on reverse current

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

- a) Connect resistance ladder circuit (3 resistors) and measure the voltages at the output by varying input voltage while Zener is reverse biased

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

- a) Implementing Half wave rectifier with and without filter
- b) Implementing Full wave rectifier with and without filter
- c) Implementing Bridge rectifier with and without filter

- d) Implementing Voltage Doubler circuit
- e) Connect a diode IN4007 in series with a 60W 230V Lamp and test it .(Record your observations)

4. To 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 Regulator ii) Implement a Dual regulated power supply using both +ve and -ve 3 terminal regulators
- C. i) Obtain a voltage above 30V using Dual RPS in the laboratory and measure

5. To draw Input and output characteristics of NPN Transistor and determine Beta of the transistor

- a) For CB configuration and for CE configuration
- b) Turn on and turn off a relay using Transistor (BC148 as a switch.)
- c) Connect a 6v lamp in series with BD139 and observe the effect of base current variation on lamp brightness .
- d) Know the package and differences between BC148A, 148B, 148C and BF194 from the data sheets.

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

- a) Demonstrate that a FET can be used as a constant current source with appropriate bias
- b) Apply -2 volts to the gate circuit through resistors of value 10k, 100k and 1M separately and measure the output current and analyse.

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

- a) Calculate the gain, f_1 , f_2 and band width from the response.
- b) Observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion.
- c) Measure the voltage across Emitter Resistance using CRO, with and without emitter bypass capacitor C_e
- d) Measuring the output power using ac power meter

8. To observe the output of a tuned circuit oscillator and identify the oscillator type from the components in the circuit

- a) Colpitt's oscillator and Hartley oscillator
- b) observe the effect of varying the core of inductor
- c) Observe the effect of using a crystal in the oscillator circuit

9) To plot the characteristics of a Photo electric devices

a)Photodiode b)photo transistor c)LDR

10. To 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 h_{fe} 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.

Part 2: Circuit Simulation using pspice

- 1) Representation of passive elements
- 2) Representation of active elements
- 3) Representation of time varying signals
- 4) Representation of nodes
- 5) Zener regulator
- 6) Half wave rectifier
- 7) BJT model description
- 8) BJT I/V characteristics
- 9) Simulation of CE amplifier
- 10) Simulation of RC Coupled amplifier

Objectives and Key Competencies

Exp NO	Name of the Experiment	Objectives	Key Competencies
1	To draw the forward & reverse characteristics of Silicon diode and a) determine Knee voltage, b) identify Cutoff , and Linear regions a) Connect a 6V lamp in series with diode and test it on DC power supply b) Using the CRO & Curve tracer to observe the Characteristics. c) Heat the diode with a soldering Iron and observe the effect on reverse current	1.Identification of meters and equipment 2.Using DRB, DIB, DCB and measuring Voltage and current 3.Interpreting diode datasheets and finding the specifications of components used in the experiment	1. assembling the circuit as per the circuit diagram 2. Identification of Diode terminals by observation and also with DMM & Analogue Multimeter 3. Drawing inference and writing the report

2	<p>a) To draw the forward & reverse characteristics of Zener diode and determine Breakdown Voltage</p> <p>b) Connect resistance ladder circuit (3 resistors) and measure the voltages at the output by varying input voltage while Zener is reverse biased</p>	<p>1. Identification of meters and equipment</p> <p>2. Using DRB, DIB, DCB and measuring Voltage and current</p> <p>3. Interpreting Zener diode datasheets and finding the specifications of components used in the experiment</p>	<p>1. Assembling the circuit as per the circuit diagram</p> <p>2. Identification of Zener Diode terminals by observation and with DMM & Analogue Multimeter</p> <p>3. Drawing inference and writing the report</p>
3.	<p>To implement Rectifier circuits using Diodes and observe the effect of Filtering</p> <p>a) Implementing Half wave rectifier with and without filter</p> <p>b) Implementing Full wave rectifier with and without filter</p> <p>c) Implementing Bridge rectifier with and without filter</p> <p>d) Implementing Voltage Doubler circuit</p> <p>e) Connect a diode IN4007 in series with a 60W 230V Lamp and test it. (Record your observations)</p>	<p>1. Drawing the symbols of Transformer, Diode, Inductor and Capacitor</p> <p>2. Reading the circuit Diagram</p> <p>3. Identification of Diode terminals</p> <p>4. Identification of meters and equipment</p> <p>5. Using DRB, DIB, DCB and measuring Voltage and current.</p> <p>6. Observing the polarity of capacitors.</p> <p>7. Interpreting diode datasheets and finding the specifications of components used in the experiment</p>	<p>1. Assembling the circuit as per the circuit diagram</p> <p>2. Using the CRO to observe the waveforms</p> <p>3. Assess the Power supply performance in terms of ripple and % Regulation</p> <p>4. Drawing inference and writing the report</p>
4.	<p>To build a Regulated power supply and draw the regulation characteristics</p> <p>A. i) using Zener diode ii) using 3 Terminal +ve Regulator</p> <p>B. i) implement a -ve 3 Terminal Regulator ii) Implement a Dual regulated power supply using both +ve and -ve 3 terminal regulators</p> <p>C. i) Obtain a voltage above 30V using Dual RPS in the laboratory and measure</p>	<p>1. Drawing the symbols</p> <p>2. Reading the circuit Diagram</p> <p>3. Identification of Regulator terminals</p> <p>4. Identification of meters and equipment</p> <p>5. Using DRB, DIB, DCB and measuring Voltage and current.</p> <p>6. Observing the polarity of capacitors.</p> <p>7. Interpreting IC Regulator datasheets and finding the specifications of components used in the experiment</p>	<p>1. Assembling the circuit as per the circuit diagram</p> <p>2. Identification of 3 terminal Regulator and its package & pin Configuration</p> <p>3. Finding the output voltage and type from the IC Regulator number</p> <p>4. Using the CRO to observe the waveforms</p> <p>5. Assess the Power supply performance in terms of ripple and % Regulation</p>

5	<p>To draw Input and output characteristics of NPN Transistor and determine Beta of the transistor</p> <p>a) in CB configuration and CE configuration</p> <p>b) Turn on and turn off a relay using Transistor(BC148 as a switch.)</p> <p>c) Connect a 6v lamp in series with BD139 and observe the effect of base current variation on lamp brightness .</p> <p>d) Know the package and differences between BC148A, 148B, 148C and BF194 from the data sheets.</p>		
6	<p>Draw the input and output characteristics of JFET and determine pinch off voltage and transconductance.</p> <p>b) Show that a FET can be used as a constant current source with appropriate bias</p> <p>c) Apply -2 volts to the gate circuit through resistors of value 10k, 100k and 1M separately and measure the output current and analyse.</p> <p>4. Study the MMBFJ175L (P channel FET) data sheet</p>	<p>1. Drawing the symbols of FET,</p> <p>2. Reading the circuit Diagram</p> <p>3. Identification of FET terminals</p> <p>4. Identification of meters and equipment</p> <p>5. Interpreting JFET datasheets and finding the specifications.</p>	<p>1. Assembling the circuit as per the circuit diagram</p> <p>2. Identifying the ground, drain, gate and source terminals using multimeter (DMM and Analogue) also by physical observation</p> <p>3. Observing the pinch off voltage accurately</p>
7	<p>Plot the frequency response characteristics of a RC coupled Amplifier.</p> <p>b) Calculate the gain, f_1, f_2 and band width from the response.</p> <p>c) Observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion.</p> <p>d) Measure the voltage across Emitter Resistance using CRO, with and without emitter bypass capacitor C_e</p> <p>e) Measuring the output power using ac power meter</p>		<p>1. Assembling the circuit as per the circuit diagram</p> <p>2. Identifying the coupling and bypass capacitors(types, values)</p> <p>3. Observing the 3db points</p> <p>4. Observing the distortion(clipping) of signal on CRO and adjusting the input for distortionless output</p> <p>5. Plot the output</p>

			characteristics on semi log graph sheet and also on normal graph sheet. 6. Calculating the gain in db
8	Tuned circuit oscillators : To observe the output of a tuned circuit oscillator and identify the type from the components in the circuit a) Colpitt's oscillator b) Hartley oscillator c) observe the effect of varying the core of inductor ii) Observe the effect of using a crystal in the oscillator circuit	Identifying Tuned circuit ii. Identifying the active component and amplifier circuit . iii. Identifying feed back circuit iv. Observing the waveforms on CRO. V. Observe the effect of varying the core of inductor VI) Observe the effect of using a crystal in the oscillator circuit	1. Identifying different sections in the Oscillator circuit 2. Identifying the Type of oscillator .3. Observe the waveforms on CRO
9	To plot the characteristics of a Photo electric devices A) Photodiode B) photo transistor C) LDR	Identifying the devices b. Drawing the symbols c. Noting down the Assembling the circuit and performing the experiment as per procedure specifications	Performing the experiment as per procedure . Plotting the characteristics of the Photo diode , Photo transistor and LED , Identifying the device from the characteristics. Noting down the specifications.
10.	Connect two BC148 transistors in a Darlington pair and calculate the effective Beta A) Find out the device specifications of TIP 120 from the data sheets and compare the h_{fe} with that of BD 139. B) Connect a 6V lamp in the collector circuit of TIP120 transistor and apply few micro amperes current at the base and observe the effect.	To know Darlington Pair connections b) Calculating the Effective Beta from individual Betas of the transistors c) Identifying darlington component from the device number d) Knowing the typical current gains of	To assemble the circuit and Perform the experiment as per procedure. To identify Darlington pair connections in the circuit. Searching for Darlington pair devices

		Darlington devices. E) Using the darlington pair in practical circuits.	from data sheets, d) Knowing the typical current gains of Darlington devices. E) Using the darlington pair in practical circuits.
PARTB			
11	Representation of passive elements	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
12	Representation of active elements	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
13	Representation of time varying signals	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
14	Representation of nodes	a) Familiarity with computer operation b) Familiarity with pspice	Using Pspice for circuit simulation

		interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	
15	Zener regulator	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
16	Half wave rectifier	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
17	BJT model description	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
18	BJT I/V characteristics	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit	Using Pspice for circuit simulation

		parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	
19	Simulation of CE amplifier	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
20	Simulation of RC Coupled amplifier	a) Familiarity with computer operation b) Familiarity with pspice interface c) Defining circuit parameters d) Modelling the circuit e) simulating the circuit f) Observing and interpreting results g) Saving the files	Using Pspice for circuit simulation
	11) Industrial Visit		Observe the equipment and machinery in the industry and note down the important points and prepare a report.

ANALOG COMMUNICATION LAB

Subject Title : Analog Communication Lab
Subject Code : EC-308
Periods/Week : 03
Periods/Semester : 45

Rationale:

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

S. No.	Major Topics	No. of Periods
I.	Using Electronic measuring equipment	6
II.	Resonance and verification of Network theorems	6
III.	Measurements using CRO	6
IV.	Integrators and Differentiators	6
V.	Filters and Attenuators	6
VI	Modulation & Demodulation Techniques &Antennas	6
VII	Circuit simulation using Pspice	9
		45

LIST OF EXPERIMENTS

1. To measure the component values using special equipment
 - a) Use of bridges/Digital LCR meter to measure RLC and Q
 - b) To measure the signal distortion using a Distortion Factor Meter
2. To plot resonant curves of a tuned circuit
 - a)Series Resonance., b)Parallel Resonance. c) Wind a small coil and determine its inductance
3. Verification of Network theorems

- a)Thevenin's theorem.b)Nortons theorem
- 4. a)Verification of Super position theorem. b) Maximum power transfer theorem.
- 5. Measurements using CRO (both analogue and Digital)
 - a) Measurement of Voltage amplitude, b)frequency and c)phase angle
 - b) Measure the signal amplitude a) when the signal level is in milli Volts b) Signal level is above 80V
 - c) Observe and measure Amplitude and Frequency of the standard signal provided on CRO
 - d) observe and measure Amplitude and Frequency of Different wave forms provided in the function generator
 - e)Observe the characteristics of a Pulse on CRO
 - f) Connect a RC Series circuit to the function generator to create Phase difference and measure the same using lissajous patterns.
- 6. To Design and implement RC integrator and RC differentiator circuits
 - A) To apply a square wave and observe the output waveform for the above circuits
 - B) To use a differentiator circuit to convert a long Push button trigger signal into a pulse for use in Timer circuits
 - C)Use integrator circuit for producing triangular wave / Ramp
 - D)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
 - G) Observe the Bass and Treble controls. Equalizer controls on Audio amplifier and their effect on music output
 - H) Observe graphic equalizer adjustments on computer to understand the effect and applications of filtering (digital)
- 7. 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
- 8. Design and Realize 3 types of Attenuator circuits (L, T, and π types) and determine the actual attenuation.
- 9. To observe AM signal and determine Modulation index using CRO
 - i) Using Envelop method b) Trapezoidal Pattern method
 - a) Objectives: Observing the AM signal on CRO
Measuring the amplitude and frequencies of carrier and Modulating Signal
Observing the maxima and minima of Envelop
Observing the effect of over modulation on the envelop
Measuring the modulation index using two methods
 - b) To Demodulate A.M signal and compare the output signal with original modulating signal.
- 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
- 11- a) Identify different sections in AM/FM radio receiver and observe the waveforms at various stages on CRO.

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

12 .To determine the frequency of a given folded dipole antenna .

a) Assemble the given Yagi-Uda antenna

13. Simulate experiments 6,7,8 using PSpice

14. Simulate constant K Band pass and Band stop filters using pspice

Objectives & Key Competencies

Exp No	Name of the Experiment	Objectives	Key competencies
1.	To measure the component values using special equipment a) Use of bridges/Digital LCR meter to measure RLC and Q b) To measure the signal distortion using a Distortion Factor Meter	a) To identify the RLC bridge/Digital RLC meter and note the front panel controls. b) Measure component values by selecting the proper mode and range c) Using distortion factor meter for measuring percentage of distortion	Identify RLC meters b) Using the RLC meter and Distortion factor meter
2.	To plot resonant curves of a tuned circuit a)Series Resonance., b)Parallel Resonance. c) Wind a small coil and determine its inductance	a) To identify the TUNED circuit components b) connect L and C to form a series and parallel resonant circuit c) Plot the resonant curves d) Calculate the resonant frequency and BW and verify with measured values e) compare series and parallel resonances percentage of distortion	a) performing the experiment as per procedure b) Observe that the resonant circuit acts as a frequency selector and magnifier.
3.	Verification of Network theorems-I a) Thevenin's theorem. b) Nortons theorem	To Verify above Network theorems. Estimate the voltages & currents in a circuit element when multiple sources are involved Understand the importance of Thevenins impedance and applying the knowledge in analogue circuits Reinforce the skills of using Voltmeters and Ammeters Connecting the Components as per the circuit	Perform the experiment as per procedure and analyze the reasons for errors Correlate the Experimental knowledge in the Electronic circuits.

		Follow the sequence of procedure	
4.	<p>Verification of Network theorems-II</p> <p>a) Verification of Super position theorem.</p> <p>b) Verification of Maximum power transfer theorem</p>	<p>To Verify above Network theorems.</p> <p>Estimate the voltages & currents when multiple sources are involved</p> <p>Understand the importance of impedance matching and applying the knowledge in analogue circuits</p> <p>Reinforce the skills of using Voltmeters and Ammeters</p> <p>Connecting the Components as per the circuit</p> <p>Follow the sequence of procedure</p>	<p>Perform the experiment as per procedure and analyze the reasons for errors</p> <p>Correlate the Experimental knowledge in the Electronic circuits</p>
5.	<p>Measurements using CRO (both analogue and Digital)</p> <p>a) Measurement of Voltage amplitude, b) frequency and c) phase angle</p> <p>b) Measure the signal amplitude</p> <p>a) when the signal level is in milli Volts b) Signal level is above 80V</p> <p>c) Observe and measure Amplitude and Frequency of the standard signal provided on CRO</p> <p>d) observe and measure Amplitude and Frequency of Different wave forms provided in the function generator</p> <p>e) Observe the characteristics of a Pulse on CRO</p> <p>f) Connect a RC Series circuit to the function generator to create Phase difference and measure the same using lissajous patterns</p>	<p>To use various controls and select appropriate ranges on analog and Digital CROs</p> <p>Testing the BNC Cable before applying the signal</p> <p>Observing Positive and Negative peaks of a wave form.</p> <p>Measure the amplitude and frequencies of small and high level signals using CRO Probes</p> <p>Measuring phase angle by lissajous pattern method and interpreting them</p> <p>Experimentally verifying the concept of Phase angle in circuits involving RC elements. and observing the effect of variation of R and C on the phase angle at different frequencies</p>	<p>To measure the Amplitude, Frequency and phase angles of given Signals and also observe the waveform for its shape and Distortion.</p> <p>To know the Pulse parameters and Observing them on CRO</p>
6.	<p>To Design and implement RC integrator and RC differentiator circuits</p> <p>A) To apply a square wave and observe the output waveform for the above circuits</p> <p>B) To use a differentiator circuit to convert a long Push button trigger signal into a pulse for use in Timer circuits</p>	<p>1. To understand the behaviour of Passive Differentiator and integrator circuits.</p> <p>2. Know the Time constant and its importance in the circuit design.</p>	<p>To perform experiment as per procedure and observe waveforms on CRO</p>

	<p>C) Use integrator circuit for producing triangular wave / Ramp</p> <p>D) Design a Low pass filter Using Integrator circuit for a given cut off frequency</p> <p>F) Design a High pass filter Using Differentiator circuit for a given cut off frequency</p> <p>G) Observe the Bass and Treble controls. Equalizer controls on Audio amplifier and their effect on music output</p> <p>H) Observe graphic equalizer adjustments on computer to understand the effect and applications of filtering (digital)</p>	3. Know the use of Differentiator and integrator circuits for wave shaping	
7.	<p>Design and construct constant K filters of 1st order</p> <p>A) Design and implement a Low pass filter with a cut off frequency of 10 KHz(or any other frequency) and evaluate the performance</p> <p>B) Design and implement a High pass filter with a cut off frequency of 10 KHz(or any other frequency) and evaluate the performance</p>	<p>To Know the purpose of filters and Types</p> <p>Know the formulas for Filter Design</p> <p>Know the specifications of Filters</p> <p>To understand the filter design</p> <p>Evaluate the performance of constant k filters (observe the limitations)</p> <p>Observe and locate 3db points on the response curve</p>	<p>Know the formulas for Filter Design</p> <p>Designing Constant K filters for a given cut off frequency</p>
8.	Design and Realize 3 types of Attenuator circuits (L, T, and π types) and determine the actual attenuation	<p>Know the Function and types of Attenuators</p> <p>Know the formulas used for attenuator design (impedance matching criterion)</p> <p>Know the specifications of attenuator</p> <p>Using dB measurements/ calculations</p> <p>Implementing attenuator and evaluating performance</p>	Designing attenuator with required specifications and evaluation
9.	<p>To observe AM signal and determine Modulation index using CRO</p> <p>i) Using Envelop method b) Trapezoidal Pattern method</p>	<p>Observe diode demodulator circuit components</p> <p>Observe the input and output signals</p> <p>Compare modulating signal waveform with that of detected signal</p>	<p>To perform the Experiment as per procedure and calculate modulation index.</p> <p>b) Identify the diode detector circuit in an</p>

		Observe the effect of variation of C in the detector circuit. Identify the detector section in AM Radio.	AM radio receiver
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	Observing the FM signal on CRO Measuring the amplitude and frequencies of carrier and Modulating Signal Observing the Frequency Deviation Observing the effect of change in modulating signal on amplitude and frequency of FM signal Calculating the modulation index Observe FM Detector circuit and note down the IC numbers Observe the demodulated FM signal and compare with original modulating signal Observe the amplitude limiter section on FM detector	Perform the experiment as per procedure Identify FM signal, measure frequency deviation and calculate modulation index
11	a) Identify different sections in AM/FM radio receiver and observe the waveforms at various stages on CRO. b) Observe the different types of inductors used in the radio tuned circuits.(Local oscillator coils, IFT coils, Ferrite core	to familiarize with Radio Circuits Observe the Radio frequency Bands by observing the Dial. Identifying the tuned circuits corresponding to different bands Observing Band selection switch connections in AM receiver Identifying different sections in Radio receiver . Measuring the Voltages at important points with multimeter Observing the output signal on CRO.	Identifying different sections in Radio receiver and observing the signal at test points
12	To determine the frequency of a given folded dipole antenna . a) Assemble the given Yagi-Uda antenna	To identify the yagi uda antenna Know the materials used in antenna construction Identify various elements of	identifying Yagi antenna and its elements Assembling the antenna

		antenna Know the design formulas for element dimensions given the frequency Assembling the antenna Observing the directional properties of antenna.	Calculating the dimensions for a given frequency
13	Simulate experiments using PSpice 6,7,8	To reinforce the knowledge of filters and Pspice simulation	Using pspice for filter design
14	Simulate constant K Band pass and Band stop filters using pspice	To reinforce the knowledge of filters and Pspice simulation	Using pspice for filter design

DIGITAL ELECTRONICS LAB PRACTICE

Subject Title : **Digital Electronics Lab Practice & CAD Tools Lab . Practice**
Subject Code : **EC-309**
Periods/Week : **06**
Periods/Semester : **60 + 30**

Rationale: This is a core lab . student is expected to understand and demonstrate practical skills in handling , identifying 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
I.	Basic Gates	6
II.	Resonance and verification of Network theorems	6
III.	Measurements using CRO	6
IV.	Integrators and Differentiators	6
V.	Filters and Attenuators	6
VI	Modulation & Demodulation Techniques &Antennas	6
VII	Circuit simulation using Pspice	9
		45

LIST OF EXPERIMENTS

1. Identification of Digital Ics and noting down pin details from data sheets

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

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

- 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

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

- a) From the data sheets find out CMOS Equivalent of above ICs
- b) Implement a 4bit complement generator using 7486 quad XOR IC
- c) Realize a simple comparator using XOR Gate
- d) Realize a NOT gate using XOR gate

4. Realize a given Boolean function using TTL NAND gates

- a) 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

5. Implement Half adder and full adder circuits using TTL gates and verify the truth tables.

6 . To study the Features of 74138 Decoder IC

- a) Verify the function of 74138 decoder IC.
- b) Combine two 3 to 8 decoder to realize a 4 to 16 Decoder

7 . To study the Features of 74148 Encoder IC

- a) Verify the function of 74148 Encoder
- b) Combine two 74148 Encoder

8. To Verify the Functions of Multiplexer and De multiplexers (Using IC 74153&IC 74154)

- a) Understand the function of Multiplexer and demultiplexer
- b) Implement the given function using IC 74153 and 74154
- c) Combine two Multiplexers

9. To 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

10. To 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

11. To 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.
- e) Verify the function of octal latch 74LS373

12.To Construct and verify the function of decade counter using 7490 ICs.

- a) change the modulus of the counter
- b) display decimal number using 7447
- c) From data sheets Findout other Types of counter ICs available and their Pin configuration

13. To 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) Use the Preset inputs of CD4029 Counter

14. To Verify the function of shift register (ICs like 7495, 74194 etc.)

15. To Verify the function of Johnson counter using CD 4017 IC

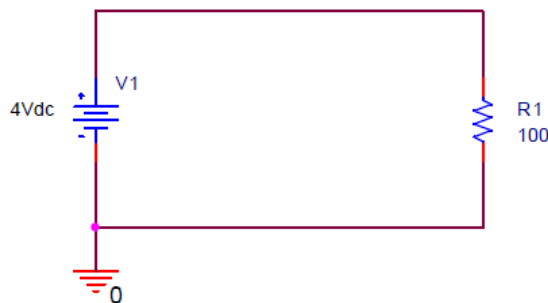
- a) Change the modulus of the counter
- b) Design a Frequency divider circuit using 4017 IC
- c) Implement running LED circuit with 4017 IC

16. To Identify Various Memory ICs and Note their pin Configuration from the datasheets

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

Part 2: CAD TOOLS LAB PRACTICE (30 Periods)

1. Familiarization of usage of ORCAD suite of tools for the design and layout of printed circuit boards (PCBs).
2. Enter the following schematic, simulate and obtain the current vs. voltage characteristics of a linear resistor using PSPICE.



3. Draft the following circuit , simulate and obtain forward and reverse bias characteristics of a diode using PSPICE
4. Using ORCAD PSPICE design, simulate and observe the output waveforms.
 - a. Half wave rectifier
 - b. RC circuit with square wave input.
 - c. RC Phase Shift Oscillator
5. Using ORCAD design, simulate and prepare the PCB layout of the following circuits.
 - a. Regulated power supply 0-30V, 1A using LM317 Regulator
 - b. 3 digit decade counter using 7490ICs

ELECTRICAL TECHNOLOGY LAB PRACTICE

Subject Title	:	Electrical technology Lab Practice Practice
Subject Code	:	EC-310
Periods/Week	:	03
Periods/Semester	:	45

Rationale: Electrical Technology lab is included to enable the student to supervise and handle electronically controlled electrical equipment with confidence when they join the industry. Sound knowledge in electrical engineering greatly helps the students in understanding the concepts in subjects like Industrial electronics. Emphasis is laid on basic electrical engineering skills.

List Of Experiments

1. Identifying Electrical Machines and Equipment, wires cables etc
2. Identifying Single phase Transformer b) Auto transformer c) single phase Induction motor d) 3 Phase induction motor e) DOL Starter f) Star Delta starter g) Loading Resistance h) Electric Lamp Load i) Water load
3. Identifying Electrical Instruments.
4. A) Moving coil Volt meters B) Moving coil Ammeters c) Moving Iron Voltmeters d) Moving Iron Ammeters e) Dynamo meter type watt meter .
5. To study the PMMC meters
 - a) To convert an ammeter into Voltmeter
 - b) To Extend the range of voltmeter using multiplier
 - c) To Measure current using voltmeter
 - d) To extend the range of ammeter using a shunt
 - e) To observe the Loading effect of volt meter on high impedance circuit
 - f) Open and identify the following parts a) Permanent magnet b) Coil c) Former d) Phosphor bronze springs e) Pointer , Multiplier / Shunt etc
6. Measure the power consumed by a 100 watts incandescent lamp using Voltmeter and ammeter method a) On AC 230V b) DC 220V
7. Apply a Low voltage to an Incandescent lamp using auto Transformer and observe the effect of voltage on Light output (Measure the Voltage and current)

8. Measure the power consumed by an Electric motor (Fan) and Lamp load separately using wattmeter, Voltmeter and Ammeter and Determine power factor
9. Connect a 2500 ohm 1A Rheostat in series with a 100 W Lamp and observe the effect of Variation of Resistance on the input current and Light output
10. Draw the OCC Characteristics of Shunt generator
11. Control the speed of a DC shunt motor using a) Armature control method b) Field control method
12. Plot the Load characteristics of DC shunt motor
13. Starting a DC Series motor Using a 2 point/4 point starter
14. To Determine the transformation ratio of a 1 phase transformer
 - a) Apply rated Voltage to the secondary terminals of transformer using auto transformer and measure the Voltage across primary winding
15. To Perform OC and SC tests on transformer to determine Efficiency and Regulation at any given

List of Experiments, Objectives and Key Competencies

1	Identifying Electrical Machines and Equipment, wires cables etc. a) Identifying a) Electrical Control Panel a) SCR Power Rectifier unit b) DC shunt Generator, c) DC Shunt Motor d) DC Series Motor e) 3 point starter f) 4 point starter e) DC Motor Generator Sets	a) Identifying the Control Panel and Correct Mains switch b) Identifying DC power Source c) Identifying DC machines by Their Size Shape and Name plate details d) Identifying the DC Motor Starters by their construction.	a) Should be able to switch on/Off the correct mains switch in the panel corresponding to the experiment location. b) Identify the correct Machine in the laboratory by Name c) Identify the appropriate starter for the DC motor
2	Identifying Single phase Transformer b) Auto transformer c) single phase Induction motor d) 3 Phase induction motor e) DOL Starter f) Star Delta starter g) Loading Resistance h) Electric Lamp Load i) Water load	a) Identifying the 1 phase transformer & Auto Transformer and noting down the name plate details b) Identifying AC motors and noting down name plate details c) Identifying AC motor starters d) Identifying Different electrical loads and	a) Should be able to Guess the transformer/Auto transformer capacity by size and weight .b) Interpret Name plate details and Estimate the fuse wire rating .b) Identify the suitable

		operating them e) Fuse Rating (1.25 times the Full load Current)	Electrical load from the name plate details
3	1. Identifying Electrical Instruments.	<p>a) Identifying MC and MI Voltmeters by observing the dial, Symbol, Polarity Marking</p> <p>b) Identifying MC and MI Ammeters by observing the dial, Symbol, Polarity Marking</p> <p>C) Identify Wattmeter</p>	<p>a) Identify different types of meters and know their usage</p> <p>b) Should be able to select Correct meter with correct Range.</p>
4	<p>To study the PMMC meters</p> <p>a) To convert an ammeter into Voltmeter</p> <p>b) To Extend the range of voltmeter using multiplier</p> <p>c) To Measure current using voltmeter</p> <p>d) To extend the range of ammeter using a shunt</p> <p>e) To observe the Loading effect of volt meter on high impedance circuit</p> <p>f) Open and identify the following parts a) Permanent magnet b) Coil c) Former d) Phosphor bronze springs e) Pointer, Multiplier / Shunt etc</p>	<p>a) To identify the PMMC meters and observe the linear scale.</p> <p>b) Measure meter Resistance</p> <p>c) noting down full scale deflection current.</p> <p>d) Calculation of Multiplier and shunt values e) observe the loading effect and understand the need for high input impedance. f) measuring current using voltmeter.</p>	<p>a) Identify PMMC meters</p> <p>b) Understanding the importance of high input impedance of voltmeter c) extend the range of meters.</p>
5	Measure the power consumed by a 100 watts incandescent lamp using Voltmeter and ammeter	a) Select Correct meters and Ranges (Both AC and DC) for measuring Voltage and	: a) connect Voltmeter and ammeter in the circuit

	method a) On AC 230V b) DC 220V	Current b) To know that Lamp load is Resistive c) Infer that for resistive loads power consumption is same for both AC and DC	b) Choose Correct meters and select correct Ranges c) Take the reading without parallax error d) Draw inference from the results.
6	Apply a Low voltage to an Incandescent lamp using auto Transformer and observe the effect of voltage on Light output (Measure the Voltage and current)	a) Understand the Purpose of Auto Transformer b) Adjust the Auto transformer to required Voltage c) Infer that Low voltage causes less brightness of the lamp	a) Use the Auto transformer and adjust to produce required Low/ High Voltage
7	. Measure the power consumed by an Electric motor (Fan) and Lamp load separately using wattmeter , Voltmeter and Ammeter and Determine power factor	a) Connect Wattmeter for power measurement b) choose correct ranges , Type for wattmeter , Voltmeter and Ammeter c) Calculate multiplying factor d) Calculate PF from the resultse) e) Infer that Power factor causes decrease in the output power .	a) Use the Wattmeter to measure the power b) infer that PF is unity for resistive loads and Power factor causes decrease in the output power .
8	Connect a 2500 ohm 1A Rheostat in series with a 100 W Lamp and observe the effect of Variation of Resistance on the input current and Light output	Familiarize with the construction and operation of Rheostat ,b) Setting rheostat to minimum and Maximum positions c) Using the rheostat as a variable Resistance d) understand the heating effect of Electric current e) infer that Resistance is proportional to length of the conductor by observation	a)Use the rheostat as variable Resistance b) Setting rheostat to minimum , Maximum and to desired values of Resistance
9	Connect the Rheostat as a potential divider and produce a variable voltage	Familiarize with the construction and operation of Rheostat ,b) Setting rheostat to minimum and Maximum positions c) Using the	a)Use the rheostat as variable Resistance b) Setting rheostat to minimum , Maximum

		<p>rheostat as a Potentiometer</p> <p>d) understand the heating effect of Electric current</p>	and to desired values of Resistance
10	Draw the OCC Characteristics of Shunt generator	<p>: a) Interpreting name plate details</p> <p>b) Identify the Terminals on shunt generator b) Measure the resistance of field winding and armature winding with multimeter and note the readings</p> <p>c) Identify the winding with i) high resistance and ii) Low resistance</p> <p>d) Set the Rheostat to minimum and maximum Resistance positions</p> <p>d) Identify the following parts</p> <p>1)Yoke 2)Pole shoes 3. Field winding 4)Armature 5) Commutator 6)Brushes 7) Coupling 8) Bearing</p> <p>9) 3 point starter 10)Knife switch</p> <p>e) Touch the pole shoes with a screw driver and observe residual magnetism.</p> <p>f) Make connections as per circuit diagram</p> <p>g) Perform the experiment as per procedure and plot the characteristics</p> <p>h) Interpret the results.</p>	Perform the experiment and interpret the results.

11	Control the speed of a DC shunt motor using a) Armature control method b) Field control method	<p>a) Interpreting name plate details</p> <p>a) Identify 3point starter</p> <p>b) Identify i) No Volt coil and ii) Overload relay</p> <p>d) Set the Rheostat to minimum and maximum Resistance positions</p> <p>c) Measure the resistance between 1st and last studs on 3point starter and note your observations</p> <p>d)Identify the terminals of DC shunt motor with test lamp</p> <p>f) Make connections as per circuit diagram</p> <p>g) Perform the experiment as per procedure</p> <p>h) Measuring the speed with tachometer</p> <p>h) Reverse the polarity and check whether motor direction reverses</p> <p>i) Interchange either armature or field connections and observe the direction of rotation</p> <p>j) Interchange both field and armature windings and observe the direction of rotation.</p> <p>k) Plot the required graphs and interpret.</p>	Perform the experiment and interpret the results.

12	Plot the Load characteristics of DC shunt motor	<p>: a) Observe how load on Motor can be varied with Brake arrangements.</p> <p>b) Choose appropriate wires (Gauge and Colours) and Correct meters.</p> <p>c) Adjusting the load in steps</p> <p>d) Measuring the speed with tachometer</p> <p>e) Making connections as per circuit diagram</p> <p>f) Perform the experiment as per the procedure.</p> <p>g) Plot the required graphs and interpret the results.</p> <p>h) Know the precautions</p>	Perform the experiment and interpret the results.
13	Starting a DC Series motor Using a 2 point/4 point starter	<p>a) Identifying 2/4 point starter</p> <p>f) Making connections as per circuit diagram</p> <p>g) Performing the experiment as per procedure</p> <p>h) Measuring the speed with tachometer</p> <p>h) Reverse the polarity and check whether motor direction reverses</p>	Perform the experiment and interpret the results.
14	To Determine the transformation ratio of a 1	<p>Familiarize with the construction and operation of Transformer</p> <p>b) Interpreting</p>	Identify the transformer windings

	<p>phase transformer</p> <p>b) Apply rated Voltage to the secondary terminals of transformer using auto transformer and measure the Voltage across primary winding</p>	<p>name plate details c) Identifying Primary and secondary windings i) by observation ii) by testing with DMM c) Making connections as per circuit diagram d) Measure AC current and voltages d) Performing experiment as per procedure e) Interpreting the results f) Determine transformation Ratio g) understand the step up and step down functions of transformer.</p>	<p>b) Interpret name plate details and know the transformer rating</p> <p>c) use transformer for Step down and Step up applications</p> <p>d) Infer that transformer provides Electrical isolation between Primary and Secondary.</p> <p>e) determine transformation Ratio</p>
15	<p>To Perform OC and SC tests on transformer to determine Efficiency and Regulation at any given load and Powerfactor</p>	<p>a) Interpreting name plate details</p> <p>b) Identifying Primary and secondary windings</p> <p>1. OC Test :</p> <p>a. Using Autotransformer to apply desired voltage</p> <p>b) Connecting Wattmeter ,choosing correct range and finding Multiplication factor</p> <p>c) Making connections as per circuit diagram</p> <p>d) Performing experiment as per procedure</p> <p>e) Interpreting the results and determining the iron loss</p> <p>SC test</p> <p>A) Short circuiting the secondary winding</p> <p>b) Connecting Wattmeter, choosing correct range and finding Multiplication factor</p>	<p>a) Perform experiment as per procedure</p> <p>b) Calculate</p> <p>i .% Regulation ,</p> <p>ii. % Efficiency</p> <p>iii. Copper losses</p> <p>iv. Iron :Losses</p> <p>v. Plot the graphs</p>

		<p>c) Making connections as per circuit diagram</p> <p>d. Applying low voltage using Autotransformer without exceeding the rated current</p> <p>e) Performing experiment as per procedure</p> <p>f) Interpreting the results and determining the copper loss</p> <p>g) Calculating % Regulation , total losses , Efficiency at any given load</p>	
16	To Run the AC 1 Ø_ Servo motor in forward and reverse directions using SPDT Switch	<p>a) Identifying AC servomotor</p> <p>b) To familiarize with the operation of AC servomotor</p> <p>b) Interpret name plate details</p> <p>c) Using SPDT switch for reversing the AC servomotor direction</p>	<p>a) Identifying AC servomotor</p> <p>b) Reversing the direction of rotation.</p>

LINEAR INTEGRATED CIRCUITS

Subject Title	:	LINEAR INTEGRATED CIRCUITS
Subject Code	:	EC- 402
Periods/Week	:	04
Periods/Semester	:	60

Rationale : Linear integrated circuits is a core subjects which gives a clear insight in to the Use of operational amplifiers and other integrated circuits in Industrial applications . Emphasis is laid on fundamental concepts and practical applications

TIME SCHEDULE

SI	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	IC Manufacturing	08	16	2	1
2	Operational Amplifier	10	16	2	1
3	Op-Amp Applications	16	16	1	2
4	Non Linear Wave Shaping Circuits, Timers and PLL	16	29	3	2
5	Instrumentation amplifiers, A/D & D/A Converters	10	26	2	2
		60	110	10	8

OBJECTIVE:

The student will be able to

6.0 Explain the IC Manufacturing methods

- 6.1 List the advantages and disadvantages of **Integrated Circuits** over discrete assembly.
- 6.2 Classify ICs based on manufacturing process (monolithic, thin film, thick film and hybrid).
- 6.3 Describe the manufacturing process of monolithic ICs.
- 6.4 Describe the fabrication of resistor, and capacitor on monolithic IC.
- 6.5 Describe the fabrication of diode and transistor on monolithic IC.
- 6.6 List different IC packages.
- 6.7 Explain various levels of integration (SSI, MSI, LSI, VLSI etc.,).
- 6.8 Give an idea of Surface Mount Technology (SMT) and know its advantages.

7.0 Understand the working Differential amplifiers and Operational amplifiers.

- 7.1 Draw and explain the differential amplifier.

- 7.2 State the function of an operational amplifier.
- 7.3 Define the operational amplifier characteristics like Input impedance, Open loop gain, Slew rate, CMRR, Input offset voltage, Input offset Current,
- 7.4 Draw the block diagram and pin out diagram of IC 741 and explain each block and pin Open loop gain, Slew rate, CMRR, Input offset voltage, Input offset Current,
- 7.5 List the specifications of ideal operational amplifier.

8.0 Understand Operational Amplifier applications

- 8.1 Explain how operational amplifier works as summer, integrator, differentiator, inverter and multiplier.
- 8.2 Draw and explain OP-Amp Wein-bridge Oscillator.
- 8.3 Define Sweep Voltage.
- 8.4 State the fundamental consideration of sweep waveform.
- 8.5 Distinguish between voltage and current time-base generation and list their applications.
- 8.6 Draw and explain Bootstrap sweep circuit.
- 8.7 Draw and explain Miller's sweep circuit using op Amp.
- 8.8 Classify Multi vibrators.
- 8.9 Draw and explain the working of OP-Amp Bistable multi vibrator with waveforms.
- 8.10 Draw and explain the working of OP-Amp Mononstable multivibrator with waveforms.
- 8.11 Draw and explain the working of OP-Amp Astable multi vibrator with waveforms.
- 8.12 List 6 applications of multivibrators
- 8.13 Draw and explain the working of OP-Amp Schmitt trigger circuit.
- 8.14 Understand the working principle of different OP-AMP circuits.
- 8.15 Use of opamp for implementing Active low pass and high pass filters of first order.
- 8.16 List the types of IC regulators and give the advantage of IC regulators
- 8.17 Explain the operation of fixed positive and negative voltage regulators.(using 7800 series and 7900 series)
- 8.18 Explain the operation of adjustable voltage regulator (LM317).

9.0 Understand Non Linear Wave Shaping Circuits, Timers and PLL

- 9.1 List the different types of clippers.
- 9.2 Explain the unbiased and biased clippers.
- 9.3 Explain the double ended clipper.
- 9.4 Explain the principle of clamper circuit.
- 9.5 List the applications of clippers and clampers
- 9.6 Draw the block diagram of 555 IC and explain.
- 9.7 Explain the working of astable multi using 555 IC.
- 9.8 Explain the working of Monostable Multivibrator using 555 IC.
- 9.9 State PLL
- 9.10 Draw and explain the block diagram of PLL – LM565.
- 9.11 Explain the operation VCO (LM566)
- 9.12 Define lock range of PLL
- 9.13 Define capture range of PLL.
- 9.14 List the applications of PLL.
- 9.15 Explain frequency multiplier and FM demodulator using PLL.

10.0 Understand Instrumentation amplifiers, A/D and D/A Converters.

- 10.1 Draw and explain the instrumentation amplifier using three Op-Amps
- 10.2 Advantages of instrumentation amplifier.
- 10.3 State the need for A/D and D/A converters.
- 10.4 Explain the terms resolution, Accuracy, Monotonicity and settling time of D/A converter.

- 10.5 Explain D/A conversion using binary weighted resistors.
- 10.6 Explain D/A conversion using R-2R ladder network.
- 10.7 Explain A/D conversion using counter method.
- 10.8 Explain A/D conversion using successive approximate method
- 10.9 State the need for A/D and D/A converters.
- 10.10 Explain the terms resolution, Accuracy, Monotonicity and settling time of D/A converter.
- 10.11 Explain D/A conversion using binary weighted resistors.
- 10.12 Explain D/A conversion using R-2R ladder network.
- 10.13 Explain A/D conversion using counter method.
- 10.14 Explain A/D conversion using successive approximate method

COURSE CONTENTS:

1. **IC Manufacturing** Classifications of ICs based on manufacturing process, IC packages , IC Regulators Transistor series and shunt regulators.
2. **Operational amplifiers** Differential amplifiers and Operational amplifiers. Parameters definitions.
3. **Operational Amplifier applications** –OP-Amp as summer, integrator, differentiator, inverter and multiplier.,OP-Amp as Sinr Wave and Square Wave generator(Wein Bridge Oscillators and Schmitt Trigger circuit).
- 4 **Non Linear Wave Shaping Circuits** Like Clippers and Clamper Circuits,555 Timer block diagram, 555 Timer as Astable and Monostable Multivibrator , voltage Control Oscillators and PLL.
- 5 **Instrumentation amplifiers** (three op-Amps type), A/D and D/A Converters, define the terms the terms resolution, Accuracy, Monotonicity and settling time of D/A converter. DAC and ADC using op-Amps.

REFERENCE BOOKS

1. Electronic Devices and Circuits by Bogart, TMH
2. Integrated Electronics by Milliman and Hallkias, TMH
3. Linear Integrated Circuits by Gaykwad,
4. Linear Integrated Circuits by Roy Chowdary
5. Linear Integrated Circuits by Clayton.

NETWORK ANALYSIS

Subject Title : NETWORK ANALYSIS
Subject Code : EC- 403
Periods/Week : 04

Periods/Semester : 60

Rationale ; Network analysis is a core subjects 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

SI	Major topics	No. of periods	Weight age of marks	Short Answer Questions	Essay Questions
1	Mesh current and Node voltage analysis	20		2	1
2	Network theorems	10		2	2
3	Transient analysis	08			1
4	Application of Laplace transforms	06		2	2
5	Two port networks	10		2	2
6	Filters and Attenuators	06			
	Total	60		10	8

OBJECTIVES

On completion of the study of the subject a student shall be able to:

- 1.0 Understand the Mesh current analysis and Node voltage analysis**
- 1.1 Define active and passive elements.
- 1.2 Explain resistance, capacitance and inductance parameters.
- 1.3 Define energy source and classify the energy sources.
- 1.4 Define junction, branch and loop in circuits.
- 1.5 State limitations of Ohm's law.
- 1.6 State Kirchhoff's current law and Kirchhoff's voltage law.

- 1.7 Solve problems on KCL, KVL, star to delta and delta to star transformations .
- 1.8 Define tree, co-tree, twigs and links.
- 1.9 Obtain the tie set tie-set matrix and cut set matrix for a given network graph.
- 1.10 Identify the mesh currents.
- 1.11 Determine the number of mesh equations required to solve the given Network
- 1.12 Write the mesh current equations for a given network and arrange them in matrix form.
- 1.13 Solve for mesh currents using Cramer's rule.
- 1.14 Apply super mesh technique to find the mesh current for the circuits having current sources.
- 1.15 Identify the nodes in a network.
- 1.16 Determine the number of node voltage equations.
- 1.17 Write the node voltage equation for a given network and arrange them in matrix form.
- 1.18 Solve node voltages using Cramer's rule.
- 1.19 Apply super node technique to find the node voltage for the circuits having voltage sources.
- 1.20 Draw the dual network for a given network.
- 1.21 Transform a voltage source to a current source and vice versa.

2.0 Understand the network theorems

- 2.1 Explain ideal voltage source and ideal current source
- 2.2 Convert ideal voltage source to ideal current source and vice versa.
- 2.3 State and use Thevenin's, Norton's, superposition, Reciprocity, and Maximum power transfer theorems.
- 2.4 Apply the above theorems to solve networks.
- 2.5 Bring out the advantages and limitations of above theorems.

3.0 Understand the transient analysis.

- 3.1 Define the terms initial conditions, steady state and transient.
- 3.2 Explain the dc response for an RL circuit.
- 3.3 Derive expression for current for an RL circuit.
- 3.4 Explain the dc response for an RC circuit.
- 3.5 Derive expression for current for an RC circuit.
- 3.6 Explain the dc response for an RLC circuit.
- 3.7 Solve the simple problems on series RL, RC circuits of DC excitation.

4.0 Understand the application of Laplace transforms in circuit analysis

- 4.1 Express Resistor in S-domain.
- 4.2 Express capacitor in S-domain.
- 4.3 Express inductor in S-domain.
- 4.4 Find the natural response of an RC circuit through Laplace transform technique.
- 4.5 Find the step response for a parallel RLC circuit through Laplace transform technique.
- 4.6 Define the transfer function.
- 4.7 Explain the concept of complex frequency

5.0 Understand the Two port networks

- 5.1 Define port.
- 5.2 Explain the open circuit impedance (Z) parameters with equivalent circuit.
- 5.3 Explain the short circuit admittance (Y) parameters with equivalent circuit.
- 5.4 Explain the hybrid (h) parameters with equivalent circuit.
- 5.5 Explain the Transmission (ABCD) parameters.

- 5.6 Give the conditions for symmetry, reciprocity in terms of Z, Y, h, ABCD parameters.
- 5.7 Find the Z- parameters for a given T- network and Y parameters for a π -network

6.0 Understand the filters and attenuators

- 6.1 Define neper, decibel, characteristic impedance, propagation constant, Attenuation
- 6.2 Define filter, LPF, HPF, BPF, BEF.
- 6.3 Derive the expression for characteristic impedance for T and π network.
- 6.4 Give the expression for f_c for constant k-LPF, HPF.
- 6.5 Design a simple LPF and HPF for a given cutoff frequency and resistance
- 6.6 Explain the need of m-derived filter.
- 6.7 Explain the m-derived T-section.
- 6.8 Give the expression for f_c for m-derived low pass filter and m-derived high pass filter
- 6.9 Design a T-type attenuator for the given attenuation and characteristic impedance.
- 6.10 Design a π -type attenuator for the given attenuation and characteristic impedance.

REFERENCE BOOKS

- 1. Circuit analysis by Hayt & Kemerly.
- 2. Network analysis by Van Valkenberg.
- 3. Circuits and Networks Sudhakar & Shyam Mohan TMH
- 4. Network Theory-Administer-Schaum Series

DIGITAL COMMUNICATIONS

Subject Title : **Digital Communications**
Subject Code : EC-404
Periods/Week : 04
Periods/Semester : **60**

Rationale ; Digital communication is a core subject which gives a clear insight in to the concepts of digital telephony . Emphasis is laid on fundamental concepts and practical applications . sound knowledge in this course is helpful for those who join telecommunication sector.

TIME SCHEDULE

SI	Major Topics	Periods	Weightage of Marks	Short Answer Questions	Essay Type Questions
1	Digital Communication	14	26	2	2
2	Error Detection and Correction	12	16	2	1
3	Digital Modulation techniques	12	26	2	2
4	Multiplexing techniques	12	26	2	2
5	Telephone system	10	16	2	1
	Total	60	110	10	8

OBJECTIVES

On completion of the study of the subject the student shall be able to

1.0 Understand the principles of Digital Communication

- 1.1 Explain analog and digital signals.
- 1.2 Compare analog and digital communication techniques.
- 1.3 Define information capacity of a channel.
- 1.4 State sampling theorem and explain its significance.
- 1.5 Classify pulse modulation techniques.
- 1.6 Define PAM,PWM and PPM
- 1.7 State the advantages and disadvantages of PAM

- 1.8 Explain the generation and demodulation of PAM with block diagram.
- 1.9 List the advantages and disadvantages of PAM.
- 1.10 Describe PWM and PPM with waveforms.
- 1.11 List three advantages and disadvantages of PWM
- 1.12 List three advantages and disadvantages of PPM
- 1.13 Compare PAM, PWM and PPM.
- 1.14 Define quantization, bit rate, and dynamic range for PCM systems.
- 1.15 Describe the coding and decoding of a PCM signal.
- 1.16 Explain delta modulation with block diagram.
- 1.17 Explain the advantages of delta modulation over PCM.
- 1.18 Describe adaptive delta modulation with block diagram and waveform
- 1.19 Compare PCM, DM and ADM
- 1.20 Describe the operation of vocoders.
- 1.21 Describe different data compression techniques.

2.0 Understand the principles of Digital Data Transmission

- 2.1 Explain analog and digital signals.
- 2.2 Compare analog and digital communication techniques.
- 2.3 List four digital signal encoding formats
- 2.4 Explain NRZ line coding techniques.
- 2.5 Explain RZ line coding techniques
- 2.6 Understand the various error detection and correction techniques.
- 2.7 Define the term bit overhead. Define overhead efficiency.
- 2.8 Describe the conversion between parallel and serial data.
- 2.9 Describe the process of synchronous transmission.
- 2.10 List different types of errors during data transmission.
- 2.11 Mention different error detection techniques.
- 2.12 Explain parity check method of error detection.
- 2.13 Explain VRC method of error detection with an example.
- 2.14 Explain LRC method of error detection with an example.
- 2.15 Explain Checksum method of error detection.
- 2.16 Explain CRC method of error detection with an example.
- 2.17 State the advantages of CRC method of error detection.
- 2.18 List different error correction techniques.
- 2.19 Explain retransmission method of error correction.
- 2.20 Explain symbol substitution method of error correction.
- 2.21 Explain importance of hamming code in error detection and correction.

3.0 Understand various Digital Modulation Techniques.

- 3.1 State the need for digital modulation
- 3.2 Explain the difference between bit rate and baud rate
- 3.3 List the three basic types of digital modulation techniques.
- 3.4 Define ASK, FSK and PSK
- 3.5 Explain ASK modulator with block diagram.
- 3.6 Explain ASK coherent demodulator with block diagram
- 3.7 List four advantages of ASK
- 3.8 List two disadvantages of ASK
- 3.9 Explain BFSK modulator with block diagram.
- 3.10 Explain Coherent BFSK demodulator.
- 3.11 Draw and explain FSK demodulator using PLL.
- 3.12 List two advantages and disadvantages of FSK

- 3.13 Draw and explain BPSK modulator.
- 3.14 Draw and explain BPSK demodulator.
- 3.15 List four advantages of BPSK
- 3.16 State the importance of Constellation diagram.
- 3.17 Explain QPSK and 8 PSK with constellation diagrams briefly
- 3.18 Compare ASK, FSK and PSK.
- 3.19 Explain Quadrature Amplitude Modulation (QAM).
- 3.20 State typical application areas of different digital modulation techniques.

4.0 Understand the principles of Multiplexing techniques.

- 4.1 State the need for multiplexing
- 4.2 Explain Frequency Division Multiplexing
- 4.3 Explain Time Division Multiplexing.
- 4.4 List four advantages of TDM
- 4.5 List three disadvantages of TDM
- 4.6 Compare TDM and FDM
- 4.7 State the need for a modem in data communication.
- 4.8 Describe the operation of telephone modem.
- 4.9 Explain the difference between fax and data modem.
- 4.10 Explain cable modems.
- 4.11 Explain Digital Subscriber Line (DSL).
- 4.12 Explain Asynchronous Digital Subscriber Line (ADSL) technology
- 4.13 Describe ISDN
- 4.14 State the advantages of ISDN.

5.0 Know Telephone System.

- 5.1 Classify different switched telephone systems.
- 5.2 Describe the topology of the switched telephone network.
- 5.3 Mention the advantages of electronic telephony over manual telephony.
- 5.4 Define local loop in telephone system.
- 5.5 Mention various signals present on a local-loop telephone line.
- 5.6 State the functions of various signals present on a local-loop telephone line.
- 5.7 List the types of dialling.
- 5.8 Explain pulse dialling and DTMF.
- 5.9 State the advantages of DTMF.
- 5.10 Compare in-band and out-of-band signalling systems for telephony.
- 5.11 Explain briefly the use of Signal system Seven(SS7).
- 5.12 Explain the use of FDM in telephony
- 5.13 Explain the use of TDM in telephony.
- 5.14 State the need for EPABX
- 5.15 List important functions of EPABX
- 5.16 Explain the use of FAX machine.
- 5.17 Explain Internet telephony.
- 5.18 Explain IP telephony (VOIP).

COURSE CONTENTS

1. Digital Communication and Digital Modulation.

Introduction to digital communication, Sampling theorem, pulse modulation, pulse code modulation, delta modulation, vocoders and data compression techniques.

2. Data Transmission

Data coding, asynchronous transmission, synchronous Transmission, error detection and correction: Parity check, VRC, LRC, Checksum, CRC, hamming code, symbol substitution method.

3.Digital Modulation Techniques

Digital modulation, Amplitude shift keying(ASK), frequency shift keying (FSK), phase shift keying (PSK), QPSK,8PSK, Constellation diagrams, quadrature amplitude modulation (QAM).

4. Multiplexing techniques.

Multiplexing techniques: FDM and TDM, Telephone modem, fax modem and data modem, cable modem, digital subscriber lines, ADSL,ISDN

5. Telephone System.

Public switched telephone network(PSTN), manual and electronic Telephony , the local loop, signals on local loop, in band and out band signaling, SS-7system,FDM and TDM in telephony, EPABX, FAX, Internet telephony.

REFERENCES BOOKS

1. Electronic communications systems by Roy Blake, Thomson Delmar
2. Analog & Digital Communication by T L Singal, Tata McGraw Hill.
3. Electronic Communication System by George Kennedy.
4. Electronic Communication Systems A Complete Course –4th Edi by Schweber PHI
5. Communication systems:Analog and Digital by RP Singh, SD Spare, Tata McGraw Hill.
6. Digital communication Theory, Techniques & applications, by R.N Mutagi, Oxford university press
7. Communication systems by V.Chamdrasekhar, Oxford university press.
8. Data Communications and networking by VBehrouz A Forouzan, TMH

MICROPROCESSOR & MICROCONTROLLER PROGRAMMING

Subject Title	:	Microprocessor & Microcontroller Programming
Subject Code	:	EC-405
Periods/Week	:	04
Periods/Semester	:	60

Rationale ; Microprocessors & Microcontroller programming is a core subjects which gives a clear insight in to the Use of Microcontrollers and other integrated circuits in Industrial applications . Emphasis is laid on fundamental concepts and practical applications to enable the student Industry ready .

TIME SCHEDULE

Sl.	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Introduction to 8085 architecture, timing diagrams	16	21	2	1 ½
2	Architecture of 8051	14	18	1	1 ½
3	Instruction set	12	29	3	2
4	Programming of 8051	12	26	2	2
5	Applications using 8051	06	16	2	1
	Total	60	110	10	8

OBJECTIVES

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

1.0 Comprehend the architecture of Microprocessor 8085

- 1.1 Draw the block diagram of a microprocessor and explain the function of each block.
- 1.2 Know the features of micro processors
- 1.3 Give the functional block diagram of 8085
- 1.4 Working of Address and Data Bus/multiplexing
- 1.5 Know the register structure of 8085.
- 1.6 Explain the function of various registers.
- 1.7 Draw the pin out diagram of 8085
- 1.8 Explain the terms operation code, operand and illustrate these terms by writing an instruction. Understand the hex code for the same
- 1.9 Understand fetch cycle, execution cycle and instruction cycle
- 1.10 Understand execution of STA, LDA, IN, OUT instructions.

- 1.11 Draw the timing diagrams of the above instructions, and understand thoroughly in terms of clock cycles

2.0 Comprehend the architecture of Microcontroller 8051

- 2.1 Draw the block diagram of a microcomputer and explain the function of each block.
- 2.2 List the features of micro controllers.
- 2.3 Give the functional block diagram of 8051 microcontroller
- 2.4 Draw the register structure of 8051 and explain briefly
- 2.5 Explain the function of various special function registers.
- 2.6 Give the pin diagram of 8051 micro controller and specify the purpose of each pin.
- 2.7 Describe internal memory, external memory and ports of 8051.
- 2.8 Explain counters & timers in 8051
- 2.9 Explain serial input/output of 8051
- 2.10 Explain interrupts in 8051
- 2.11 Describe modes of operation.

3.0 Know the instruction set of 8051 micro controller

- 3.1 State the need for an instruction set.
- 3.2 Give the instruction format of 8051.
- 3.3 Explain fetch cycle, execution cycle and instruction cycle.
- 3.4 Distinguish between machine cycle and T-state.
- 3.5 Know the timing diagram for memory write, memory read operations of 8051.
- 3.6 Define the terms machine language, assembly language, and mnemonics.
- 3.7 Give the difference between machine level and assembly level programming.
- 3.8 List the major groups in the instruction set along with examples.
- 3.9 Explain the terms operation code, operand and illustrate these terms by writing an instruction.
- 3.10 Explain the data manipulation functions, data transfer, arithmetic, logic and branching with examples
- 3.11 Classify the 8051 instructions into one byte, two byte and three byte instructions.
- 3.12 List the various addressing modes of 8051 and Explain with examples.
- 3.13 Explain data transfer instructions of 8051.
- 3.14 Explain the arithmetic instructions and recognise the flags that are set or reset for given data conditions.
- 3.15 Explain the logic instructions and recognize the flags that are set or reset for given data conditions.
- 3.16 Illustrate the logic operations and explain their use in making, setting and resetting of individual bits.
- 3.17 Explain unconditional and conditional jump and how flags are used to change the sequence of program.

4.0 Programming Concepts

- 4.1 List the various symbols used in drawing flow charts.
- 4.2 Draw flow charts for some simple problems.
- 4.3 Write programs in mnemonics to illustrate the application of data copy instructions and translate these mnemonics into hex codes.
- 4.4 Write programs of instructions to perform single byte, double byte and multi byte addition and subtraction.
- 4.5 Illustrate the application of jump instruction in the program.
- 4.6 Write a program using counter techniques.
- 4.7 Define a subroutine and explain its use.

- 4.8 Explain the sequence of program when subroutine is called and executed.
- 4.9 Explain how information is exchanged between the program counter and the stack and identify the stack pointer register when a subroutine is called.
- 4.10 List and explain unconditional and conditional call and return instructions.
- 4.11 Use PUSH, POP instructions in programs.
- 4.12 Illustrate the concept of nesting, multiple ending and common ending in subroutines.
- 4.13 Use input/output, machine related statements in writing assembly language programs.
- 4.14 Explain the term debugging a program.
- 4.15 List the important steps in writing and trouble shooting a simple program.
- 4.16 Explain the principles of single step and break point debugging techniques.
- 4.17 Write instructions to set up time delay.

5.0 Programming for Applications using 8051

- 5.1 Describe the Interfacing of push button switches and LEDs.
- 5.2 Describe the Seven segment display interface
- 5.3 List reasons for the popularity of LCDs
- 5.4 Describe the functions of pins of LCD
- 5.5 List instruction command code for programming a LCD
- 5.6 Interface LCD to 8051
- 5.7 Program LCD in assembly language
- 5.8 Explain the basic operations of keyboard
- 5.9 Explain key press and detection mechanisms
- 5.10 Interface a 4 X 4 Matrix Key Board.
- 5.11 Explain RS232 standards
- 5.12 List RS232 pin , DB 25 and DB 9 connectors
- 5.13 MAX 232 and 233 and interfacing

COURSE CONTENT

1. ARCHITECTURE OF 8085

Block diagram of microcomputer, Block diagram of 8085, Pin out diagram of 8085, registers, timers, interrupts, modes of operation-address and data bus multiplexing-. Instructions- instruction cycle-timing diagrams

2. ARCHITECTURE OF 8051:

Block diagram of microcomputer, Block diagram of 8051, Pin out diagram of 8051, registers, timers, interrupts, fetch cycle, execution cycle, machine cycle

3. INSTRUCTION SET OF 8051:

Instruction set of 8051, instruction format, fetch cycle, execution cycle, instruction cycle, machine cycle, timing diagrams, machine language, assembly language, classification of instructions, addressing modes- Groups of instructions, opcode, operand

4. PROGRAMMING CONCEPTS:

Flow charts, Data transfer, single and multi byte addition and subtraction, subroutines, nesting, multiple ending and common ending, use of Input output and machine related statements, debugging, time delay program.

5. APPLICATIONS PROGRAMMING:

Interfacing of various hardware circuits for applications-push button switches - LEDs-Seven segment display-Matrix Key Board- ADC chip - DAC chip- DC motor- Stepper motor

REFERENCE BOOKS:

1. 8085-Micro Processors by Ramesh S Gaonkar
2. 8051 Micro controller by Mazidi and Mazidi.
3. 8051 Micro controller by Kenneth J. Ayala.
4. Programming customizing the 8051 Microcontroller by Myke Predko, TMH
5. Microprocessors and interfacing by Douglas Hall.
6. Intel Microprocessors by Barry Brey, Prentice-Hall.
7. Introduction to microprocessors for engineers and scientists by Ghosh & Sridhar, Prentice-Hall.
8. Microprocessors and Microcontrollers by N.Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford press.

PROGRAMMING IN 'C'

Subject Title : **PROGRAMMING IN C**
Subject Code : **EC- 406**
Periods / Week : **04**
Periods / Sem. : **60**

Rationale ; Programming in C is introduced as the programming skills have become very common even at school level. The knowledge of C programming is essential for courses in microcontrollers. Emphasis is laid on fundamental concepts and practical applications. Further Programming knowledge is a must in the industry.

TIME SCHEDULE

OBJECTIVES
 On completion of the study of this subject a student shall be able to

Sl.	Major Topics	Periods	Weightage of marks	Short Type	Essay Type
1	C Programming Basics	10	16	2	1
2	Decision & Loop Control Statements	10	26	2	2
3	Arrays & Strings	10	26	2	2
4	Functions and Pointers in C	18	26	2	2
5	Structures, Unions & Preprocessor Directives	12	16	2	1
	Total	60	110	10	08

1.0 Understand C Programming Basics.

- 1.1 Explain Binary, Octal, Hexadecimal number systems and compare Decimal system
- 1.2 Convert a given decimal number into Binary, Octal, and Hexadecimal. numbers and vice versa.
- 1.3 Know the character set of C language working of transistor as an amplifier (CB configuration)
- 1.4 Know the data types in C
- 1.5 List the five Arithmetic Operators
- 1.6 Define an expression and show how to evaluate.
- 1.7 know the assignment statement.
- 1.8 Explain the increment and decrement operators.
- 1.9 Identify compound Assignment Operators.
- 1.10 Explain the Nested assignments.
- 1.11 Explain printf () and scanf () functions
- 1.12 Know various type conversion techniques and discuss them.
- 1.13 List the four relational operators.
- 1.14 List the three logical operators supported by 'C'
- 1.15 Give the operator precedence.
- 1.16 Evaluate a logical expression.
- 1.17 Explain bitwise logical operators.

2.0 Understand Decision & Loop Control Statements

- 2.1 State the importance of conditional expression.
- 2.2 Explain the concept of DC and AC load line.
- 2.3 List the four conditional statements supported by C
- 2.4 Explain If, If-else and If-else-If statements.
- 2.5 Explain Switch Case statement.
- 2.6 Write simple programs based on conditional statements.
- 2.7 List the three types of iterative statements supported by C.
- 2.8 Explain while loop, Do-While and For loops.
- 2.9 Know nested loops and write simple programs based on nested loops
- 2.10 Differentiate break and continue statements.
- 2.11 Know null statement and comma operator.

3.0 Understand Arrays & Strings

- 3.1 Define one dimensional and two dimensional arrays.
- 3.2 Know the initialization of the above arrays & Access Array elements.
- 3.3 Pass array elements as arguments and arrays as arguments.
- 3.4 Define string
- 3.5 List three functions used for reading strings
- 3.6 List three functions used for writing strings.
- 3.7 Write the operation of getchar(), getch(), getche() and putchar() functions.
- 3.8 Write the operations of string manipulation functions strcat(), strchr(), strcmp(), strcpy(), and strlen()
- 3.9 Write simple programs based on string manipulation functions.

4.0 Understand Functions & Pointers

- 4.1 Define a function.
- 4.2 State the use of return statement.
- 4.3 Explain passing parameters to the function
- 4.4 Write programs using function call technique.
- 4.5 List the four storage classes supported by C.
- 4.6 Differentiate local and external variables.
- 4.7 Identify automatic and static variables and discuss them in detail
- 4.8 State the application of external declaration.
- 4.9 Define Recursion and Explain with examples.
- 4.10 Declare a pointer, assign a pointer, and initialize a pointer.
- 4.11 Discuss pointer arithmetic.
- 4.12 Differentiate address and de referencing operators.
- 4.13 Illustrate with example how pointer can be used to realize the effect of parameter passing by reference.
- 4.14 Illustrate with examples the relationship between arrays and pointers.
- 4.15 Discuss pointer arrays with example.
- 4.16 Describe concept of pointers to functions.

5.0 Understand Structures, Unions and preprocessor directives

- 5.1 Define a structure
- 5.2 Describe structure variable.
- 5.3 Explain initialization of structures.
- 5.4 Know the accessing of members of a structure.
- 5.5 Illustrate concept of structure assignment

- 5.6 Explain how to find size of a structure.
- 5.7 Discuss nested structure concept.
- 5.8 know passing of individual members of a structure to a function
- 5.9 Know passing entire structure as function argument.
- 5.10 Illustrate the concept of structures containing pointers.
- 5.11 Define a Union and Illustrate use of a union.
- 5.12 List six unconditional preprocessor directives.
- 5.13 List six conditional preprocessor directives.
- 5.14 Explain the preprocessing directives: define, include, ifdef, ifndef.

COURSE CONTENT

1. C-Programming Basics

Structure of a C programme, Programming rules, Character Set, Delimiters Keywords, Constants, Variables, Data types, Type conversion. Arithmetic, Logical, Relational operators and precedences – Assignment, Increment, Decrement operators, evaluation of expressions. Console IO formatted and unformatted functions.

2. Decision and Loop control Statements

If, If-else, Nested If else, Break, Continue, Goto and Switch statements Loops:- For, While, Do-while, Nesting of Loops.

3. Arrays and Strings

1 D Array declaration, Initialization, 2 D Array declaration, Initialization, Accessing of Array elements, Character Arrays declaration and Initialization of Strings, Display of strings with format.

4. Functions and pointers in C

Function-Definition, Declaration, Return statement, passing parameters to function- Function calls, Nesting of functions and Recursion Storage classes of variables, Scope and visibility. Pointer declaration, Arithmetic operations and pointers, Pointers and Arrays

5. Structures, Unions and preprocessor directives

Structure features, Declaration and Initialization, Structure within a structure, Array of structure, Accessing of Structure members, Structures and functions, Unions. Preprocessor directives.

REFERENCE BOOKS

- 1. Programming in ANSI C, Balaguru Swamy.E , 3rd Edition, TMH
- 2. Programming In C by Samarjit Ghosh-PHI
- 3. Programming with ANSI and Turbo C by Kamthane, Pearson Education
- 4. Programming in C by Gottfried (Schaum Series)
- 5. Programming in C by Reema Thareja, Oxford university press.
- 6. Let us C, by Yashwant Kanetkar, BPB Publication, New Delhi

LINEAR INTEGRATED CIRCUITS LABORATORY PRACTICE

Subject Title : LINEAR INTEGRATED CIRCUITS LAB PRACTICE
Subject Code : EC-407
Periods/Week : 06
Periods/Semester : 90

Rationale: Linear integrated circuits lab is introduced to reinforce the theoretical knowledge by experimental verification. Experiments on opamps are designed in such a way they also give insight into design concepts.

TIME SCHEDULE

S. No.	Major Topics	No. of Periods
I.	Clippers and Clamper Circuits	12
II.	Operational Amplifier Circuits	12
III.	Opamp Oscillators & 555 Timer IC	12
IV.	Phase locked loops	12
V.	Op Amp applications	12
VI	Circuit simulation using Pspice or equivalent	30

List of Experiments

1 To 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 two diodes back to back and apply an AC signal from function generator and observe the waveform on CRO. Draw the inference.
- D) Connect a Zener diode in place of diode and measure the output voltage with DMM and also observe waveform on CRO

2. Familiarize with Operational amplifier 741 and Quad opamp LM 324 and comparator LM 339 Ics

3. Determine the CMRR and Slew Rate of the OP-AMP.

4) Applications of Operation amplifier as

- a) inverting amplifier
- b) Non Inverting amplifier
- c) summer

- d) Difference amplifier
- e) Voltage follower (Buffer),

5. Wave shaping Applications of Opamp.

- a) differentiator and integrator.
- b) comparator
- c) Schmitt trigger
- d) Interfacing op amp with TTL gates with input amplitude limiting circuit

6. To implement Current to Voltage and Voltage to current converters using Op amps

- a) Implement Current to Voltage converter and use it to detect photodiode reverse current.
- b) Implement a Voltage to current converter that produces a proportionate current in the range of 4mA to 20mA corresponding to input voltages from 0 to 5V

7) To assemble Audio Power Amplifiers using LM 380 IC

8.) OPamp Oscillator Circuits

- a) RC-phase shift oscillator
- b) Wein bridge oscillator

9) Op-Amp Relaxation Oscillators

- a) Implement Monostable multivibrator
- b) Implement Astable multivibrator

10) Working with 555 IC.

- a) Implement Monostable multi vibrator
- b) Implement Astable multivibrator

11 . Working with Phase Locked loops

- A) Implement 565 Phase locked loop circuit
- b) Frequency demodulation using 565

12) Use 566 as a square and Triangular wave generator

- a) use 566 for VCO and waveform generator applications
- b) use 566 for producing Frequency modulation

13. Working with Tone Decoder IC 567 IC

(Refer to the application notes and implement following circuits)

- a) 10 KHz signal detector b) Double frequency output c) Quadrature output Oscillator

14. D/A conversion using R-2R ladder network/Binary Weighted type.

A) Implement D/A converter using Opamp and R-2R ladder and Binary weighted network and test

- a) Implement Precision Rectifier using Opamp

15. To implement active filters and evaluate the performance

- a) To implement active low pass filter
- b). To implement Active High pass filter

16, Pspice simulation

- a) Simulate the experiments 4,5,6,8,9,10, 15 using Pspice

17. Industrial Visit

3hrs

List of Experiments , Objectives & Competencies

Exp No	Name of the Experiment	Objectives	Key Competencies
1	1 To 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 two diodes back to back and apply an AC signal from function generator and observe the waveform on CRO. Draw the inference. D) Connect a Zener diode in place of diode and measure the output voltage with DMM and also observe waveform on CRO	Appreciate the wave shaping applications of Diodes b) Familiarize with wave shaping circuits c) Use of Zener diode for amplitude limiting d) Analyze the behavior of clamper circuits	Assembling the circuit and testing with proper bias. Observing the waveforms and drawing inference Use the clipper and clamper circuits in the projects
2	2. familiarize with Operational amplifier 741 and Quad opamp LM 324 and comparator LM 339 Ics	a) Identify the package b) Note down the Pin configurations c)	Identify the Opamp Type from the IC number. Choose the suitable IC

		<p>Understand the Power supply requirements of OpAmp .</p> <p>d) Produce Positive and Negative Voltages and Ground from the dual power supply .e)</p> <p>Interpret specifications from Data sheets.</p>	<p>to meet the circuit requirements. From data sheets.</p> <p>Use Laboratory power supply to power Opamp circuit.</p>
3	Determine the CMRR and Slew Rate of the OP-AMP.	<p>a) Assemble the Circuit .</p> <p>b) Performing the experiment as per procedure</p> <p>c) Comparing the results with data sheet specifications</p>	Choose the suitable opamp for high speed applications
4	<p>4) Applications of Operation amplifier as</p> <p>a) inverting amplifier</p> <p>b) Non Inverting amplifier</p> <p>c) summer</p> <p>d) Difference amplifier</p> <p>e) Voltage follower (Buffer),</p>	<p>a)Performing the experiment as per procedure</p> <p>.b) Observing wave forms on CRO.</p> <p>C). Observing the effect of circuit Time constant</p>	<p>Draw Inference from the Observed waveforms</p> <p>b) use the Opamp for general and wave shaping applications.</p>
5	<p>Wave shaping Applications of Opamp.</p> <p>a) differentiator and</p>	<p>a) Performing the experiment as per procedure</p>	<p>Draw Inference from the Observed waveforms</p> <p>b) use the Opamp for</p>

	integrator. b) comparator c) Schmitt trigger d) Interfacing op amp with TTL gates with input amplitude limiting circuit	.b) Observing wave forms on CRO. c) Observing the effect of circuit Time constant	general and wave shaping applications.
6	To implement Current to Voltage and Voltage to current converters using Op amps a) Implement Current to Voltage converter and use it to detect photodiode reverse current. b) Implement a Voltage to current converter that produces a proportionate current in the range of 4mA to 20mA corresponding to input voltages from 0 to 5V	To know the use of Opamp for converting current to voltage and Voltage to current To give the concept of current telemetry and the use of Op amp in Instrumentation	Perform the experiment as per procedure and verify
7	7) To assemble Audio Power Amplifiers using LM 380 IC	a). Constructing the circuit . b) Testing the audio amplifier by connecting it to the speaker and Microphone . c) Calculate Amplifier Gain at 1	Assembling the circuit b) Connecting Microphone and speakers c) Testing the Circuit .
8	.) OPamp Oscillator Circuits a) RC-phase shift oscillator b) Wein bridge oscillator	a) Performing the experiment as per procedure b) Observing wave forms on CRO. c) Observing the effect of	Draw Inference from the Observed waveforms b) Use the Opamp for sine wave Oscillator applications.

		changing R, C component Values	
9	Op-Amp Relaxation Oscillators a) Implement Monostable multivibrator b) Implement Astable multivibrator	a) Performing the experiment as per procedure b) Observing wave forms on CRO. c) Observing the effect of changing R, C component Values	Draw Inference from the Observed waveforms b) use the Opamp for sine wave Oscillator applications.
10	Working with 555 IC. a) Implement Monostable multi vibrator b) Implement Astable multivibrator	a)Familiarize with 555 pin configuration b) Performing the experiment as per procedure's c) Observing wave forms on CRO. d). Observing the effect of changing R, C component Values e) .Observe wave forms at Pins 2 , 3 and 5 f) observe the effect of applying a voltage to pin 5 g) Observe the effect of connecting pin 4 to ground.	a) Draw Inference from the Observed waveforms b) use 555 for Square wave Oscillator/Clock and Voltage controlled Oscillator applications.
11	. Working with Phase Locked loops	a) familiarize with 565 pin configuration	Draw Inference from the Observed waveforms

	<p>A) Implement 565 Phase locked loop circuit</p> <p>b) Frequency demodulation using 565</p>	<p>b) Performing the experiment as per procedure's</p> <p>c) Observing wave forms on CRO.</p> <p>d). Observing the effect of changing R, C component Values</p> <p>e) Determine free running frequency</p> <p>f) Calculate Locking range</p> <p>g) Determine capture range experimentally</p> <p>h) using 565 as FM demodulator</p>	<p>b) use 565 for PLL applications.</p>
12	<p>Use 566 as a square and Triangular wave generator</p> <p>a) use 566 for VCO and waveform generator applications</p> <p>b) use 566 for producing Frequency modulation</p>	<p>Familiarize with 566pin configuration</p> <p>b) Performing the experiment as per procedure's</p> <p>c) Observing wave forms on CRO.</p> <p>d). Observing the effect of changing R, C component Values</p> <p>e) Determine free running frequency</p> <p>f) Observing the waveforms at different pins</p> <p>g) Using 566 for</p>	<p>Using 566 for VCO applications b) Using 566 for Frequency modulation applications</p>

		frequency modulation	
13	Working with Tone Decoder IC 567 IC (Refer to the application notes and implement following circuits) a)10 Khz signal detector b) Double frequency output c) Quadrature output Oscillator	To develop design capabilities b) To search for Resource material. c) Assemble the circuits d) Developing 567 IC applications	To explore features of 567 b) use 567 in circuits and projects
14	D/A conversion using R-2R ladder network/Binary Weighted type. a) Implement D/A converter using Opamp and R-2R ladde and Binary weighted network and test a)Implement Precision Rectifier using Opamp	Assemble the circuit and test the performance. b) refer to the data sheets and note down the number of IC version of D/A converter and specifications c) Observe the output of precision rectifier on CRO and infer.	Assemble the Digital to analog converter and test
15	To implement active filters and evaluate the performance a) To implement active low pass filter b). To implement Active High pass filter	a)To implement active filters using Opamps b) Appreciate the performance of active filters . c) To determine the cut off frequencies	Implement active filters using Opamps.
16	16, Pspice simulation a) Simulate the experiments 4,5,6,8,9,10, 15 using Pspice	Practice using P spice for simulation . b) Appreciate the special applications of Op amp	Use pspice for simulation

17	.Industrial Visit 3hrs	To Know the industrial Practices	Noting down important points and preparing a report
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DIGITAL COMMUNICATION LAB PRACTICE

Subject Title : Digital Communication Lab Practice

Subject Code : EC – 409

Periods/Week : 03

Periods/ Semester: 45

Rationale: Digital communication lab is designed to reinforce the theoretical concepts learnt in digital communication by experimental verification. Sound knowledge in Digital communication is essential to learn new technology trends in the ever growing communication Industry

TIME SCHEDULE

S.No.	Major Topic	No. of Periods
1	Pulse Amplitude Modulation	9
2	Pulse Code Modulation	9
3	Time Division & Frequency Division Multiplexing	9
4	Keying Techniques	9
5	DTMF Signalling	9

LIST OF EXPERIMENTS

1. To sample an analog signal (using IC 398) at Nyquist rate and above Nyquist rate. And observe the waveforms

b) Refer to the data sheets and find out the specifications of LF198/LF398 Ics

2. To demonstrate working of Pulse amplitude modulation and demodulation.

3. To Perform an experiment to study Pulse Code Modulation and Demodulation

4. To demonstrate Pulse Width modulation and demodulation.

5. To demonstrate 2-channel TDM .

6. To demonstrate FDM.

7. Modulation and Demodulation of ASK signals

a) To generate and demodulate ASK signal

b) Enter and execute a Matlab program to generate ASK signal. Debug any programming mistakes

8. Modulation and Demodulation Of FSK signals

- a).To generate and demodulate FSK signal
- b) Enter and Execute a Matlab program to generate FSK signal. Debug any programming mistakes.

9. Modulation and Demodulation Of PSK signals

- a).To generate and demodulate PSK signal
- b) Enter and Execute a Matlab program to generate PSK signal. Debug any programming mistakes.

10. To generate DTMF signals using UM91214B IC/5089IC or any other equivalent ICs

- a)To demonstrate DTMF decoder using 8870 IC or its equivalent
- b) Enter a program to generate DTMF Signals and execute using Matlab. Debug any programming mistakes

List of Experiments

Exp No	Name of the Experiment	Objectives	Key Competencies
1	1. To sample an analog signal (using IC 398) at Nyquist rate and above Nyquist rate. And observe the waveforms B) refer to the data sheets and find out the specifications of LF198/LF398 Ics	a)To understand the working of sample and Hold Circuits by experimenting. b) To observe the effect of holding capacitor value on bandwidth. c)To observe the effect of sampling rate on the output signal. d)To be conversant with industry standard ICs e) Refer to data sheets for specifications and applications	To perform the experiment as per procedure , observe the waveforms and analyze
2	To demonstrate working of Pulse amplitude modulation	a)To understand the process of PAM	a)To identify PAM signal

	and demodulation.	b)To pulse amplitude modulate the input sinusoidal signal c)To observe the waveform on CRO d)Observing the effect of low sampling rate (aliasing) on the output signal e) To Demodulate the PAM signal and recover the modulating signal	b)To perform the experiment as per procedure and analyze the observed waveform.
3	To Perform an experiment to study Pulse Code Modulation and Demodulation	a. To understand the process of PCM b) To comprehend the process of quantization by experimental verification c) To pulse code modulate the input signal d) To observe the waveform on CRO e) Observing the effect of quantization on the output signal f) To identify various sections in PCM decoder g) To Demodulate the PCM signal and recover the modulating signal	a) Key competencies: To identify quantized signal b) To perform the experiment as per procedure and analyze the observed waveforms.
4	4.To demonstrate Pulse Width modulation and demodulation.	a) To understand the process of PWM b) To comprehend the process of PWM by experimental verification c) To pulse Width modulate the input signal	a) To identify PWM signal b) To perform the experiment as per procedure and analyze the observed waveforms

		<p>d) To observe the waveform on CRO</p> <p>e) Observing the effect of PWM on the output signal</p> <p>f) To Demodulate the PWM signal and recover the modulating signal</p>	
5	5. To demonstrate 2-channel TDM .	<p>a) To comprehend the Process of TDM by experimentation.</p> <p>b) To transmit two signals (sine wave and square wave) using TDM</p> <p>c) Identify various sections in TDM multiplexer</p> <p>d) Demultiplex TDM signal and observe the waveforms.</p>	To perform the experiment as per procedure and analyze the observed waveforms
6	6.To demonstrate FDM.	<p>a) To comprehend the Process of FDM by experimentation.</p> <p>b) To transmit two signals (sine wave and square wave) using FDM</p> <p>c) Identify various sections in FDM multiplexer</p> <p>d) Demultiplex FDM signal and observe the waveforms.</p>	To perform the experiment as per procedure and analyze the observed waveforms

7	<p>7. Modulation and Demodulation of ASK signals</p> <p>a) To generate and demodulate ASK signal</p> <p>b) Enter and execute a Matlab program to generate ASK signal. Debug any programming mistakes</p>	<p>a) To comprehend the Process of ASK by experimentation.</p> <p>b) To transmit data using ASK</p> <p>c) Identify various sections in ASK transmitter</p> <p>d) Recover the data and observe the waveforms.</p> <p>e) Reinforcing Matlab skills</p>	<p>a) To perform the experiment as per procedure and analyze the observed waveforms</p> <p>b) Use matlab for analyzing ASK</p>
8	<p>Modulation and Demodulation Of FSK signals</p> <p>a). To generate and demodulate FSK signal</p> <p>b) Enter and Execute a Matlab program to generate FSK signal. Debug any programming mistakes.</p>	<p>a) To comprehend the Process of FSK by experimentation.</p> <p>b) To transmit data using FSK</p> <p>c) Identify various sections in FSK transmitter</p> <p>d) Recover the data and observe the waveforms.</p> <p>e) Using Matlab program to analyse FSK signals</p>	<p>a) To perform the experiment as per procedure and analyze the observed waveforms</p> <p>b) Use matlab for analyzing FSK</p>
9	<p>Modulation and Demodulation Of PSK signals</p> <p>a) To generate and demodulate PSK signal</p> <p>b) Enter and Execute a Matlab program to generate PSK signal. Debug any</p>	<p>a) To comprehend the Process of PSK by experimentation.</p> <p>b) To transmit data using PSK</p> <p>c) Identify various sections in PSK transmitter</p> <p>d) Recover the data</p>	<p>To perform the experiment as per procedure and analyze the observed waveforms</p>

	programming mistakes.	and observe the waveforms. e) Reinforcing Matlab skills	
10	To generate DTMF signals using UM91214B IC/5089IC or any other equivalent ICs a) To demonstrate DTMF decoder using 8870 IC or its equivalent b) Enter a program to generate DTMF Signals and execute using Matlab. Debug any programming mistakes	a) To understand dialing method in telephone systems b) To know the frequencies that represent 16 alphanumeric characters on telephone set c) To observe DTMF signal waveforms on CRO d) To understand DTMF Decoder IC Functioning e) To know the Pin configuration of 8870 IC f) To observe decoded DTMF signal on LED display	a) To use the DTMF Encoder and Decoder ICs in the circuits b) Identifying the character from the frequencies observed. c) Reinforcing Matlab skills. d) Using Matlab to generate DTMF signals and listen to the DTMF tones

Programming in C and MATLAB Practice

Subject Title : **Programming in C & MAT LAB Practice**
Subject Code : **EC- 410**
Periods/Week : **06**
Periods/Semester : **90**

Rationale ; Programming in C Lab Practice is introduced to reinforce the programming skills learnt in the class Room . Mat Lab is also included to give an opportunity to the students to understand the design concepts by simulate electronic circuits .

TIME SCHEDULE

Sl	Major Topic	No. of Periods
1	C Programming Basics	6
2	Decision & Loop Control Statements	12
3	Exercises on functions	15
4	Arrays, Strings and Pointers in C	15

5	Structures, Unions & Preprocessor Directives	12
6	MAT Lab Practice	30

LIST OF EXPERIMENTS

At end of this lab practice, the student shall be able to perform

1. Editing, compiling and executing programs
2. Exercises on printf and scanf functions
3. Exercises on Selective Structures
4. Exercises on Repetitive Structures
5. Exercises on functions to demonstrate prototyping, parameter passing, function returning values.
6. Exercises on recursion
7. Exercises on global variables.
8. Exercises on arrays and Strings
9. Exercises to demonstrate use of Pointers, pointers as function arguments, functions returning pointers
10. Exercise on structures.
11. Exercises on C preprocessor Directives.

MAT LAB PRACTICE

1. Compute the following quantities

a. $\frac{2^5}{2^5 - 1}$

b. $\sin \frac{\pi}{6}, \cos \pi$

c. $\frac{1+3i}{1-3i}$

2. The equation of a straight line is $y=mx+c$, where m and C are constants. Compute the y-coordinates of a line with slope $m=0.5$ and the intercept $c=-2$ at the following co-ordinates: $X=0, 1.5, 3, 4, 5, 7, 9$ and 10
3. Create a column vector for θ with values $0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi$ and $\frac{5\pi}{4}$. Take $r=2$ and compute the column vectors x and y .
4. Plot $y = \sin x, 0 \leq x \leq 2\pi$, taking 100 linearly spaced points in the given interval. Label the axes and put "Plot created your name" in the title.
5. Write a script file that when executed, greets you, displays the date and time
6. Write a function to calculate factorial of a given number. Enter the following matrices.
 $A = \begin{bmatrix} 2 & 6 \\ 3 & 9 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$
Compute a) $A+B$ b) $B+A$ c) $A*B$
7. An exercise to import data from a JPEG file and reconstruct the image.
8. Plot simple graphs using `fplot()`
9. Plot simple graphs using `ezplot()`
10. Solve the following linear equations using MATLAB
 $5x-3y+2z=10$
 $-3x+8y+4z=20$
 $2x+4y-9z=9$

Reference Book:

1. Getting started with MATLAB by Rudra Pratap, Oxford university Press

ADVANCED COMMUNICATION SYSTEMS

Subject Title : Advanced Communication Systems

Periods/Week : 04 Subject Code : EC-501

Periods/Semester : 60

Rationale: Advanced Communication systems subject is a core subject aimed to impart sufficient theoretical inputs in Transmission lines Microwave devices, Radars, and satellite communication to keep in pace with the fast changing technology.

TIME SCHEDULE

SI	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Transmission Lines	10	16	2	1
2	Microwave components and Tubes	14	26	2	2
3	Microwave semiconductor devices and MICs	10	16	2	1
4	RADAR	13	26	2	2
5	Satellite Communication	13	26	2	2
	Total	60	110	10	8

OBJECTIVES

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

1.0 Transmission Lines

- 1.1 List different types of Transmission Lines.
- 1.2 Draw the Electrical equivalent circuit of a Transmission line.
- 1.3 Define Primary and Secondary constants of a Transmission line.
- 1.4 Study the transmission line equations
- 1.5 Derive the expressions for attenuation and phase constants
- 1.6 Define group and phase velocities in transmission lines
- 1.7 Study the concept of Infinite Line

- 1.8 Define lossless Line
- 1.9 List two types of distortions in transmission lines
- 1.10 Derive the condition for distortion less line
- 1.11 Define Reflection coefficient and SWR
- 1.12 Derive the relation between Reflection Coefficient & SWR
- 1.13 Explain the need for impedance matching in transmission lines.
- 1.14 Impedance Matching using quarter wave transmission line.
- 1.15 Explain single stub matching in transmission lines.
- 1.16 List the various bands in microwave frequency range.
- 1.17 Define rectangular and circular waveguides.
- 1.18 Describe various modes of operation of waveguides.
- 1.19 Define dominant mode and cut-off wavelength in rectangular waveguide.
- 1.20 Calculate the cut-off frequency, cut-off wavelength, guide wavelength, phase velocity, group velocity and characteristic impedance in rectangular waveguide.

2.0 Microwave Components and Tubes

- 2.1 State the need for microwave devices.
- 2.2 State the need for microwave bends, corners and twists
- 2.3 List different T-Junctions
- 2.4 Explain the operation of E-Plane Tee and H-Plane Tee.
- 2.5 Explain the operation of Magic Tee
- 2.6 State the need for isolators and circulators
- 2.7 Explain the operation of Isolator
- 2.8 Explain the operation of Circulator.
- 2.9 Explain the construction and working of Multi cavity Klystron amplifier.
- 2.10 List the applications of Multi cavity Klystron.
- 2.11 Explain the construction and working of Reflex Klystron oscillator
- 2.12 List the applications of Reflex Klystron.
- 2.13 Explain the construction and working of Magnetron oscillator
- 2.14 List applications of Magnetron.
- 2.15 Explain the construction and working of Travelling Wave Tube amplifier
- 2.16 List applications of TWTA.

3.0 Microwave Semiconductor Devices and MICs

- 3.1 State the need for microwave semiconductor devices
- 3.2 Distinguish between ordinary semiconductor devices and microwave semiconductor devices.
- 3.3 Define Gunn Effect.
- 3.4 Describe constructional features and working principle of GUNN diode
- 3.5 List the applications of GUNN diode.
- 3.6 State the Tunnelling phenomena
- 3.7 Explain the operation of Tunnel diode
- 3.8 Explain the working of IMPATT diode
- 3.9 Explain the working of TRAPATT diode
- 3.10 List the applications of IMPATT & TRAPATT
- 3.11 List the advantages of microwave semiconductor devices over electron beam devices.
- 3.12 State the need for Microwave Integrated Circuits (MICs)
- 3.13 Explain the working of micro-strip antenna
- 3.14 List the applications of micro-strip antennas.

4.0 Understand RADAR

- 4.1 State the basic principle of Radar with a block diagram.
- 4.2 Derive the basic Radar range equation.
- 4.3 Predict the range performance factors from range equation.
- 4.4 Draw and explain the block diagram of pulsed Radar system.
- 4.5 State the need for duplexer in Radar
- 4.6 Explain the operation of branch type Duplexer with sketch.
- 4.7 List the types of indicators used in radar systems.
- 4.8 Briefly explain A-scope and PPI displays.
- 4.9 State the disadvantages of pulsed radar.
- 4.10 Explain the Doppler Effect.
- 4.11 Explain the principle of CW radar
- 4.12 Draw and explain the block diagram of CW radar.
- 4.13 List the limitations of a CW Radar
- 4.14 Explain the working of FM CW Radar.
- 4.15 Explain the application of FM CW Radar as altimeter
- 4.16 Draw and explain the block diagram of MTI Radar.
- 4.17 List the applications of various Radar systems.
- 4.18 Explain the principle of instrument landing system.

5.0 Understand the principle of working of satellite communication

- 5.1 State the need for satellite communication
- 5.2 Define foot print of a satellite
- 5.3 Describe the basic structure and uses of microwave links.
- 5.4 Explain fixed microwave link with block diagram.
- 5.5 List the advantages of satellite communication over terrestrial radio communication.
- 5.6 Explain geostationary satellites and satellites in lower orbits.
- 5.7 List the advantages and disadvantages geostationary satellites.
- 5.8 Define azimuth and elevation with reference to satellites.
- 5.9 Define terms apogee and perigee.
- 5.10 Define uplink frequency and down link frequency
- 5.11 List the functions of a transponder
- 5.12 List three types transponders used in satellites (single conversion, double conversion and regenerative)
- 5.13 Explain the working of the three types of transponders.
- 5.14 Explain bandwidth allocation of a satellite.
- 5.15 List the three methods of increasing satellite capacity
- 5.16 Explain the methods of increasing channel capacity. Frequency reuse, polarization and spatial isolation).
- 5.17 Draw and explain the block diagram of communication satellite.
- 5.18 Draw and explain the block diagram of Earth station.
- 5.19 Explain the working of GPS
- 5.20 List the applications of satellites.

COURSE CONTENTS

1. Transmission Lines

Introduction-electrical equivalent circuit-primary constants- characteristic impedance-propagation constant-infinite line-lossless line-condition for distortion less line-reflection coefficient-SWR-impedance matching-quarter wave line-stub matching-rectangular waveguide-modes of operation-dominant mode in rectangular waveguide-cut off wavelength-group velocity-phase velocity

2. Microwave components and Tubes

Introduction to microwave devices -microwave bends-corners-twists-tees-circulators-isolators-Multi cavity Klystron-Reflex Klystron-Magnetron-TWT-applications.

3. Microwave semiconductor devices and MICs

GUNN Effect-GUNN diode-Tunnel diode-IMPATT-TRAPATT-MICs-applications

4. RADAR

Introduction to Radar system-Radar range equation - Pulsed Radars-Indicators-Duplexer-CW radar-FM CW Radar-Radar altimeter-MTI Radar-Instrument landing system

5. Satellite Communication

Microwave link-advantages of satellite communication system - Frequency bands-bandwidth-channel capacity-communication satellite-Earth station-GPS-applications of satellites

REFERENCE BOOKS

1. Electronic communication system by George Kennedy, TMH
2. Electronic Communication Systems by Blake. Thomson
3. Communication Electronics by Frenzel, TMH
4. Introduction to RADAR Engineering by Meryll I Skolnik. TMH
5. Understand Microwave Engineering by Sanjeeva Gupta
6. Communication systems by Shradar
7. Modern Electronic Communication by Ashok Raj.
8. Microwave Integrated circuits by Samuel Leo

CONSUMER ELECTRONICS

Subject Title : **CONSUMER ELECTRONICS**
Subject Code : **EC-502**
Periods/Week : **04**
Periods/Semester : **60**

Rationale: Consumer Electronics Subject is introduced to meet the needs of consumer electronics Industry. The units in the course are designed to impart the concepts of Audio Video systems, Television, Cable TV, DTH services and other domestic appliances like Microwave ovens and Automatic washing Machines.

TIME SCHEDULE

Sl.	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Microphones & Speakers	10	21	2	1 ½
2	Audio Systems	8	13	1	1
3	TV Picture & Composite Video Signal	16	23	1	2
4	Colour T.V.	8	21	2	1 ½
5	Cable, Satellite and digital TV	10	16	2	1
6	Domestic Appliances	8	16	2	1
	Total	60	110	10	8

OBJECTIVES

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

1.0 Understand basics of audio systems.

Familiarise with different types of microphones and loud speakers

- 1.1 List the different types of microphones based on impedance, polar characteristics and principle of working.
- 1.2 Explain the working of carbon, condenser, Crystal, ribbon and dynamic microphones along with their polar characteristics.
- 1.3 Compare the parameters like sensitivity, noise, frequency response, directivity, output impedance, bias necessity, size, cost and applications of above microphones.
- 1.4 List the ratings of condenser, crystal, carbon, ribbon and dynamic microphones.
- 1.5 Explain the constructional features and principle of operation of PMMC Loudspeaker and its ratings.

- 1.6 Mention the necessity of Baffle for a Loudspeaker and types of Baffles (like open, infinite, bass reflex, acoustic labyrinth) and constructional details.
- 1.7 Mention the use of woofers and tweeters.
- 1.8 Give the need for a Horn loud speaker with its construction and advantages. Mention different types of horns.
- 1.9 Compare the performance characteristics of cone type and horn type loud speakers.
- 1.10 Explain the principle, construction and working of magnetic and crystal headphones and their uses.
- 1.11 Mention the specifications of Loudspeaker and Microphones

2.0 Understand Audio & Video Systems

- 2.1 Define speech, music and noise.
- 2.2 Explain frequency response and equalization.
- 2.3 Define the concept of Hi-Fi and Stereo.
- 2.4 State the need of bass, treble, balance, and volume control in stereo amplifier.
- 2.5 Explain a simple circuit showing the above controls.
- 2.6 Briefly explain the principle of magnetic recording and reproduction.
- 2.7 List five advantages and disadvantages magnetic recording.
- 2.8 State the principle of optical recording.
- 2.9 Explain the method of optical recording of sound on film
- 2.10 Explain the working principle of DVD player.
- 2.11 Explain working of DVD player with block diagram.
- 2.12 Define the MP3 & MP4 formats..
- 2.13 Explain the concept of noise reduction using DOLBY system.
- 2.14 Explain home theatre sound system.
- 2.15 Describe the speaker arrangement and features of Dolby Digital 5.1 Surround Sound (AC3)

3.0 Comprehend TV Picture & Composite video signal

- 3.1 Explain formation of picture.
- 3.2 State the need for horizontal and vertical scanning.
- 3.3 State the frame and field frequencies.
- 3.4 State need for vertical synchronisation, horizontal synchronisation and blanking pulses.
- 3.5 Mention the frequency allocation of T.V. Channels used in India.
- 3.6 List all standards of T.V. transmissions as per C.C.I.R.
- 3.7 List different types of scanning
- 3.8 Distinguish between progressive and interlaced scanning.
- 3.9 Draw the standard scanning pattern in an interlaced scanning.
- 3.10 State the need for interlaced scanning with reference to Bandwidth.
- 3.11 List all different pulses in a composite video signal.
- 3.12 State and compare positive and negative modulation.
- 3.13 Sketch composite video signal as per I.S.I. specification.
- 3.14 State the need for front porch and back porch in blanking pulses.
- 3.15 State the necessity of equalising pulses and serrated vertical blanking pulses.

4.0 Understand the working of Colour Television.

- 4.1 Explain the main characteristic of human eye with regard to perception of colours.
- 4.2 Distinguish between additive and subtractive mixing of colours.
- 4.3 Explain complementary colours, hue, saturation, and Colour circle.
- 4.4 Explain compatibility in TV system.

- 4.5 List three standards of Colour transmission system like NTSC, PAL and SECAM.
- 4.6 Explain how chrominance signals are transmitted on one carrier in PAL system.
- 4.7 Draw the block diagram of a Colour TV transmitter and state the function of each block.
- 4.8 Draw the block diagram of a Colour TV receiver and state the function of each block.
- 4.9 Explain the processing of Colour video signal (PAL system) in a Colour receiver.
- 4.10 List different types of Colour TV monitors.
- 4.11 Explain basic principles of above technologies
- 4.12 Explain the features of HDTV

5.0 Understand the principles of Cable, Satellite and Smart TV

- 5.1 Draw and explain the block diagram of CATV.
- 5.2 Explain the cable TV components such as amplifiers directional couplers and Converters.
- 5.3 Explain the necessity of mid-band and super-band channels
- 5.4 State the need for satellite for TV broadcasting over wide area.
- 5.5 Explain the merits of DTH system
- 5.6 With a block diagram explain DVB-S channel reception with block diagram.
- 5.7 State the need for SET TOP BOX.
- 5.8 Explain TV Remote control transmitter with block diagram
- 5.9 List all features of Projection TV
- 5.10 List applications of Projection TV

6.0 Understand the working of Domestic Appliances

- 6.1 State the working principle of Microwave oven
- 6.2 Explain functional block diagram of Microwave oven
- 6.3 List advantages of Microwave oven
- 6.4 Explain the functional block diagram of Electronic Washing machine
- 6.5 List any three advantages of Fuzzy logic in washing machines
- 6.6 Explain functional block diagram of Camcorder
- 6.7 List applications of Camcorder

COURSE CONTENTS

1. Introduction to Audio Systems

properties of sound, Hi-Fi and stereo systems, disc recording and reproduction. Magnetic recording and reproduction, optical recording. Working of DVD player, MP3 & MP4 player..

2. TV Picture & Composite Video Signal

Picture elements. Horizontal and vertical scanning, frame and field frequencies, Horizontal and vertical synchronisation, Horizontal and vertical blanking. T.V. Channel standards. Construction of composite Video signal, Horizontal blanking time and vertical blanking time. Linear scanning, standard scanning pattern. Flicker, sync Pulses, blanking signals.

3. Colour Television

Fundamental concepts of 3 colours systems. Additive and subtractive mixing of colours.

Different Colour systems like NTSC, PAL, and SECAM. Colour TV Transmitter block diagram. Colour TV receiver block diagram (PAL). Colour video signal processing, operating and service controls,

4. Cable, satellite and digital TV

Cable TV, DTH system, DTH receiver, HD TV

5. Domestic Appliances

Microwave oven, washing Machine, Digital camera – camcorders-

REFERENCE BOOKS

1. Electronic communication systems by Roy Blake, Thomson Delmar.
2. Colour Television by R.R.Gulati. TMH
3. How Electronic Things Work.& What to Do When They Don't -Robert L. Goodman, -TMH
4. Consumer electronics - SP Bali, -Pearson
5. Digital Satellite Television Handbook By Mark E. Long

COMPUTER HARDWARE

Subject Title : **Computer Hardware**
Subject Code : **EC-503**
Periods /Week : **04**
Periods/Semester : **60**

Rationale : Computer Hardware subject is included in the V semester as the understanding of computer and its associated hardware is rather a necessity for survival in the present situation. Units are designed to give a clear understanding of Computer Hardware including Operating system. The knowledge of computer hardware makes the students eligible for jobs computer industry also.

TIME SCHEDULE

Sl.	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Mother Board	20	19	3	1
2	Peripherals.	20	36	2	3
3	Windows OS	10	36	2	3
4	PC assembly & Software Installation	10	19	3	1
	Total	60	110	10	8

OBJECTIVES

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

1.0 Understand mother board and its features

- 1.1 Draw the layout of components in the motherboard.
- 1.2 List different expansion slots available on the motherboard.
- 1.3 List all the details of different chipsets in use.
- 1.4 Explain the processor interface and specifications of processor.
- 1.5 List all different types of MEMORIES in use..

- 1.6 Explain accelerated graphics port.
- 1.7 Explain power supply connectors and external devices.
- 1.8 Know different types of serial, parallel and USB ports.
- 1.9 List all the connector details for printer, serial port, mouse, keyboard and USB.

2.0 Know various computer peripherals

- 2.1 Explain the Working of Hard Disk and data access.
- 2.2 Explain the storage of data on DVD
- 2.3 Explain the functioning of GRAPHIC CARD.
- 2.4 Explain the functioning of Network card and list its specifications.
- 2.5 List five specifications of monitor.
- 2.6 Explain the working of LCD monitor.
- 2.7 Explain the working principle of infrared keyboard and infrared mouse
- 2.8 List three types of printers.
- 2.9 Explain the working of dot matrix printer.
- 2.10 Explain the working of Laser printer.
- 2.11 Explain the working of inkjet printer.
- 2.12 Explain the working of scanners.
- 2.13 Explain OCR (optical character recognition).
- 2.14 Explain the JPEG and MPEG formats.
- 2.15 Explain the principle of DVD and Writer.
- 2.16 List out the features of a LAPTOP
- 2.17 Differences between DESKTOP and LAPTOP.
- 2.18 List five features of TABLET(TAB)
- 2.19 List three features of FABLET
- 2.20 List out features of TOUCH SCREEN for modern gadgets.

3.0 Understand windows operating systems.

- 3.1 Define the Power On Self Test (POST).
- 3.2 Explain the need for BIOS settings.
- 3.3 Know about the booting procedure.
- 3.4 Describe the usage of File Allocation Table (FAT).
- 3.5 Describe the structure and uses of Windows registry
- 3.6 State the purpose of INI and INF files
- 3.7 List all device classes in the device manager.
- 3.8 Explain the purpose of control panel icons
- 3.9 List all types of viruses and ways of removing viruses.
- 3.10 List any five Anti-Virus Software available in market

4.0 Understand PC assembly and software installation

- 4.1 Explain the steps in assembling a PC.
- 4.2 Explain the editing of CMOS set up and its details.
- 4.3 Describe the process of formatting.
- 4.4 State the use FDISK.
- 4.5 Explain disk manager and disk partitioning
- 4.6 List the operating systems and their features.
- 4.7 Explain Installation of WINDOWS OS
- 4.8 State the uses of Linux OS and ANDROID OS
- 4.9 State the need for installation of device drivers.

- 4.10 Explain blocking, damaged sectors, Defragmentation, and Removal of temporary files.
- 4.11 List different microprocessors (INTEL, MOTOROLA) for PC applications

COURSE CONTENTS

1. Motherboard.: Motherboard – component layout, chip set, slots, serial port, parallel port, USB port, connectors. RAM, cache memory, AGP.

2. Peripherals: HDD, FDD, sound card, Video grabber card, network card, Monitor, Keyboard, and mouse. Laptop

3. Accessories: Working and specifications of dot matrix, Laser and inkjet printers-Scanner-JPEG, MPEG-DVD RW-ANTI VIRUS

4. Windows Operating System: Power On Self Test, BIOS, Booting, auto executable batch file, config.sys file, windows registry, Device manager, control panel, viruses.

5. PC assembly and Software Installation: Assembling PC, CMOS set up, Installation OS, Installation of device drivers, system tools.

REFERENCE BOOKS

1. Peter Norton's complete guide to PC upgrades 2nd edition by Peter Norton, Micheal Desmond, PHI
2. Peter Norton's new inside the PC by Peter Norton, Scott Clark, PHI
3. Microprocessors, PC Hardware and interfacing by N. Mathivanan PHI
4. Trouble shooting your PC by M. David Stone and Alfred Poor, PHI
5. Enhanced guide to managing and maintaining your PC-Third Edition, Thomson

OPTICAL FIBER COMMUNICATIONS

Subject Title : Optical Fibre Communications

Periods/Week : 04 Subject Code : EC-504

Periods/Semester : 60

Rationale: Optical fibre communication is introduced as a separate course keeping fast growing trends of communication Engineering in mind and to meet the needs of Internet and Mobile communications industry

TIME SCHEDULE

SI	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Over View of Fiber Optic Communication	10	16	2	1
2	Fiber Drawing Process and cabling	12	21	2	1 ½
3	Fiber Optic Components	13	26	2	2
4	Fiber Optic Devices	15	31	2	2½
5	WDM and Optical Networks	10	16	2	1
	Total	60	110	10	8

OBJECTIVES

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

1.0 Over View of Fibre Optic Communication

- 1.1 State the advantages of Light wave communication system over EM wave systems.
- 1.2 List different optical spectral bands.
- 1.3 List three generations of optical fibres
- 1.4 Explain the structure of optical fibre
- 1.5 Classify optical fibres based on refractive index profile
- 1.6 List the types of fibres based on core diameter
- 1.7 Define Single mode fibre (SMF)
- 1.8 Define multimode fibre (MMF)
- 1.9 List the advantages of SMFs over MMFs.

- 1.10 Define Snell's law in optics
- 1.11 Explain Total internal reflection in optical fibre.
- 1.12 Define acceptance angle
- 1.13 Define cone of acceptance.
- 1.14 Define numerical aperture (NA)
- 1.15 Derive the expression for NA in terms of core and cladding refractive indices.
- 1.16 List the advantages of optical fibres over other communication media

2.0 Fibre manufacturing and cabling

- 2.1 List four types of fibre drawing processes.
- 2.2 Explain Outside Vapour Phase Oxidation (OVPO) method
- 2.3 Explain Vapour phase Axial Deposition (VAD) method
- 2.4 Explain Modified Chemical Vapour Deposition (MCVD) method
- 2.5 Explain Plasma activated Chemical Vapour Deposition (PCVD) method.
- 2.6 List different structural elements used for cable design.
- 2.7 List two types of fibre optic cables.
- 2.8 Describe the characteristics of loose buffered cable
- 2.9 Describe the characteristics of tight buffered cable
- 2.10 List various losses in optical fibres.
- 2.11 Explain intrinsic and extrinsic losses
- 2.12 Classify different types of dispersions occur in optical fibres.
- 2.13 Explain Group velocity dispersion
- 2.14 Distinguish between inter modal and intra modal dispersion.
- 2.15 Define wave guide dispersion
- 2.16 Briefly explain Polarization mode dispersion

3.0 Fibre Optic components and measuring instruments

- 3.1 List various fibre optic components
- 3.2 State the need for connectors in FOC
- 3.3 State the function of splice in optical fibres
- 3.4 List two types of connectors.
- 3.5 List two types of splices.
- 3.6 Distinguish between mechanical splice and fusion splice
- 3.7 Predict different losses occur due to improper splicing
- 3.8 State the need for optical coupler/splitter
- 3.9 List different optical couplers
- 3.10 Explain the working of an optical coupler
- 3.11 State the need for isolator in OFC
- 3.12 Explain the working of isolator.
- 3.13 List different types of measuring/testing instruments used in the field of OFC.
- 3.14 Describe the use of optical power meters
- 3.15 State the use of optical attenuators
- 3.16 Explain the working of Optical Time Domain Reflectometer (OTDR).

4.0 Fibre Optic Devices

- 4.1 List two types of sources used in OFC
- 4.2 Define salient features of an optical source
- 4.3 List two types of detectors used in OFC
- 4.4 Define salient feature of an optical detector

- 4.5 Explain the construction and working of an LED
- 4.6 State the principle of LASER.
- 4.7 Explain the construction and working of LASER source.
- 4.8 List the differences between LED and LASER sources
- 4.9 Explain the construction and working of PIN photo diode.
- 4.10 Explain the construction and working of APD (Reach through APD)
- 4.11 State the need for repeater/regenerator in FOC
- 4.12 List three types of repeaters
- 4.13 Differentiate R, 2R and 3R repeaters.
- 4.14 Distinguish between repeaters and optical amplifiers.
- 4.15 Draw the block diagram of Erbium Doped Fibre Amplifier (EDFA).
- 4.16 Explain the principle and operation of EDFA
- 4.17 Draw the block diagram of fibre optic communication system and explain each block.
- 4.18 List the other applications of LED and LASER

5.0 Wavelength Division Multiplexing & Optical Networks

- 5.1 Define optical time domain multiplexing
- 5.2 Limitations of time division multiplexing (OTDM) in FOC
- 5.3 Define wavelength division multiplexing.
- 5.4 Explain the need for WDM in fibre optic communication
- 5.5 List two types of WDM systems
- 5.6 Distinguish between wideband WDM and narrowband WDM (DWDM)
- 5.7 Draw the block diagram of WDM system
- 5.8 Draw and explain the block diagram of DWDM
- 5.9 List three types of network topologies
- 5.10 Briefly explain bus, ring and star topologies used in fibre optic networks.
- 5.11 State the use of fibre optic cables in local area networks.
- 5.12 Describe use of fibres in Ethernet and Gigabit Ethernet.
- 5.13 Explain the use of fibre optic cables as submarine cables.
- 5.14 Explain the use of fibres in local telephone and cable T.V (FTTH)

COURSE CONTENTS

1. Over View of Fibre Optic communication

Motivation-optical spectral bands-generations of optical fibers-structure of fiber-classification of fibers-Single mode fibers-multimode fibers-total internal reflection-acceptance angle-cone of acceptance-numerical aperture-advantages of fibers

2. Fiber manufacturing and cabling

Types of fiber drawing processes-outside vapor phase oxidation method-vapor phase axial deposition (VAD)-modified chemical vapor deposition (MCVD)-Plasma activated Chemical Vapor Deposition (PCVD)-cable design-types of fiber optic cables-losses in optical fibers-types of dispersions.

3. Fiber Optic components and measuring instruments

Connectors-splices-optical couples/splitters-isolator-optical power meters-optical attenuators-optical time domain reflectometer (OTDR)

4. Fiber Optic Devices

LED-LASER-PIN diode-APD-repeaters-optical amplifiers-Erbium Doped Fiber Amplifier (EDFA)-.block diagram of fiber optic communication system

5. Wavelength Division Multiplexing & Optical Networks

OTDM- wavelength division multiplexing-types of WDM-block diagram of DWDM-network topologies-applications-Ethernet-gigabit Ethernet-FTTH

Reference Books

1. Optical Fiber Communications by Gerd Keiser McGraw Hill
2. Optical fiber and Laser- Principles and applications by Anuradha De, New Age publications
3. Optical fiber communications-Principles and practice, John M. Senior, Pearson Publications
4. Optical Fiber Communications and Its Applications – S.C.Gupta, 2004, PHI.

MICRO CONTROLLER APPLICATIONS

SUBJECT TITLE : MICRO CONTROLLER PPLICATIONS

SUBJECT CODE : EC- 505

PERIODS/WEEK : 04

PERIODS/SEMESTER : 60

Rationale: Microcontroller applications is introduced to further develop the concepts learnt in IV semester by giving theoretical inputs at application level. This course will make the students feel confident in the present Electronic industry.

TIME SCHEDULE

SI	Major Topics	No. of Periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Hardware Interface	10	16	2	1
2	Interfacing External Memory	15	26	2	2
3	Interfacing 8255 PPI	15	26	2	2
4	Interfacing with RTC	10	26	2	2
5	Control Applications	10	16	2	1
	Total	60	110	10	8

OBJECTIVES

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

6.0 HARDWARE INTERFACING

- 6.1 Explain hardware interfacing of ADC chip.
- 6.2 Explain Interfacing temperature sensors to 8051
- 6.3 Explain the process of data acquisition using ADC chips
- 6.4 Explain the choice of selecting ADC chip
- 6.5 Explain the function of 8047/809/848/ ADC chips
- 6.6 Describe the function of chips MAC 1112 ADC chip
- 6.7 Interface serial ADC chip to 8051
- 6.8 Program serial and parallel chips in 8051 in 'C' and assembly
- 6.9 Describe the basic operation of DAC chip with 8051.
- 6.10 Explain the function of precision IC temperature sensors
- 6.11 Describe the signal conditioning and its role in data acquisition

7.0 INTERFACING EXTERNAL MEMORY

- 7.1 Explain semiconductor memories with respect to memory capacity and organisation
- 7.2 Explain the features of EPROM
- 7.3 List any 6 popular UV EPROM chips and explain the pin configuration of any one
- 7.4 List other memory types flash memory, mask ROM, RAM, SRAM, NVRAM, DRAM, checksum byte ROM, DRAM
- 7.5 Explain memory address decoding 740LS138 3 X 8 decoder
- 7.6 Explain interfacing with external ROM
- 7.7 Explain data memory space of 8051 and accessing
- 7.8 Explain interfacing of large external memory (256KB)

8.0 INTERFACING 8255 PPI chip

- 8.1 Describe expansion of I/O ports using 8255
- 8.2 List 3 ports of 8255 and describe their features
- 8.3 Explain the use of control register in selecting a mode
- 8.4 Define modes of 8255
- 8.5 Define the term memory mapped I/O and describe its application
- 8.6 Program 8255 as simple i/o port for connection with LCD and ADC
- 8.7 Interface 8051 with external devices such as stepper motor using 8255
- 8.8 Program 8255 in simple I/O mode using 'C' language

9.0 Interfacing with RTC

- 9.1 Interfacing DS12887 RTC with 8051
- 9.2 Explain how RTC chip works
- 9.3 Explain the function of DS12887 pins
- 9.4 Explain the function of registers
- 9.5 Understand the interfacing of DS12887 RTC to 8051
- 9.6 Write a program in C to access RTC registers
- 9.7 Write a program to display time and date in assembly and C
- 9.8 Understand interrupt and alarm features DS12887
- 9.9 Explore and program the alarm and interrupt features of RTC DS12887

10.0 CONTROL APPLICATIONS AND 8051 FAMILIES (FLASH VERSIONS)

- 10.1 Explain the need of relays and opto couplers for interfacing
- 10.2 Interface 8051 with relay to drive a lamp
- 10.3 Interface a solid state relay to drive a mains operated motor
- 10.4 Interface a stepper motor
- 10.5 Write a program to motor continuously
- 10.6 Describe the controlling of stepper motor using opto isolator and write a program in C
- 10.7 Explain pulse width modulation for controlling the speed
- 10.8 Draw the interfacing circuit for Control of a small DC motor using Darlington and MOSFET
- 10.9 Write a program in C for Control of a small DC motor.
- 10.10 Develop applications for traffic control, pump, lift controller, temperature controller

COURSE CONTENT

HARDWARE INTERFACING

hardware interfacing -temperature sensors-process of data acquisition-selecting ADC chip-8047/809/848/ ADC chips -MAC 1112 ADC chip-‘ C’ and assembly -DAC chip with 8051.-IC temperature sensors-Signal conditioning

INTERFACING EXTERNAL MEMORY

semiconductor memories -memory capacity and organization – EPROM - UV EPROM chips - flash memory, mask ROM, RAM, SRAM, NVRAM, DRAM, checksum byte ROM, DRAM - memory address decoding-interfacing external ROM-memory space of 8051 and accessing-interfacing of large external memory (256KB)

INTERFACING 8255 PPI chip

Expansion of I/O ports using 8255 -Ports of 8255-features-control register-modes of 8255-memory mapped I/O-connection with LCD and ADC-Interface 8051 with external devices-stepper motor

Interfacing with RTC

Interfacing DS12887 RTC with 8051-RTC chip working-function of DS12887 pins-program in C to access RTC registers-display time and date in assembly and C-interrupt and alarm features DS12887-

8051 Applications

Interfacing Relays and opto couplers - Driving a lamp with relay –Interfacing a solid state relay –Interfacing a stepper motor- running motor continuously -controlling of stepper motor using opto isolator in C-PWM control of speed-interfacing DC motor-traffic control- pump & lift controller-Temperature controller

REFERENCE BOOKS:

9. 8051 Micro controller by Mazidi and Mazidi.
10. 8051 Micro controller by Kenneth J.Ayala.
11. Programming customizing the 8051 Microcontroller by Myke Predko TMH
12. Microprocessors and interfacing by Douglas Hall. McGraw Hill.
13. Microcontrollers (theory and applications) by Ajay V Deshmukh

DATA COMMUNICATIONS AND COMPUTER NETWORKS

Subject Title : Data Communications Computer Networks

Subject Code : EC-506

Periods/Week 04

Periods/Semester : 60

Rationale: The Knowledge of Data communications and communication and computer networks is essential for Electronics & Communication engineering students as everything from Banking to Railway ticket booking being completely computerized there are ample opportunities for the students to get good jobs .

TIME SCHEDULE

SI	Major Topics	No. of periods	Marks	Short Answer Questions	Essay Questions
1	Basics of Data communication and OSI Layer	10	21	2	1 ½
2	Concepts of LAN & DLL Protocols	16	26	2	2
3	IP addressing & Network Layer Protocols	12	21	2	1 ½
4	WAN Protocols	10	21	2	1 ½
5	Web Applications & Network Security	12	21	2	1 ½
	Total	60	110	10	8

OBJECTIVES

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

1.0 Basics of Data communication & OSI Layer

1.1 Define data communication

- 1.2 State the need for data communication networking.
- 1.3 Distinguish between analog and digital data.
- 1.4 Define computer network and state its use.
- 1.5 Draw the ISO: OSI 7 layer architecture and explain the function of each layer.
- 1.6 List the different types of physical transmission media.
- 1.7 Explain the use of UTP, STP, Coaxial and Fiber optic cable in networking.
- 1.8 Define simplex, half-duplex and full-duplex communication.
- 1.9 Define bandwidth and throughput of a physical medium.
- 1.10 List the three types of switching techniques used in networking.
- 1.11 Explain circuit switching, packet switching and message switching.
- 1.12 Define virtual circuit and datagram approaches in packet switching

2.0 Understand the concepts of LAN and DLL protocols

- 2.1 Define Local area network and state its use.
- 2.2 Explain different network topologies (Bus, Star, Ring)
- 2.3 Compare the performances of the three topologies.
- 2.4 Explain the working of token ring network.
- 2.5 Explain the use of different networking devices such as repeater/hub, switch, bridge in constructing networks
- 2.6 Differentiate between repeater, switch and bridges.
- 2.7 State the need for protocols in computer networks.
- 2.8 State the need for framing in data link layer.
- 2.9 Explain the Ethernet frame format (IEEE 802.3).
- 2.10 State the need for flow control and error control protocols.
- 2.11 Define stop-and-wait ARQ and Go-back-N ARQ protocols.
- 2.12 Explain the point-to-point protocol (PPP).
- 2.13 Explain CSMA/CD and CSMA/CA.
- 2.14 Explain the topology of wireless LAN and explain its frame format (IEEE 802.11).
- 2.15 Discuss FDDI and its properties.
- 2.16 Explain the Bluetooth technology.
- 2.17 Write the applications of WAP.

3.0 Understand IP addressing and Network layer protocols

- 3.1 Define the terms Internet and Intranet.
- 3.2 Define internet protocol.
- 3.3 Distinguish between connection oriented (virtual circuit) and connectionless (datagram) services.
- 3.4 Classify the two types of Internet Protocol addressing IPv4 and IPv6 and state the need for IPv6.
- 3.5 Explain classful addressing and classless addressing in IPv4.
- 3.6 Describe Internet protocol version-6 (IPv6) addressing.
- 3.7 Explain the use of routers in networking
- 3.8 Explain the concept of routers and routing.
- 3.9 Define cut through & store-and-forward and adaptive switch mechanisms.
- 3.10 Write the packet transfer mechanism using routers and IP address.
- 3.11 Explain the internal architecture of ISP.
- 3.12 Know about Dial up access, leased line, DSL, ISDN types of internet connectivity for an individual user/ organization.

4.0 WAN protocols

- 4.1 Know about WAN architecture.
- 4.2 List the three commonly used WAN technologies.
- 4.3 Describe the working of X.25 WAN Protocol
- 4.4 Describe the FRAME relay WAN Protocol.
- 4.5 Explain ATM WAN Protocol.
- 4.6 Describe the ARPANET and WWW.
- 4.7 Explain different layers of TCP/IP.
- 4.8 Explain the features of TCP.
- 4.9 Explain Address Resolution Protocol (ARP).
- 4.10 Write the functions of port and sockets.
- 4.11 Describe the features of UDP
- 4.12 Explain the connectivity of systems using TCP & UDP
- 4.13 Describe the use of Gateways.

5.0 Understand Web Applications & Network security.

- 5.1 Write the role of DNS server.
- 5.2 Explain DNS namespace.
- 5.3 Explain how email is transferred.
- 5.4 Discuss POP server and SMTP server.
- 5.5 Explain file transfer operation using FTP
- 5.6 Explain the working of Web server.
- 5.7 Explain the working of Web browser.
- 5.8 List HTTP commands.
- 5.9 Write the purpose of proxy server.
- 5.10 Discuss about hyperlinks.
- 5.11 Describe the web browser architecture.
- 5.12 Explain remote login.
- 5.13 State the need for network security.
- 5.14 List various security services.
- 5.15 Define message confidentiality and message integrity
- 5.16 Define message authentication and entity authentication.
- 5.17 Know about key management, digital signature and firewalls in securing the networks

COURSE CONTENTS

1.0 Basics of Data communication & OSI Layer

Introduction-concepts of data communication- analog and digital data-computer network-OSI 7 Layered architecture-UTP- STP- Coaxial and Fiber optic cable - simplex, half-duplex and full-duplex communication-bandwidth and throughput-circuit switching-packet switching-message switching

2.0 Understand the concepts of LAN and DLL protocols

Local area network-network topologies (Bus, Star, Ring)-Token ring network-Hub/Repeaters-bridges-routers-need for protocols-Ethernet frame format (IEEE 802.3)- flow control-error

control-simplest protocol - stop-and-wait protocol-stop-and-wait ARQ-Go-back-N ARQ protocols-PPP-CSMA/CD-CSMA/CA-wireless LAN frame format (IEEE 802.11)-FDDI-Bluetooth-WAP.

3.0 Understand IP addressing and Network layer protocols

Internet and Intranet- Internet protocol-connection oriented (virtual circuit) and connectionless (datagram) services-IPv4 addressing-classful and classless addressing-IPv6 addressing-router and routing-cut through & store-and-forward protocols-packet transfer mechanism using routers and IP address-architecture of ISP-PSTN Internet connectivity: Dial up access-leased line-DSL-ISDN

4.0 WAN protocols

WAN architecture-X.25, FRAME relay and ATM WAN Protocols- ARPA NET and WWW-TCP/IP-Address Resolution Protocol- port and sockets-UDP- gateways

5.0 Understand Web Applications & Network security.

DNS server- email transfer-POP server-SMTP server-FTP- Web server-Web browser- HTTP commands-proxy server- hyperlinks-web browser architecture-remote login-network security-security services.

Reference Books:

1. Network communication Technology by Ata Elahi Thomson
2. Data Communication and Networking by Godbole TMH
3. Data and Computer Communications: William Stallings 7th edition. PHI
4. Data Communication and Networking: Behrouz Forouzan 3rd edition.TMH
5. Computer Networks by Andrew S. Tanenbaum 4th Ed. PHI
Computer Communications and Network Technologies by Michael A.Gallo & William Hancock , Thomson

COMPUTER HARDWARE & NETWORKING PRACTICE

Subject Title : **Computer Hardware & Networking Lab Practice** .
Subject Code : **EC-507**
Periods/Week : **04**
Periods/Semester : **60**

Rationale: With the computer becoming a household item , the need for Computer hardware knowledge need not be stressed. Computer hardware industry is another major area where excellent job opportunities are available. Experiments in Optical fibre communication are also included to give additional practical inputs.

TIME SCHEDULE

S. No.	PRACTICE	No. of Periods
1.	COMPUTER SYSTEM(DESKTOP,LAPTOP)	20
2.	COMPUTER PERIPHERALS	10
3.	NETWORKING	20
4	FIBRE OPTICS	10
	Total	60

List of Experiments

1.0 PC Hardware

- 1.1 Identifying Basic Computer Hardware and Cables
 - a. CPU . Cabinet , Key Board , Monitor, Mouse , Speakers, power Cord, TRs connector, VGA Cable
- 1.2 Identifying external ports on CPU and know their purpose
- 1.3 Study of mother board
- 1.4 Identification of various slots in the mother board
- 1.5 Inserting and Removing RAM
- 1.6 Identifying ports on the cards and interfacing
- 1.7 Assembling the PC and Testing

- 1.8 Understanding control panel settings.
- 1.9 Installing Operating system Windows and Linux
- 1.10 PC Troubleshooting
- 1.11 CMOS Setup
- 1.12 Partitioning and formatting Harddisks.
- 1.13 Installing system and application software
- 1.14 Working with antivirus software
- 1.15 Preventive maintenance of a PC
- 1.16 Working with Backups and Archival utilities
- 1.17 Study of Laptop Hardware

2.0 Printers , Scanners, Cameras

- 2.1 Study of a) Inkjet Printer b) Laser Printer c) Dotmatrix Printer
- 2.2 Study of Scanner
- 2.3 Study of Web Cam

3. Computer Networking

- 3.1 **To study the functions of various networking devices used in local area networks.**
- 3.2 **Preparing the UTP cable for cross and direct connections using crimping tool**
- 3.3 **Connecting systems in a network using switch.**
- 3.4 IP addressing and Subnet masking
- 3.5 **Installing wireless access point**
- 3.6 **Remote login using Team viewer**
- 3.7 **Cloud sharing -Working with google drive -Permissions**
- 3.8 **Study the features of Windows 2000 server**

4.0 Fibre Optics

- 4.1 Setting up fiber analog link.
- 4.2 Setting up fiber digital link.
- 4.3 Study of modulation & Demodulation of light source by pulse width modulation technique.
- 4.4 To demonstrate Fibre optic Voice Link .
- 4.5 To demonstrate the NRZ & RZ modulation formats in Optical Communication.

MICROCONTROLLER APPLICATIONS LAB PRACTICE

SUBJECT TITLE : MICROCONTROLLER APPLICATIONS LAB PRACTICE

SUBJECT CODE : EC-509

PERIODS/WEEK : 04

PERIODS/SEMESTER : 60

Rationale: Microcontroller Applications Lab Practice is included in the same semester to ensure contiguity and give an opportunity for the students to reinforce their theoretical knowledge by practically verifying in the laboratory. care has been taken to match the Experiments with field requirements.

TIME SCHEDULE

S. No.	EXPERIMENT	No. of Periods
1.	COMPUTER SYSTEM(DESKTOP,LAPTOP)	20
2.	COMPUTER PERIPHERALS	10
3.	NETWORKING	20
4	FIBRE OPTICS	10
	Total	60

LIST OF EXPERIMENTS

1.Working with microcontroller kits and Simulators

- Familiarization of 8051 Microcontroller Kit
- Familiarization of 8051 simulator EDSIM 51 (or similar)
- Write small ALP to demonstrate different register addressing techniques

2. Practicing **Arithmetic instructions of 8051**

- a) Write an ALP to demonstrate Addition , subtraction , division and multiplication of 8 bit numbers using immediate data access.
- b) Write an ALP to Add and Subtract 16 bit numbers
- c) Write an ALP to Square and Cube program
- d) Write an ALP to find LCM of given numbers
- e) Write an ALP To find HCF of given numbers

3. Practicing Data transfer instructions

- a) Write an ALP to Block move - 10bytes of data from 0X30-0X39 to 0X40-0X49 (without overlap)
- b) Write an ALP to Block move - 10bytes of data from 0X30-0X39 to 0X35-0X39 (with overlap)
- c) Write an ALP to Block exchange – 10bytes of data between 0X30-0X39 to 0X40-0X49
- d) Write an ALP to Block move - 10bytes of data from 0X30-0X39 to 0X1000-0X1009 (Internal to external memory or vice versa)

4. Data Manipulation

- a) Smallest/Largest number in 10bytes of data from 0X30-0X39 (R3 – should store the smallest/largest number and R4 – should store address of the smallest/largest number)
- b) Search an element in the 10bytes of data from 0X30-0X39 (R3 =1, if element is found else R3=0)
- c) Sorting 10bytes of data from 0X30-0X39 in Ascending order
- d) Sorting 10bytes of data from 0X30-0X39 in Descending order

5. Boolean & Logical instructions :

- a) Find 2's complement of a number using (CMP)
- b) Packed to Unpacked BCD(bit Masking) Using (ANL)
- c) Unpacked BCD to ASCII Using (ORL)
- d) ASCII to BCD Using(XRL)

6. Implementing Counters

- a) To implement a HEX up/down counter - (Program should check value @R0=0X30, if 0X30=0 then up counter else down counter)
- b) To implement BCD(00-99) up/down counter - (Program should check value @R0=0X30, if 0X30=0 then up counter else down counter)

7. Implementing Delays and Timers

- a) To write a program in assembly language and in "C" produce required time delay a)Using instructions only b) Using Timers
- b)To write a program in assembly language and C to demonstrate Call and return instructions with port programming
- c) To write a program in assembly language and C to demonstrate Logical or Delay loop using Call and return instructions

8. Using Interrupts and Flags

To Write a program to generate a square wave of 50 Hz on pin 1.2 . Assume that crystal frequency is 11.0592 MHz

9. Micro controller interfacing

- 9.1 Interfacing Switches and LEDS to 8051
 - a) To make an LED connected to port 1.5, light up for specific time on pressing a switch connected to port 2.3
 - b) Write a Program to make an LED connected to pin 1.7 to blink at a specific rate
 - c) Connect a Relay in place of LED to control a AC 230 V Lamp
- 9.2 To Interface a Single DOTMATRIX DISPLAY and display the given number
- 9.3 To Interface 3-digit 7SEGMENT LED DISPLAY using timer for digit scan
- 9.4 To Interface a (3x4 matrix) Key Board to 8051
- 9.5 To control the direction of rotation of a small DC motor
- 9.6 To interface I²C BUS Device using DS1307 IC .
- 9.7 To interface a) ADC IC b) DAC IC

9.8 To interface Microcontroller serial interface to PC COM port

10. Burning of an EPROM and Loading flash controllers for 8051

FIELD PRACTICES

Subject Title : **FIELD PRACTICES**
Subject code : **EC-510**

Periods/Week : **07**

Periods/Semester : **105**

Rationale: Field practices subject is introduced as a substitute for industrial Training. This course is aimed at imparting same skills a student would acquire in the industry during the initial training period. In other words, industry-like environment is simulated in the institution during this course to prepare the students for Industry.

TIME SCHEDULE

1	Industrial Safety, First Aid and Role play (supervisory role in labs, inventory, procedures, log maintenance, house keeping, dress code, tie, shoe etc.....)	7
2	Identification and familiarization of various tools/equipment used in electronic industry	7
3	Familiarization of measuring equipment used in electronic industry	7
4	Preparation of PCB using copper clad for a particular circuit (Use ORCAD)	7
5	Design and drawing a circuit for an industrial application/ electronic machine	7
6	Fabrication/Rigging up the circuit for above exercise. Acquiring knowledge on different soldering technologies available in the market. SMD component soldering practice Industrial Visit to a	7

	PCB manufacturing industry	
7	Industrial Visit to a PCB Manufacturing Industry	7
8	Reverse Engg: Derive circuit from circuit board and interpretation of circuit diagrams	7
9	Testing the given circuit and finding faults and their rectification	7
10	Simulation of electronic circuit using different tools like Pspice and Multisim , Matlab etc	7
11	Industrial visit to local telephone exchange/ TV relay station	7
12	a) Maintenance/ Testing of Domestic appliances b) Maintenance/ Charging of the batteries	7
13	Installation and Testing of Solar panels, UPS and inverters	7
14	Industrial visit to a process industry	7
15	Industrial Safety, First Aid and Role play (inventory, procedures, log maintenance, housekeeping)	7

OBJECTIVES

On completion of the practice the student shall be able to practice and perform/implement at the Institution /Hostel/ nearby establishment along with the staff

1.0 Identification and familiarization of various tools/equipment used in electronic industry

- 1.1 Cleaning the equipment
- 1.2 Student should attend laboratory with in-shirt and wearing formal shoes.
- 1.3 Identification of Electronic components and noting their numbers
- 1.4 Finding the significance of the numbers
- 1.5 Identification of Different tools used in electronic industry and their applications

2.0 Familiarization of measuring equipment used in electronic industry

- 2.1 Cleaning the equipment
- 2.2 Student should attend laboratory with in-shirt and wearing formal shoes.
- 2.3 Identification of electronic measuring equipment like multi meter, ammeter, voltmeter, power meter and CRO
- 2.4 Observing the front panels of each instrument
- 2.5 Drawing the front panel diagrams
- 2.6 Identifying the Various parameters measured using the above instruments

3.0 Preparation of PCB using copper clad for a particular circuit (Use ORCAD)

- 3.1 Cleaning the equipment
- 3.2 Student should attend laboratory with in-shirt and wearing formal shoes.
- 3.3 Develop the PCB layout using ORCAD for simple circuits with timer 555 IC(LED Flasher, Tone Generator)
- 3.4 Take print out of the BOM circuit diagram, pcb layout.
- 3.5 Transfer the layout onto the copper clad board. Drill holes as per the required sizes then etch the remaining clad.
- 3.6 Fix the components onto the pcb and solder neatly.
- 3.7 Test the various check points and apply power supply to get the expected results

4.0 Design and drawing a circuit for an industrial application/ electronic machine Cleaning the equipment

- 4.1 Student should attend laboratory with in-shirt and wearing formal shoes.
- 4.2 Identify the one simple industrial application by the lecturer
- 4.3 Design the circuit required for above application
- 4.4 Draw the circuit on a paper
- 4.5 Identify and list the components and equipment required

5.0 Fabrication/Rigging up the circuit for above exercise. Acquiring knowledge on Different soldering technologies available in the market

- 5.1 Cleaning the equipment
- 5.2 Student should attend laboratory with in-shirt and wearing formal shoes.
- 5.3 Identifying the components and tools required for rigging up the circuit
- 5.4 Preparing PCB for the above circuit
- 5.5 Drilling holes for installing components on the PCB
- 5.6 Soldering the components on the PCB
- 5.7 Identify the various soldering techniques

6.0 Industrial Visit to a PCB manufacturing industry

- 6.1 Student should attend industry with in-shirt and wearing formal shoes.
- 6.2 The student should maintain utmost discipline in the industry premises
- 6.3 Student should accompany the lecturer to the industry
- 6.4 Student should observe the various activities in the industry
- 6.5 Note down the specifications of various machines used in industry
- 6.6 Note down the various operations carried out by industry
- 6.7 Prepare report on industrial visit and submit to Lecturer
- 6.8 Each Student should give a seminar on the visit

7.0 Reverse Engg: Derive circuit from circuit board and interpretation of circuit diagrams

- 7.1 Cleaning the equipment
- 7.2 Student should attend laboratory with in-shirt and wearing formal shoes.
- 7.3 Derive the circuit diagram from a given PCB with components
- 7.4 Redraw the circuit diagram
- 7.5 Understand the functioning of the circuit
- 7.6 List the various stages in the circuit
- 7.7 Interpret the functional specifications of the board
- 7.8 Note down the active devices numbers (Diode, IC and transistors)

8.0 Testing the given circuit and finding faults and their rectification

- 8.1 Cleaning the equipment
- 8.2 Student should attend laboratory with in-shirt and wearing formal shoes.
- 8.3 Identify the given circuit
- 8.4 Identify the function of the circuit
- 8.5 List various components in the circuit
- 8.6 Test the given circuit and compare with its theoretical results
- 8.7 Identify the faults in the circuit
- 8.8 Rectify the fault and test the circuit again

9 Simulation of electronic circuit using different tools like Pspice and Multisim

- 9.1 Student should attend laboratory with in-shirt and wearing formal shoes.
- 9.2 Switch on the Computer system
- 9.3 Go to the particular software tool like PSPICE or Multisim
- 9.4 Go to the design console (Multisim)
- 9.5 Draw the given circuit diagram using tools present in the various tools console (Multisim)
- 9.6 Simulate the Circuit and get the PSPICE code on PSPICE console
- 9.7 Apply inputs and observe the outputs
- 9.8 Observe the waveforms on equipments available on equipment console

10 Industrial visit to local telephone exchange/ TV relay station

- 10.1 Student should attend industry with in-shirt and wearing formal shoes.
- 10.2 The student should maintain utmost discipline in the industry premises
- 10.3 Student should accompany the lecturer to the industry
- 10.4 Student should observe the various activities in the industry
- 10.5 Note down the specifications of various machines used in industry
- 10.6 Note down the various operations carried out by industry
- 10.7 Prepare report on industrial visit and submit to Lecturer
- 10.8 Each Student should give a seminar

11 Maintenance /Charging of the Batteries

- 11.1 Record the Electrical specifications of the Battery.
- 11.2 Record the specific gravity of the Electrolyte of each cell using Hydrometer.
- 11.3 Note the level of Electrolyte in each cell.
- 11.4 Add the distilled water if necessary.
- 11.5 Record the Voltage of each cell using multi-meter.
- 11.6 Keep the ventilating plugs open while charging if it is not a maintenance free battery.
- 11.7 Connect the battery to the Battery charger by selecting proper method (constant current, Constant voltage), and voltage.
- 11.8 Observe the temperature of the battery after charging.
- 11.9 Clean the terminals and apply Grease/petroleum Gelly to avoid sulphation.
- 11.10 Testing and repair of domestic appliances

11.8 Perform the dismantling, assembling, and testing of following Domestic appliances with Electronic tools: (Television, Computer, Printer, Setup box, Remotes)

12.0 Installation and Testing of solar panels & appliances, Ups, Inverters

12.1 Identify the solar collector used.

12.2 Note the applications of solar energy in different areas like water heaters, driers, Cookers, furnaces, Green houses, water distillation, Pond Electric power plant.

12.3 Identify the type of solar cell, different module, panel and array construction.

12.4 Note the rating of UPS and sequence of operations of switching ON/OFF.

12.5 Record the maintenance of UPS, batteries and inter connections.

12.6 Note the block diagram of Inverter and describe about each block.

12.7 Design the rating of Inverter as per the given load

12.8 Prepare the external wiring to connect an Inverter to a particular installation.

12.9 Observe the rating of the MG set .

12.10 List the electrical accessories required to connect the Generator output through panel board.

12.11 List the electrical accessories required to connect Motor to an Electric supply.

13.0 Industrial visit to a process industry

13.1 Student should attend industry with in-shirt and wearing formal shoes.

13.2 The student should maintain utmost discipline in the industry premises

13.3 Student should accompany the lecturer to the industry

13.4 Student should observe the various activities in the industry

13.5 Note down the specifications of various machines used in industry

13.6 Note down the various operations carried out by industry

13.7 Prepare report on industrial visit and submit to Lecturer

13.8 Each Student should give a seminar

14.0 Industrial Safety, First Aid and Role play

14.1 Learn about the use of fire extinguishes

14.2 Safety precautions to be taken in case fire accidents in electronic industry

14.3 Taking demonstrations from Fire service dept of Government

14.4 Learn about first aid required in case of electrical shocks

14.5 Keeping rehearsals regularly and playing a role

Student should be given a role play in task management.

INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP

Subject Title : INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP
Subject Code : EC-601
Periods/Week : 04
Periods/Semester : 60

Rationale: Industrial management Entrepreneurship subject is aimed at giving the concepts of Industry , its functioning and management to encourage the students to set up their own enterprise. Care has been taken to cover all the essential topics including quality management.

TIME SCHEDULE

SI	Major Topics	No. of periods	Marks	Short Answer Questions	Essay Questions
1	Principles of Management, Organisation structure and behaviour	15	26	02	2
2	Production, Materials Management, Marketing & Sales.	25	38	04	03
3	Introduction to ISO 9000 & T.Q.M.	10	26	02	02
4	Role of Entrepreneur and Entrepreneurial Development	10	16	02	01
	Total	60	110	10	8

OBJECTIVES

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

1.0 Understand the principles of management as applied to industry.

- 1.1 Define industry, commerce (Trade) and business.
- 1.2 Know the need for management.
- 1.3 Understand the evolution of management
- 1.4 Explain the principles of scientific management.
- 1.5 Understand functions of Management.

- 1.6 Differentiate between management and administration.
- 1.7 Understand types of ownerships
- 1.8 Differentiate types of ownerships.
- 1.9 Understand salient features of joint stock companies.
- 1.10 Understand the philosophy and need of organisation structure of an industry.
- 1.11 List types of organisation structures.
- 1.12 Explain line organisation and its advantages and disadvantages.
- 1.13 Understand the line and staff organisation.
- 1.14 List the advantages and limitations of line and staff organisation.
- 1.15 Explain functional organisation and its advantages & disadvantages.
- 1.16 Understand organisational behaviour.
- 1.17 Conduct job analysis.
- 1.18 Assess the incurring applicants.
- 1.19 Outline the selection process.
- 1.20 Understand the sources of manpower.
- 1.21 State motivation theories.
- 1.22 Explain Maslow's theory.

2.0 Understand the different aspects of production, Materials Management and Marketing & Sales

- 2.1 Differentiate and integrate production, planning and control.
- 2.2 Relate the production department with other departments.
- 2.3 State the need for planning and its advantages.
- 2.4 Explain the stages of Production, planning and control.
- 2.5 Explain routing methods.
- 2.6 Explain scheduling methods.
- 2.7 Explain dispatching.
- 2.8 Draw PERT/CPM networks.
- 2.9 Identify the critical path.

3.0 Understand the concepts of materials and Market management

- 3.1 Explain the role of the materials in Industry.
- 3.2 Derive expression for inventory control.
- 3.3 Explain ABC analysis.
- 3.4 Define safety stock.
- 3.5 Define reorder level.
- 3.6 Derive an expression for economic ordering quantity.
- 3.7 Study Stores layout and duties of store keeper
- 3.8 List various material handling equipment
- 3.9 Explain the concept of cost.
- 3.10 List out the elements of cost.
- 3.11 Explain the concept of contribution.
- 3.12 Explain break-even analysis.
- 3.13 Explain marketing functions.

Understand the principles of Marketing management.

- 3.14 Explain Sales function.

- 3.15 List out market conditions.
- 3.16 Differentiate Sellers and Buyers' market.
- 3.17 Differentiate monopoly, oligarchy, and perfect competition.
- 3.18 Conduct market and demand surveys.
- 3.19 Differentiate product and production analysis.

4.0 Understand ISO 9000 & TQM.

- 4.1 Understand the concept of quality.
- 4.2 Know the quality systems and elements of quality systems.
- 4.3 Know the principles of quality Assurance.
- 4.4 Know the Indian Standards on quality systems.
- 4.5 Know the evolution of ISO standards.
- 4.6 Discuss ISO standards and ISO 9000 series of quality systems.
- 4.7 State the constituents of ISO 9000 series of standards for quality systems.
- 4.8 State the outstanding features and drawbacks of ISO 9000 series of standards.
- 4.9 List the beneficiaries of ISO 9000.
- 4.10 Understand 5-S principles and ZERO DEFECT.

5.0 Understand the role of entrepreneur in economic development and in improving the quality of life.

- 5.1 Outline the concepts of Entrepreneurship.
- 5.2 Define the word entrepreneur.
- 5.3 Determine the role of Entrepreneurship.
- 5.4 Describe the profile of an entrepreneur.
- 5.5 Explain the requirements of an entrepreneur.
- 5.6 Outline the expectations of Entrepreneurship.
- 5.7 Determine the role of entrepreneurs in promoting Small Scale Industries.
- 5.8 Describe the details of current self-employment schemes.
- 5.9 Explain the method of product selection.
- 5.10 Explain the factors influencing the site selection.
- 5.11 Outline the methods of plant layout.
- 5.12 State the needs for a planned and co-ordinated effort.
- 5.13 State the importance of follow up.
- 5.14 List the financial assistance programmes.
- 5.15 List out the organisations that help an entrepreneur.
- 5.16 List features of demand survey.
- 5.17 List features of market survey.

COURSE CONTENTS

1. Principles of management, Organisation structure and Behaviour

Definitions of Industry, Commerce and Business. Evolution of - Types of ownership – Sole proprietorship, Partnership management theories. Principles of Scientific Management, functions of management. Difference of administration and management, Private limited, Public limited company, Industrial Cooperatives, Philosophy, types of Organisations, Line and Staff and functional organisations. Advantages and limitations - Effective organisation. Job analysis, Assessing applicants, selection, motivation, different theories – Maslow's theory.

2. Production, Materials Management and Marketing & Sales

Production, planning and control, relation with other departments, need for planning and advantages Routing, scheduling, despatching - PERT and CPM, - simple problems. Materials in industry, inventory control model, ABC Analysis - Safety stock, re-order, level, Economic ordering quantity – Cost, Elements of Cost, Contribution, Break even analysis, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Sellers and Buyers markets - Marketing, Sales, Market conditions, monopoly, oligarchy, perfect competition, Pricing Policies. Market Survey, Product and production.

3. Introduction to ISO 9000 and TQM.

Concept of quality discussed by B. Crosby W. Edward, Deming, Joseph M. Jura Kooru Ishikawa, Genichi Taguchi, Shigco Shingo.

Quality systems – Definitions of the terms used in quality systems like, quality policy, quality management, quality systems, quality control and quality assurance.

Elements quality systems : Management responsibility, Quality system, contract review, design control, document control, purchasing, purchaser – supplied product, product identification and traceability, process control, Inspection and testing.

Principles of quality assurance – Definition of quality assurance.

Indian standards on quality systems – Main features of IS 13999 : 1990, IS 14000 : 1990, IS 14004 : 1990, IS 14001: 1990, IS 14002 : 1990, IS 14003: 1990.

Know the necessity of International standards – Evolution of ISO. **5-S** principles – importance – meaning – approach – benefits

Various standards under ISO – Outstanding features of ISO 9000 series of standards – ISO 9000 Phenomenon ISO 9000 series of quality systems – Constituents of ISO 9000 series of standards for quality systems.

Drawbacks of ISO 9000 series of standards, list the beneficiaries of ISO 9000 (Whom does ISO 9000 help).

4. Role of Entrepreneur & Entrepreneurial Development.

Concept, definition, role, expectation, entrepreneurship Vs Management, promotion of S.S.I. Self – employment schemes. Product selection, site selection, plant layout, profile and requirement, need for a planned and co-coordinated effort, following, Institutional support needed, Financial assistance programmes, Demand survey, Market survey.

REFERENCE BOOKS

1. Industrial Engineering and Management - by O.P Khanna
2. Production Management- by Buffa.
3. Engineering Economics and Management Science - by Banga & Sharma.
4. S.S.I Hand Book by S.B.P. Publishers.
5. Personnel Management by Flippo.
6. Industrial Management and Entrepreneurship by Zakria Baig.
7. Entrepreneurship – by NITTT&R, Chennai.

INDUSTRIAL ELECTRONICS

Subject Title : Industrial Electronics

Subject Code : EC-602

Periods/Week : 04

Periods/Semester : 60

Rationale: Industrial Electronics subject is included in the VI semester to make the students understand the applications of Electronic principles they have learnt in the previous semesters. This course will no doubt, make the students feel confident to face the interviews and work in the field when they join the industries.

TIME SCHEDULE

SI	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Power Electronic Devices	14	26	2	2
2	Transducers & Ultrasonics	12	26	2	2
3	Industrial heating & Welding	10	21	2	1 ½
4	PLC & Programming	12	21	2	1 ½
5	Control Engg	12	16	2	1
	Total	60	110	10	8

OBJECTIVES

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

1.0 Understand the construction and working of Power Electronic Devices

- 1.1 List different thyristor family devices.
- 1.2 Sketch the ISI circuit symbols for each device.
- 1.3 Describe constructional details of SCR.
- 1.4 Draw & Explain the Volt-Ampere characteristics of SCR.
- 1.5 Mention the ratings of SCR.
- 1.6 Explain the construction of GTO SCR
- 1.7 Compare the characteristics of GTO SCR and SCR.
- 1.8 Give constructional details of Diac & Triac.

- 1.9 Draw & Explain Volt-ampere characteristics of Diac & Triac under forward/Reverse bias.
- 1.10 State the different modes of Triac triggering.
- 1.11 Distinguish between SUS, SBS, SCS & LASCR
- 1.12 Draw & Explain SCR circuit triggered by UJT.
- 1.13 Explain power control circuits Diacs, Triacs & SCR's
- 1.14 Briefly explain the working of Reverse conducting thyristor (RCT), Asymmetrical SCR (ASCR), Power BJT, Insulated gate Bipolar transistor (IGBT), MOS-controlled thyristors (MCT) with characteristics.
- 1.15 Describe the mechanism in protecting power devices.
- 1.16 Study of Manufacturer's data sheet of power electronic devices.
- 1.17 List the applications of all power electronic devices.
- 1.18 Illustrate SMPS with block diagram.

2.0 Understand the working of transducers and Ultrasonics

- 2.1 Classify transducers on the basis of principle of operation and applications.
- 2.2 Explain the working principle, construction and applications of strain gauge.
- 2.3 Explain the working principle, construction and applications of potentiometric transducer.
- 2.4 Explain the working principle, construction and applications of capacitive and inductive transducers.
- 2.5 Explain the working principle, construction and applications of LVDT.
- 2.6 Explain the working principle, construction and applications of Piezo electric transducer.
- 2.7 Explain the working principle and applications of RTD & Thermocouple transducer.
- 2.8 Explain the application of transducer in Accelerometer, servomotors, and Tachogenerators.
- 2.9 Explain the term Ultrasonic.
- 2.10 Mention methods of generating ultrasonic waves.
- 2.11 Draw and explain pulsed-echo ultrasonic flaw detector

3.0 Industrial Heating & welding

- 3.1 Classify industrial heating methods.
- 3.2 Explain the principle of induction heating.
- 3.3 List applications of induction heating.
- 3.4 Draw the circuit of HF power source for induction heating and explain its working.
- 3.5 Explain the principle of dielectric heating.
- 3.6 Describe the electrodes used in dielectric heating & method of coupling to RF generator.
- 3.7 Mention the applications of dielectric heating.
- 3.8 Explain the principle of resistive welding.
- 3.9 Draw the basic circuit of AC resistive welding and explain its working.
- 3.10 Mention applications of resistive welding.

4.0 Understand architecture of PLCs & Programming

- 4.1 Explain the basic principle of PLCs.
- 4.2 Explain the power supply module, CPU, Bus unit, and I/O Module, Interfacing Module and programmer module.
- 4.3 Explain the working of PLCs.
- 4.4 Describe the statement list Ladder diagrams and control systems flow charts.
- 4.5 Write Ladder program using bit instructions Timer instructions and counter instructions

- 4.6 List types of PLCs.
- 4.7 Know about Siemens , Allenbradly PLC instruction set and programming concepts.
- 4.8 Explain applications to a simple process control.

5.0 Control Engineering

- 5.1 Explain the basic block diagram control system
- 5.2 Explain an open loop and closed loop system with gain equations
- 5.3 Block diagram reductions methods
- 5.4 Practice reducing 5 examples.
- 5.5 Explain system stability
- 5.6 State the importance of poles and zero
- 5.7 Routh Hurwitz criterion
- 5.8 Bode plots

COURSE CONTENTS

1. Power Electronic Devices

Types of power semiconductor devices – SCR, Triac, Power BJT, IGBT Construction,

Working principle of all devices, symbol. Two transistor analogy for SCR – V-I characteristics, Forward break over voltage, latching

current, holding current, turn on triggering time, turn off time - triggering of

SCR using UJT – protection of power devices-Applications.

2. Transducers & Ultrasonics

Introduction, classification of transducers, strain gauge, variable

resistance transducer, capacitive, inductive, piezoelectric, LVDT.

Thermocouples, Transducer applications - accelerometers,

Tachogenerators, Servomotors Ultrasonic- generation – Pulsed echo

ultrasonic flaw detector

3. Industrial Heating and Welding

Induction heating, Dielectric heating, and Resistance welding.

4. PLCs & Programming

Relay logic control panel – PLC based control panel - Architecture of PLC.

Programming software – Bit instructions – Timer/Counter instructions – Compare instructions – Move instructions – Math instructions – Program control instructions - Memory organization in PLC – analog inputs.

5. Control Engineering

basic block diagram - open loop and closed loop system - gain equations-Block diagram reductions- system stability-importance of poles and zero-Routh Hurwitz criterion-Bode plots

REFERENCE BOOKS

1. Industrial Electronics and Control by S.K.Bhattacharya, S.Chatterjee
2. User manuals of PLCs, SCADA
3. Industrial Electronics & Control by Bhattacharya, TTTI Chandigarh
4. Industrial Electronics by Harish .C Rai, Khanna Publications
5. Power Electronic systems Theory and Design by Jai. P. Agrawal (Pearson Education)
6. Industrial Electronics and Control by Biswanath Paul (p.H.I)
7. Power Electronics Principles and Applications by Joseph Vithayathis (McGraw Hill)
8. Power Electronics Circuits, Devices and Applications by M.H.Rashid
9. Introduction to Programmable Logic controllers by Gary Dunning
10. Control Engg, by Nagarath & Gopal
11. Power Electronics by Jamil Asghar – PHI, New Delhi.
12. Power Electronics – Devices, Circuits and applications PHI, New Delhi
13. Industrial Electronics by Kissell PHI
14. Industrial Electronics by Mithal
15. Industrial Electronics by P.C.Sen.
16. Industrial Electronics by Berde
17. Advanced Power Electronics by P.C.Sen.
18. Industrial & Power Electronics by Harish Rai.

ELECTRONIC PRODUCT DESIGN & QUALITY ASSURANCE

Subject Title : **Electronic Product Design and Quality Assurance**

Subject Code : **EC-603**

Periods/Week : **04**

Periods/Semester : **60**

Rationale: This is a new subject introduced in the final year based on the suggestions from the industry. This subject is aimed to make the students understand the steps involved in product design and quality assurance. This course helps the students immediately adapt to the procedures in R&D departments in the industry.

Sl	Major Topics	No of Periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Product Design and Development Stages	14	29	3	2
2	PCB design	14	26	2	2
3	Hardware design and Testing	12	16	2	1
4	Product testing	12	26	2	2
5	Documentation	06	13	1	1
Total		60	110	10	8

OBJECTIVES

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

1.0 Understand Product design and Development stages

1.1 Introduction

1.2 Know The Techno Commercial Feasibility of specifications

1.3 State R&D prototype Assessment of reliability.

- 1.4 Explain Concept of Ergonomic and aesthetic considerations of pilot production
- 1.5 Estimate power supply requirements
- 1.6 List two types of Power supply protection devices
- 1.7 Define Noise reduction.
- 1.8 Explain Grounding
- 1.9 Explain Shielding and guarding techniques
- 1.10 Explain Thermal management

2.0 Know PCB design

- 2.1 General layout considerations for analog and digital circuits Power and ground traces
- 2.2 State routing for better Decoupling
- 2.3 State Recommendations for decoupling and bypassing.
- 2.4 Explain layout considerations for mixed signal circuits
- 2.5 Explain Component mounting considerations.
- 2.6 study of packages for discrete devices and ICs calculation of parasitic elements in PCB
- 2.7 List two types of High speed EMI reduction methods in PCB designing
- 2.8 Define Cross talk

3.0 Understand Hardware design and Testing

- 3.1 Use of logic analyzer ,
- 3.2 Explain Digital storage oscilloscope
- 3.3 Explain Mixed signal oscilloscope for hardware testing ,
- 3.4 List two types of signal integrity issues
- 3.5 State the uses and limitations of different types of analysis
- 3.6 Explain DC operating point analysis
- 3.7 Explain Ac analysis, Transient analysis

4.0 Know Product testing

- 4.1 Introductions to product testing
- 4.2 Environmental testing: Dry heat
- 4.3 Vibration < temperature cycling
- 4.4 Bump and Humidity tests as specified in IS standards
- 4.5 EMI EMC compliance testing standardization
- 4.6 UL and CE Certification of industrial electronic products.

5.0 Understand Documentation

- 5.1 Explain PCB documentation
- 5.2 Understand Assembly and fabrication related documentation Laminate grade
- 5.3 Understand drilling details Plating ,
- 5.4 Explain bare board testing
- 5.5 Explain product documentation Bill of materials Production test specifications
- 5.6 Know product documentation Bill of materials Production test specifications
- 5.7 Describe Instruction, user manual service maintenance manual

COURSE CONTENTS

1. Introduction to Product design and Development stages :**Introduction, Know The Techno Commercial Feasibility of specifications, Explain R&D prototype Assessment of reliability, Concept of Ergonomic and aesthetic considerations of pilot production, Estimating power supply requirements, Power supply protection devices, Noise reduction,. Grounding, Shielding and guarding techniques, Thermal management,**

2. PCB design: General layout considerations for analog and digital circuits Poer and ground Traces, routing for better Decoupling, Recommendations for decoupling and bypassing, layout considerations for mixed signal circuits, Component mounting considerations,study of packages for discrete devices and ICs calculation of parasitic elements in PCB,High speed EMI reduction methods in PCB designing, cross talk,

3. Hardware design and Testing:Use of logic analyzer ,Digital storage oscilloscope, Mixed signal oscilloscope for hardware testing ,signal integrity issues ,use and limitations of different types of analysis, DC operating point analysis , Ac analysis, Transient analysis,

4. Product testing: Introduction to product testing,Environmental testing: Dry heat, Vibration < temperature cycling, Bump and Humidity tests as specified in IS standards, EMI EMC compliance testing standardization, UL and CE Certification of industrial electronic products,

5.Documentation :PCB documentation, Assembly and fabrication related documentation Laminate grade, drilling details Plating, bare board testing, product documentation Bill of materials Production test specifications, product documentation Bill of materials Production test specifications, Instruction. User manual service maintenance manual,

REFERENCE:

1. System engineering management by new York: Wiley
2. Electronic Product Design, R.G.Kaduskar, V.B.Baru, Wiley India
3. Printed Circuit Board design and technology-Walter CBosshart TMH-CEDT
4. Handbook of Printed Circuit manufacturing – Raymond H. Clark (Van Nostrand Reinhold Company, New York)
5. Electronic testing and fault diagnosis –G.C. Loveday (Ah wheeler Publication, India)
6. Electronics Engineers reference book 5th Edition – Edited by F.F. Mazda Butterworths Publication Co., UK)
7. Principles of Reliable Soldering Techniques, Sengupta R., New Age International

MOBILE COMMUNICATION

Subject Title : Mobile Communication

Subject Code : EC-604

Periods/Week : 04

Periods/Semester : 60

Rationale: The Course Mobile communication is included keeping the ever growing man power requirements in Telecommunications Industry. This course covers the fundamentals of mobile communications.

TIME SCHEDULE

SI	Major Topics	No. of periods	Weightage of marks	Short Answer Questions	Essay Questions
1	Introduction to wireless communication system	8	16	2	1
2	Cellular system design fundamentals	14	26	2	2
3	Multiple access techniques	16	26	2	2
4	Digital Cellular mobile system	14	21	2	2
5	Modern wireless communication systems	8	16	2	1
	Total	60	110	10	8

OBJECTIVES

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

1.0 Introduction to wireless communication system

- 1.1 List the limitations of conventional mobile phone system.
- 1.2 Evolution of cellular mobile communication system.
- 1.3 Define the terms mobile station and base station
- 1.4 State the functions of Mobile switching centre (MSC)
- 1.5 List various channels in mobile communication

- 1.6 Define voice and control channels in mobile communication
- 1.7 Define Roamer
- 1.8 List the features of various mobile radio systems around the world
- 1.9 Define simplex, half duplex and full duplex channels.
- 1.10 Distinguish between frequency division duplex (FDD) and time division duplex (TDD).
- 1.11 Define uplink and downlink channels in mobile communication
- 1.12 Draw the block diagram of a basic cellular system.
- 1.13 Explain the process of call progress in a cellular telephone system

2.0 Cellular system design fundamentals

- 2.1 State the need for cellular concept in mobile communication
- 2.2 State the need for hexagonal cell site.
- 2.3 Explain the concept of Frequency reuse.
- 2.4 Explain capacity of a mobile cellular system.
- 2.5 Define the term Cell
- 2.6 Define the term cluster
- 2.7 Explain the capacity of a cellular system
- 2.8 State the relation between capacity and cluster size.
- 2.9 State the probable sizes of cluster with formula.
- 2.10 Define co-channel interference.
- 2.11 State the relation between co-channel interference and system capacity.
- 2.12 Define Hand-off in mobile communication
- 2.13 Explain channel assignment strategies
- 2.14 List two methods of improving channel capacity
- 2.15 Explain Cell splitting and sectoring
- 2.16 Define micro-cell concept
- 2.17 Define umbrella cell
- 2.18 Solve problems on system capacity.

3.0 Multiple access techniques

- 3.1 State the need for multiple access techniques
- 3.2 List the three types of multiple access techniques.
- 3.3 Explain FDMA
- 3.4 List the features of FDMA
- 3.5 Explain TDMA
- 3.6 Draw the TDMA frame structure
- 3.7 List the features of TDMA
- 3.8 Explain the concept of spread spectrum technique
- 3.9 List two types of spread spectrum techniques
- 3.10 Explain the Direct sequence spread spectrum (DSSS) technique
- 3.11 Explain the frequency hopped spread spectrum (FHSS) multiple access technique.
- 3.12 Explain code division multiple access technique.
- 3.13 List the features and advantages of CDMA
- 3.14 Compare FDMA, TDMA and CDMA
- 3.15 State near-far effect in CDMA
- 3.16 Explain the concept of soft hand off and power control in CDMA

4.0 Digital Cellular mobile system

- 4.1 List the specifications of analog mobile phone system (Advanced mobile phone system AMPS).
- 4.2 Explain the radio interface of AMPS.
- 4.3 State the features of Narrow band AMPS (N-AMPS)
- 4.4 List the drawbacks of analog cellular system.
- 4.5 List the features of digital cellular system.
- 4.6 Explain the United States Digital Cellular system (IS-54)
- 4.7 Explain the radio interface specifications of USDC
- 4.8 Explain the Global system for mobile communication (GSM)
- 4.9 Explain the GSM architecture with block diagram.
- 4.10 List various interfaces in GSM architecture
- 4.11 Explain the GSM radio subsystem
- 4.12 Explain the frame structure of the GSM
- 4.13 List the service and security aspects of GSM.
- 4.14 Compare AMPS and GSM
- 4.15 List the advantages of GSM over AMPS

5.0 Modern wireless communication systems

- 5.1 List the draw backs of GSM system.
- 5.2 List the features of GPRS
- 5.3 List the features of EDGE
- 5.4 Compare the features of GSM, GPRS and EDGE systems
- 5.5 List specifications of Digital European Cordless Telecommunication (DECT) system.
- 5.6 Draw the architecture of DECT
- 5.7 Explain the architecture of DECT
- 5.8 Basic concept of Wireless local loop (WLL)
- 5.9 List the salient features of 3G system
- 5.10 List the advantages of 3G over earlier versions
- 5.11 List the basic concepts of 4G aspects
- 5.12 Introduction to Iridium system
- 5.13 Introduction to global star system.

COURSE CONTENTS

1. Introduction to wireless communication systems : Evolution of cellular mobile communication-basic cellular system-various mobile radio systems-important definitions-simplex, half duplex and full duplex channels-FDD- TDD-process of call progress

2. Cellular system design fundamentals: Cellular concept-frequency reuse-capacity of a cellular system-cochannel interference-hand off-channel assignment-Methods of improving coverage and capacity- micro cell-umbrella cell- problems.

3. Multiple access techniques: Introduction-types of multiple access techniques-FDMA-TDMA-spread spectrum technique-DSSS-FHSS-CDMA-soft hand off- near far effect-power control

4. Digital Cellular mobile system :Advanced mobile phone system AMPS-Concepts of digital cellular system-USDC (IS-54)-GSM-GSM architecture-GSM radio subsystem-service and security aspects-frame structure

5. Modern wireless communication systems: GPRS-EDGE-DECT-WLL-3G mobile phone system-4G aspects-salient features-iridium system-global star system

REFERENCE BOOKS

1. Mobile and Personal communication systems and services by Raj Pandya, PHI
2. Wireless communications-Principles and practice by Theodore S. Rappaport, PEARSON
3. Mobile Cellular Telecommunications-Analog and Digital systems by William C. Y. Lee, McGrawHill
4. Mobile Communications by Jochen Schiller, PEARSON

Advanced Micro Controllers & DSP

Subject title : Advanced Micro Controllers & DSP

Subject code : EC-605

Periods per week : 04

Periods / Semester : 60

Rationale: The course Advanced microcontrollers & DSP is introduced in the VI semester keeping in view the vast developments in the field of microcontrollers. This helps the students to get good job opportunities and have them an edge over others .

TIME SCHEDULE

Sl	Major Topics	Periods	Weightage of Marks	Short Type	Essay Type
1	PIC MICRO CONTROLLERS	15	29	3	2
2	MCS-96 MICROCONTROLLERS	15	26	2	2
3	ARM MICRO CONTROLLERS	12	23	1	2
4	INTRODUCTION TO DSP PROCESSORS	18	32	4	2
5	Introduction to embedded systems and RTOS				
	TOTAL	60	110	10	8

OBJECTIVE:

1.0 Introduction to PIC micro controller

- 1.1 Study about PIC micro controller family
- 1.2 Describe PIC16F8XX and PIC16CX/7X families
- 1.3 Describe PIC16F877
- 1.4 Explain Features of PIC16F877
- 1.5 Familiarize Pin diagram of PIC16F877
- 1.6 Explain Block diagram of PIC16F877
- 1.7 Explain Instruction Set of PIC16F877
- 1.8 Explain Memory Organization of PIC16F877
- 1.9 List any 10 Applications of PIC Micro Controller.

2.0 Describe MCS- XX family

- 2.1 Describe MCS – 96 Microcontrollers
- 2.2 List Important Features of MCS – 96 Microcontrollers
- 2.3 Familiarize Pin Diagram of MCS – 96 Microcontrollers
- 2.4 Explain Internal Architecture of MCS – 96 Microcontrollers
- 2.5 Explain Memory Map of MCS – 96 Microcontrollers
- 2.6 Explain addressing Modes of MCS – 96 Microcontrollers
- 2.7 Explain Instruction set of MCS – 96 Microcontrollers.

3.0 Introduction to ARM Microcontrollers

- 3.1 Explain ARM Core Architecture,
- 3.2 Study the versions of ARM
- 3.3 List the 10 application of various versions of ARM
- 3.4 Explain Memory Map of ARM
- 3.5 Explain Addressing Modes ARM
- 3.6 Explain Instruction set of ARM
- 3.7 List 5 Important Features of ARM

4.0 Introduction to programmable DSPs

- 4.1 Explain Multiplier and Multiplier Accumulator (MAC)
- 4.2 Define Modified Bus Structures and Explain?
- 4.3 Explain Memory Access schemes in DSPs
- 4.4 Explain multiple access memory, multiport memory
- 4.5 Explain VLSI Architecture of DSPs
- 4.6 Define Pipelining and Explain?
- 4.7 Explain Special addressing modes
- 4.8 Define On-Chip Peripherals and list them.
- 4.9 List versions and applications of TMS 320C5X family
- 4.10 Familiarize Architectural block diagram of TMS 320C5X
- 4.11 Explain Bus Structure of TMS 320C5X
- 4.12 Explain Central Arithmetic Logic Unit with diagram
- 4.13 Define Auxiliary Registers and explain
- 4.14 Define Index Register and explain
- 4.15 Define Auxiliary Register Compare Register and explain
- 4.16 Define and Explain Block Move Address Register

- 4.17 Define Parallel Logic Unit
- 4.18 Explain Memory mapped registers
- 4.19 Explain program controller with sketches
- 4.20 List some flags in the status registers of TMS 320C5X

5.0 Introduction to Embedded System

- 5.1 Explain an Embedded System
- 5.2 Compare Embedded System and General Computing System
- 5.3 List five Application areas of Embedded System
- 5.4 Draw general block diagram of an embedded system
- 5.5 Describe Core of the Embedded System
- 5.6 Describe Memory
- 5.7 Describe Embedded Firm ware
- 5.8 Describe Communication Interface
- 5.9 Real Time Operating System
- 5.10 Explain Operating System Basics
- 5.11 List three Types of. Operating System
- 5.12 Explain Tasks, Process and Threads
- 5.13 Define Multi Processing and Multi Tasking
- 5.14 List three Types of Multi Tasking

CONTENTS

1. **PIC MICRO CONTROLLER** : Introduction and Evolution of PIC family, Introduction to PIC16F8XX and PIC16CX/7X, Features of PIC16F877, Pin and Block diagram of PIC16F877, Instruction Set and Memory Organization of PIC16F877 and Applications of PIC Micro Controller.
2. **ADVANCED MICROCONTROLLERS:** MCS –XX family, MCS – 96 Microcontrollers: Important Features, Pin Diagram, Internal Architecture, Memory Map, Addressing Modes, Instruction set.
3. **ARM MICROCONTROLLERS:** ARM Microcontrollers: ARM Core Architecture, Versions of ARM, Memory Map, Addressing Modes, Instruction set and Important Features.
4. **INTRODUCTION TO DSP PROCESSORS:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory, Multiport memory, VLSI Architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS 320C5X- Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Registrar, Index Registrar, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers

5. **INTRODUCTION TO EMBEDDED SYSTEM AND RTOS** :Introduction, embedded system vs General computing system, classification and applications, Typical Embedded System-Core Memory, Communication Interface, Firmware
Real Time Operating System: Operating System basics, Types of OS, Tasks, Process, Threads, Multiprocessing and Multitasking, Types

REFERENCES:

1. Digital Signal Processors – Architecture, Programming and Applications, Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002
2. Micro Processors and Micro Controllers- M.Senthil Kumar, M.Saravanan and S.Jeevanathan Oxford University Press, 1st Edn, 2010
3. Microcontrollers-Deshmukh, Tata Mc-Graw Hill Edition, 2004.
4. Microcontrollers Architecture, programming, interfacing and system Design-Raj kamal, Pearson Education, 2005.
5. Microcontrollers Theory and Applications -Deshmukh, Tata Mc-Graw Hill Edition, 2005.
6. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

DIGITAL CIRCUIT DESIGN THROUGH VERILOG HDL

Subject title : **DIGITAL CIRCUIT DESIGN THROUGH VERILOG HDL**

Subject code : **EC-606**

Periods per week : **04**

Periods / Semester : **60**

Rationale: The course Digital Circuit Design Through Verilog HDL is introduced in the VI semester keeping in view the vast developments in the field of VLSI Circuits. to helps the students get good job opportunities and have them an edge over others .

TIME SCHEDULE

SI	Major Topics	Periods	Weightage of Marks	Short Type	Essay Type
1	Basic Concepts of Verilog HDL	15	19	3	1
2	Gate Level, Data flow and Behavioral Modeling	16	29	3	2
3	Modeling of Combinational Logic Circuits	15	26	2	2
4	Modeling of Sequential Logic Circuits	10	26	2	2
5	System design concepts	4	10	-	1
	TOTAL	60	110	10	8

OBJECTIVES :

On completion of the course the student will be able to

1.0 Understand Design flow for designing VLSI IC and concepts of Verilog HDL

- 1.1 Explain the steps involved in the design flow for the VLSI IC design
- 1.2 Explain the importance of Hardware Description Languages in VLSI design
- 1.3 Compare VHDL and Verilog HDL
- 1.4 List the features of Verilog HDL
- 1.5 Explain the difference between an instantiation and inference of a component.
- 1.6 Explain differences between modules and module instances in Verilog.
- 1.7 Describe four levels of abstraction to represent the internals of a module
- 1.8 Identify the components of a Verilog module definition
- 1.9 Describe the port connection rules in a module instantiation
- 1.10 Explain the lexical conventions like number specification, Identifiers keywords, etc
- 1.11 Explain different data types like value set, nets, registers, vectors, integer, real and time register data types, arrays, memories and strings.
- 1.12 Explain defparam and localparam keywords
- 1.13 Explain about system tasks and compiler directives
- 1.14 Define expressions, operators and operands.
- 1.15 Explain all types of operators used in the Verilog HDL

2.0 Analyze concepts of Gate level, Data Flow and Behavioral modeling

- 2.1 Identify the logic gate primitives provided in Verilog
- 2.2 Explain the instantiation of gates, gate symbols, and truth tables for and/or and buf/not type gates.
- 2.3 Explain rise, fall and turn-off delays in the gate level design
- 2.4 Explain about the *initial* and *always* statements.
- 2.5 Explain the assignment statements in data flow modeling
- 2.6 Explain different types of delays used in the data flow level modeling
- 2.7 Explain blocking and nonblocking procedural assignments with examples
- 2.8 Explain about timing controls like delay based timing control and event based timing control.
- 2.9 Explain conditional statements.
- 2.10 Explain multiway branching - use case, casex and casez statements.
- 2.11 Explain the difference between conditional if statement and case statements.
- 2.12 Explain looping statements such as while, for, repeat, and forever.
- 2.13 Explain sequential and parallel blocks.
- 2.14 know about User Defined Primitives(UDP)
- 2.15 Explain about the hierarchical modeling,
- 2.16 List the advantages of hierarchical modeling
- 2.17 Explain about modeling techniques in Verilog HDL.
- 2.18 Design simple logic circuits like adders, subtractors using Behavioral, Data
- 2.19 Flow and Structural modeling.

3.0 Design Verilog Modeling of Combinational and Sequential Circuits

- 3.1 Design combinational circuits like multiplexers, decoders, encoders, Comparators and ALU
- 3.2 Design RS, JK, T and D flip flops with Asynchronous and Synchronous Clock and reset
- 3.3 Implement shift registers like SISO, SIPO, PISO, PIPO, etc.
- 3.4 Design synchronous and asynchronous counters
- 3.5 Design a divide by 3 counter
- 3.6 Design shift register counters like ring counter, etc.
- 3.7 Design memories like RAM and ROM.
- 3.8 Compare RTL level and structural level modelings.

Note: Use three levels of modelings (behavioral, dataflow and gate level) for the above designs.

4.0 Apply Functional verification and Testing of Verilog modules.

- 4.1 Define test bench module.
- 4.2 Explain the need of a stimulus module.
- 4.3 Explain the structure of stimulus module.
- 4.4 Apply the stimulus modules for combinational and sequential circuits of Verilog designs.
- 4.5 Explain the concept of Finite State Machines.
- 4.6 Explain the Mealy and Moore types of State Machines.
- 4.7 Solve simple problems on Mealy and Moore state machines.
- 4.8 Design above state machines using Verilog HDL.

5.0 Analyze the system design concepts

- 5.1 Know various design tools which are useful in different stages of design
- 5.2 Explain various programmable logic devices such as PLAs, PALs, CNLD and FPGAs,
- 5.3 Design simple systems like UART, Traffic Light controller using FPGA board

REFERENCE BOOKS:

- 1. Digital systems design by Morris Mano
- 2. Verilog HDL: A guide to digital design and synthesis by S. Palnitkar
- 3. Advanced Digital Design with the VERILOG HDL by Michael D. Ciletti
- 4. Switching and finite automation theory by Zvi Kohavi
- 5. Digital state machine design by David J. Comes
- 6. Digital Systems by Ronald Tocci
- 7. Digital design principles and practice- John F Wakerly, PHI / Pearson education Asia 3rd Edn, 2005
- 8. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004.

9. A Verilog Premier – J. Bhasker, BSP, 2003.
10. Fundamentals of Logic Design with Verilog – Stephen. Brown and Zvonko Vranesic, TMH, 2005.
11. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI, 2005.

INDUSTRIAL ELECTRONICS LABORATORY PRACTICE

Subject Title : **INDUSTRIAL ELECTRONICS LABORATRY PRACTICE**
Subject Code : **EC-607**
Periods/Week : **04**
Periods/Semester : **60**

Rationale: Industrial Electronics lab is included in the VI semester to make the students industry ready by giving them practical inputs and making them experiment with Power Electronic devices which are in wide usage in Industry. This helps the students to get better job opportunities and work with confidence.

List of Experiments with Objectives and Key competencies

Exp no	Name of the experiment	Objectives	Key competencies
1	Identification of scr, triac, diac,, sus sbs, mosfet, igt, lascr, ujt, heatsinks, opto couplers mct2e, moc 3011 and interpreting their specifications	1. Identification of scr, triac , diac 2. Identify various scr family device s and their symbols 3. Reading the data sheets and identifying the terminals 4. Note down the typical applications from the data sheet	1. Identifying the scr family devices and observing their size and shape with regard to their power rating. 2. Noting down the important specifications from data sheets
2	To plot the characteristics of scr a) identify the terminals by observation b) identify the terminals by testing with dmm and analogue meter	Identify scr and its package 2.estimate scr rating by observation 3.test the scr using meter 4. Interpret scr specifications from data sheets.	1. Plot the characteristics and interpret the graph. 2. Determine holding current and triggering current.

	<p>c) demonstrate that scr remains in on state once triggered</p> <p>d) demonstrate 3 methods of switching off scr.</p> <p>e) observe the differences between power scr and low current scr.</p> <p>f) design a simple burglar alarm circuit using scr and test it</p>	<p>5. Explain the behavior of scr</p> <p>6. Use scr in projects</p>	
3	<p>To plot the characteristics of triac and diac</p> <p>c) demonstrate that triac can be triggered by positive and negative pulses</p> <p>d) demonstrate 3 methods of switching off triac</p> <p>e) observe the differences between power triac and low current triac</p>	<p>1. Identify the terminals by observation</p> <p>2. Identify the terminals by testing with dmm and analogue meter</p> <p>3. Identify triac and its package</p> <p>4. Estimate triac rating by observation</p> <p>5. Test the triac using meter</p> <p>6. Interpret triac specifications from data sheets.</p> <p>7. Verify the behavior of triac</p> <p>8. Verify the behavior of diac experimentally</p>	<p>1. Plot the characteristics and interpret the graph. Of triac and diac</p> <p>2. Determine turn on voltage ,holding current and triggering</p> <p>Current. Of triac and diac</p>
4	<p>To plot the characteristics of ujt and determine the intrinsic standoff ratio</p> <p>a) identify the terminals</p>	<p>1. Identify ujt and its package</p> <p>2. Interpret specifications from datasheets</p> <p>3.test the triac using</p>	<p>1. Plot the characteristics and interpret the graph. Of ujt</p> <p>2. Determine intrinsic standoff ratio of ujt</p>

	<p>by observation</p> <p>b) identify the terminals by testing with dmm and analogue meter</p> <p>c) construct a relaxation oscillator circuit and i) observe the output waveforms on Cro</p> <p>ii) connect a speaker in the output and observe.</p> <p>d) simulate the same in pspice</p>	<p>digital multimeter.</p> <p>4. Verify the behavior of ujt</p> <p>5. Use ujt in simple applications.</p> <p>6. Use pspice for simulation.</p>	<p>3. Construct ujt relaxation oscillator and test</p> <p>4. Pspice simulation of ujt relaxation oscillator</p>
5	<p>To plot the characteristics of mosfet and determine gate source threshold voltage</p> <p>a) identify the terminals by observation</p> <p>b) identify the terminals by testing with dmm and analogue meter</p> <p>c) implement a mosfet switch and control a 6v lamp using nand gate</p>	<p>1. Identify mosfet and its package</p> <p>2. Interpret specifications from datasheets</p> <p>3. Test the mosfet using digital multimeter.</p> <p>4. Verify the behavior of mosfet</p> <p>5. Interfacing with digital circuits</p>	<p>1. Plot the characteristics and interpret the graph. Of mosfet</p> <p>2. Determine gate source threshold voltage</p> <p>3. Interfacing with digital circuits</p>
6	<p>To vary the speed of a 1 phase ac motor using triac-diac phase control</p> <p>A) construct the speed control circuit and test the</p>	<p>1. Construct simple phase control circuit</p> <p>2. Testing the controller</p> <p>3. Drawing inferences from the waveforms</p> <p>4. Observe the variation in</p>	<p>1. Constructing an phase control circuit</p> <p>2. Testing the circuit with multimeter</p> <p>3. Observing the variations in waveform</p>

	<p>performance</p> <p>B) observe the waveforms at the gate terminal and load</p> <p>C) replace the motor with a 230 volts incandescent lamp</p> <p>D) construct a simple lamp controller using moc 3011 and triac</p>	<p>the speed.</p> <p>5. Appreciate the use of phase control circuit for lamp dimming application</p>	<p>with change in resistance(pot)</p>
7	<p>To implement a square wave inverter circuit with centre tapped transformer and power mosfets</p> <p>a) observe the output wave forms.</p> <p>B) plot the regulation characteristics</p>	<p>1. Construct simple inverter circuit.,</p> <p>2. Testing the inverter ,</p> <p>3. Drawing inferences from the graph</p> <p>4. Realize the need for heat sink</p> <p>5. Calculating maximum output power.</p>	<p>1. Constructing an inverter circuit</p> <p>2. Testing the inverter performance parameters</p>
8	<p>. Varying the speed of a small dc motor using pulse width modulation</p>	<p>1. Constructing pwm controller circuit</p> <p>2. Testing the circuit performance parameters</p> <p>3. Observing the pwm waveform</p> <p>4. Plot the graph between voltage and speed</p>	<p>1. Understand the principle of pwm for speed control</p> <p>2. Observing the pwm waveform on cro</p>
9	<p>Study the performance of LVDT</p>	<p>1. Identifying the lvdt</p> <p>2. Noting down the constructional details and specifications</p> <p>3. Plotting the graph between displacement and differential voltage</p>	<p>1. Understand the working principle of lvdt</p> <p>2. Use lvdt in the circuits to measure displacement/pressure</p>

		4. Identify the null voltage and know its significance 5. Observe the linear variation of the graph on either side of the null point 6. Know the number of secondary windings and their interconnection	
10	Using the PLCs to build basic logic gates a) Implement basic gates using plc b) Implement xor xnor gates using plc	1. Drawing the ladder diagram 2. Entering the program into the plc kit 3. Executing the program 4. Observing the output	Using the plc for building combinational logic
11	Implementing delay timers using plc a) Implement on timer b) Implement off timer	1. Drawing the ladder diagram 2. Entering the program into the plc kit 3. Executing the program 4. Observing the output	Using the plc for building timers
12	To implement up counter and down counter	1. Drawing the ladder diagram 2. Entering the program into the plc kit 3. Executing the program 4. Observing the output	Using the plc for building up counter and down counter

Verilog HDL lab Practice

Subject title : **Verilog HDL lab Practice**
Subject code : **EC-608**
Periods per week : **3**
Periods / Semester : **45**

Rationale: This laboratory course is Included to reinforce and practically verify the theoretical inputs learnt in the theory part of this semester without losing the contiguity. Further this course also helps the students to experiment with latest tools used in the VLSI

Circuit design which gives the students an edge over others .

List of Experiments

SI	Practical Name	No of Periods
1	Implement Basic Logic Gates	2
2	Implement Adders(Half adder and Full Adder)	2
3	Implement Subtractors(Half Subtractor and Full Subtractor)	2
4	Implement 4-bit Parallel Adder	3
5	Implement Multiplexers (2:1, 4:1 and 8:1 MUX)	3
6	Implement Demultiplexers (1:2, 1:4 and 1:8 DEMUX)	3
7	Implement Decoders (1:2, 2:4 and 3:8 Decoder)	3
8	Implement Encoders (2:1, 4:2 and 8:3 encoder)	3
9	Implement Comparator (2-bit and 4-bit)	2

10	Implement ALU	3
11	Implement Flip Flops (JK- Flip Flop and SR-Flip flop)	2
12	Implement Flip Flops (D- Flip Flop and T-Flip flop)	2
13	Implement Shift Registers (SISO, SIPO)	3
14	Implement Shift Registers (PISO, PIPO)	3
15	Implement Counter (BCD and Decimal Counters)	3
16	Implement Ring Counter	3

Tools Required:

Xilinx ISE 9.2i simulator and Modelsim Software

Implement the following practices using Verilog HDL

Advanced Micro Controllers Lab Practice

Subject title : Advanced Micro Controllers Lab Practice

Subject code : EC-609

Periods per week : 4

Periods / Semester : 60

Rationale: This laboratory course is Included to reinforce and practically verify the theoretical inputs learnt in the theory part of this semester without losing the contiguity. Further this course also helps the students to experiment with Advanced Microcontrollers like ARM which gives the students an edge over others and better employment opportunities.

LIST OF EXPERIMENTS

1. Write C PROGRAM FOR PIC16F877to add two 16-bit operands
2. Write C PROGRAM FOR PIC16F877to add two 32-bit operands
3. Write C PROGRAM FOR PIC16F877to subtract two 16-bit operands
4. Write C PROGRAM FOR PIC16F877to multiply two operands
5. Write C PROGRAM to generate a Square wave by interfacing 8-bit bipolar DAC with PIC16F877
6. Write C PROGRAM to generate a Sine wave by interfacing 8-bit bipolar DAC with PIC16F877
7. Write C PROGRAM to design a digital thermometer to display the temperature in $^{\circ}\text{C}$ using PIC16C71

8. Write C PROGRAM to design a LVDT interfacing with PIC16C71 using AD698
9. Write C PROGRAM to add two 16-bit operands using ARM controller
10. Write C PROGRAM to add two 32-bit operands using ARM controller
11. Write C PROGRAM to subtract two 16-bit operands using ARM controller
12. Write C PROGRAM to multiply two operands using ARM controller
13. Write C PROGRAM to interface ADC module with PIC16F877
14. Write C PROGRAM to generate PWM by interfacing ADC module with PIC16F877

PROJECT WORK

Subject Title	:	Project Work
Subject Code	:	EC- 610
Periods / Week	:	06
Periods / Semester	:	90

OBJECTIVES

On completion of the subject duration the student should be able to perform the following

1.0 Project work

- 1.1 Identifies different works to be carried out in the Project.
- 1.2 Collects data relevant to the project work.
- 1.3 Carry out need survey.
- 1.4 Select the most efficient method from the available choices based on preliminary investigation.
- 1.5 Design the required elements of the project work as per standard practices.
- 1.6 Prepares the working modules / equipments required for the project work.
- 1.7 Estimates the cost of project, technological need, computer skills, materials and other equipments.
- 1.8 Prepares the plan and schedule of starting time and sequence of operations to be carried out at the various stages of the project work in detail.
- 1.9 Preparation of critical activities at the various stages of the project work.
- 1.10 Tests to be carried at various conditions with different electrical input parameter if required.
- 1.11 Implementation of project work and recording the results at various places.
- 1.12. Collects the necessary information to procure necessary finance, and equipment.

1.13 Preparation of the chart or model for each of the project.

1.14 Preparation of project report.

2.0 Report on observations in Industrial visits

2.1 Visit nearby electronics/communication engineering industries

COURSE CONTENT

Project work is intended to provide training in the solution of various fields of engineering problems relating to

Rural Communication Systems: Connection remotely scattered hamlets with wireless technology.

Energy Saving Equipments: Replacing of Tungsten filament lamps with effective Implementation of LED, CFL Lamps at various applications.

Automobile Field: Solar Operated Vehicles, Battery Operated Vehicles with remote Operated electrical Devices involving power control with wireless technology.

Embedded Systems: Various applications in industry involving the microcontrollers for automation and efficient supervision of the systems.

Power Devices: Inverter, SCR based applications, UPS and Automatic switching DG Sets etc.

Project work will also include the implementation of Innovative Ideas which improves the nation growth and preparation of the feasibility report for any one type of enterprise under self – employment schemes also.

Students shall be divided into groups of five each and shall be assigned a problem that calls for application of the knowledge he/she acquired in the course and also which involves some extra study of reference materials.

Every student should prepare a project report and submit the same for assessment. Every student puts his share to the work in all the operations of the project. The end examination in Project work shall consist of power point presentation and Viva-voce test to be assessed by a panel of examiners comprising of an External examiner, the Head of Section, and member of staff who guided the project as Internal examiner.

Scheme of assessment

1)	Seminar	-	20 Marks
2)	Internal assessment	-	20 Marks
3)	Power point presentation,	-	60 Marks
	Report & Viva-Voce (3x20)		

Total Marks	-	100
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