UNIT V: LINEAR AND DIGITAL ELECTRONICS

1. **An ideal operational amplifier has:**
   - a) Infinite input impedance.
   - b) Zero output impedance.
   - c) Infinite gain.
   - d) All of the above.
   - o **Answer: d) All of the above.**

2. **In an inverting amplifier, the output is:**
   - a) In phase with the input.
   - b) Out of phase with the input.
   - c) Zero.
   - d) None of the above.
   - o **Answer: b) Out of phase with the input.**

3. **A summing amplifier is used to:**
   - a) Multiply signals.
   - b) Subtract signals.
   - c) Add signals.
   - d) Divide signals.
   - o **Answer: c) Add signals.**

4. **A clipper circuit is used to:**
   - a) Amplify signals.
   - b) Cut off part of the signal.
   - c) Integrate signals.
   - d) Differentiate signals.
   - o **Answer: b) Cut off part of the signal.**

5. **Boolean algebra is used in:**
   - a) Analog circuits.
   - b) Digital circuits.
   - c) Power circuits.
   - d) Communication circuits.
   - o **Answer: b) Digital circuits.**

6. **A logic gate that gives a HIGH output only when all inputs are HIGH is:**
   - a) AND gate.
   - b) OR gate.
   - c) NOT gate.
   - d) XOR gate.
   - o **Answer: a) AND gate.**

7. **The binary number 1010 is equivalent to the decimal number:**
   - a) 10.
   - b) 5.
   - c) 8.
   - d) 12.

- Answer: **a) 10.**

8. **A flip-flop is used to:**
   a) Perform arithmetic operations.
   b) Store data.
   c) Generate clock signals.
   d) Amplify signals.
   - **Answer: b) Store data.**

9. **In an A/D converter, the process of converting an analog signal to a digital signal involves:**
   a) Sampling.
   b) Quantization.
   c) Encoding.
   d) All of the above.
   - **Answer: d) All of the above.**

10. **The main function of a D/A converter is to:**
    a) Convert digital signals to analog signals.
    b) Convert analog signals to digital signals.
    c) Amplify signals.
    d) Store signals.
    - **Answer: a) Convert digital signals to analog signals.**

11. **A full adder is used to:**
    a) Add two binary digits.
    b) Add three binary digits.
    c) Subtract two binary digits.
    d) Subtract three binary digits.
    - **Answer: b) Add three binary digits.**

12. **The output of an inverting amplifier is:**
    a) Positive.
    b) Negative.
    c) Zero.
    d) Unchanged.
    - **Answer: b) Negative.**

13. **A clamper circuit is used to:**
    a) Limit the signal amplitude.
    b) Shift the DC level of the signal.
    c) Amplify the signal.
    d) Integrate the signal.
    - **Answer: b) Shift the DC level of the signal.**

14. **The output of a half adder consists of:**
    a) Sum and Carry.
    b) Difference and Borrow.
    c) Product and Quotient.
    d) Sum and Difference.
    - **Answer: a) Sum and Carry.**

15. **Which of the following is not a characteristic of an ideal OP-AMP?**
    a) Infinite bandwidth.
    b) Zero offset voltage.
    c) Infinite output impedance.
    d) Infinite common-mode rejection ratio.

- o **Answer: c) Infinite output impedance.**

UNIT I: ELECTRICAL CIRCUITS & MEASUREMENTS

Puzzle 1: Ohm's Law Maze

Objective: Find the path that gives the correct current according to Ohm's Law (V = IR).

Maze Path:
- Start -> (R1 = 2Ω, V1 = 4V) -> (R2 = 3Ω, V2 = 6V) -> End
- Start -> (R3 = 1Ω, V3 = 2V) -> (R4 = 4Ω, V4 = 8V) -> End

Desired Current: 2A

Solution Path:
- Path 1: Total Resistance = 5Ω, Total Voltage = 10V, Current = V/R = 10V/5Ω = 2A
- Path 2: Total Resistance = 5Ω, Total Voltage = 10V, Current = V/R = 10V/5Ω = 2A

Puzzle 2: Kirchoff's Laws Crosswords

Clues and Answers:
- Across:
  1. The sum of all voltages around a closed (LOOP)
  2. The point where currents meet in a circuit (JUNCTION)
- Down: 2. A property of a circuit that opposes current flow (RESISTANCE) 4. The law that states the total current entering a junction equals the total current leaving (CURRENT)

Crossword Grid:

1 L O O P
2 R
3 J U N C T I O N
4 C U R R E N T

Puzzle 3: AC Circuit Word Search

Words to Find:
- Peak
- RMS
- Frequency
- Impedance
- Reactance

Word Search Grid:

P E A K R M S X
R E A C T A N C E
F R E Q U E N C Y
I M P E D A N C E

Puzzle 4: Instrument Match-Up

Objective: Match the instruments to their descriptions.

Instruments and Descriptions:
- Moving Coil Ammeter (A) - Measures DC current using a coil in a magnetic field.
- Moving Iron Voltmeter (B) - Measures AC voltage using a piece of iron in a magnetic field.
- Dynamometer Type Wattmeter (C) - Measures electrical power in a circuit.
- Energy Meter (D) - Measures electrical energy consumption over time.

Matching Answers:
- A -> Measures DC current
- B -> Measures AC voltage
- C -> Measures electrical power

- D -> Measures electrical energy

Puzzle 5: Power Factor Calculation

Objective: Calculate the power factor given the real power (P) and apparent power (S).

Problem:

- Real Power (P) = 500W
- Apparent Power (S) = 600VA

Calculation:

- Power Factor = P/S = 500W / 600VA = 0.833

UNIT II: ELECTRICAL MACHINES

Puzzle 1: DC Generator Parts Jumble

Objective: Unscramble the jumbled letters to name the parts of a DC generator.

Jumble:

- ROTARMUCE (ARMATURE)
- TBAORMOCR (COMMUTATOR)
- BRSUEHS (BRUSHES)
- FLDEI WIWNDIG (FIELD WINDING)

Puzzle 2: DC Motor Crossword

Clues and Answers:

- Across:
    1. Converts electrical energy to mechanical energy (MOTOR)
- Down: 2. Provides the magnetic field in a motor (FIELD)

Crossword Grid:

1 M O T O R

2 F I E L D

Puzzle 3: Transformer Calculation

Objective: Calculate the output voltage of a transformer.

Problem:

- Primary Voltage = 220V
- Turns Ratio = 1:10

Calculation:

- Output Voltage = Primary Voltage * Turns Ratio = 220V * 10 = 2200V

Puzzle 4: Induction Motor Match-Up

Objective: Match the parts to their functions.

Parts and Functions:

- Stator (A) - Generates a rotating magnetic field.
- Rotor (B) - Rotates due to the magnetic field from the stator.
- Bearings (C) - Support the rotating shaft.
- Fan (D) - Cools the motor.

Matching Answers:

- A -> Generates a rotating magnetic field
- B -> Rotates due to the magnetic field
- C -> Supports the rotating shaft
- D -> Cools the motor

Puzzle 5: DC Motor Reversal

Objective: Determine how to reverse the direction of a DC motor.

Question:

- What should be changed to reverse the direction of rotation of a DC motor?

Answer:

- Reverse the polarity of the armature voltage or the field winding.

UNIT III: WIRING, GROUNDING, AND SAFETY

Puzzle 1: Wiring Maze

Objective: Navigate through a maze to create a wiring layout for a residential building.

Description:
- Design a maze with multiple paths representing different wiring routes.
- Choose the path that connects all rooms to the main distribution board correctly.

Example Path:
- Start -> Living Room -> Kitchen -> Bedroom -> End

Puzzle 2: Grounding Crossword

Clues and Answers:
- Across:
  1. Provides a path for fault current (GROUNDING)
  2. Type of wiring system used in homes (CONDUIT)
- Down: 2. Used to protect circuits from overcurrent (FUSE) 4. Measures electrical energy consumption (ENERGY METER)

Crossword Grid:

1 G R O U N D I N G
2 F
 3 C O N D U I T
4 E N E R G Y M E T E R

Puzzle 3: Safety Word Search

Words to Find:
- Short Circuit
- Overload
- Grounding
- Fuse
- Breaker

Word Search Grid:

mathematica

Copy code

S H O R T C I R C U I T
O V E R L O A D X F U S E
G R O U N D I N G B R E A K E R

Puzzle 4: Accident Prevention Match-Up

Objective: Match the causes of accidents to the prevention methods.

Causes and Prevention Methods:
- Short Circuit (A) - Proper insulation and maintenance.
- Overloading (B) - Use appropriate fuse or circuit breaker.
- Improper Grounding (C) - Ensure proper grounding techniques.

Matching Answers:
- A -> Proper insulation and maintenance
- B -> Use appropriate fuse or circuit breaker
- C -> Ensure proper grounding techniques

Puzzle 5: Grounding Type Identification

Objective: Identify the type of grounding used.

Description:
- System Grounding

- Equipment Grounding
- Neutral Grounding

Question:
- Which type of grounding is used to provide a return path for current in case of a fault?

Answer:
- Equipment Grounding

UNIT IV: ANALOG ELECTRONICS

Puzzle 1: Diode Circuit Maze

Objective: Navigate through a maze to find the correct diode circuit configuration.

Description:
- Create a maze with paths representing different diode configurations.
- Choose the path that forms a half-wave rectifier circuit.

Example Path:
- Start -> Diode -> Resistor -> Ground -> End

Puzzle 2: Transistor Crossword

Clues and Answers:
- Across:
    1. Current controlled device (BJT)
    2. Voltage controlled device (MOSFET)
- Down: 2. Type of diode used for voltage regulation (ZENER) 4. Converts AC to DC (RECTIFIER)

Crossword Grid:

1 B J T
2 Z E N E R
 3 M O S F E T
4 R E C T I F I E R

Puzzle 3: Rectifier Calculation

Objective: Calculate the output voltage of a full-wave rectifier.

Problem:
- Input Voltage (Peak) = 10V

Calculation:
- Output Voltage (RMS) = 10V * 0.707 = 7.07V

Puzzle 4: Voltage Regulator Match-Up

Objective: Match the voltage regulator types to their functions.

Types and Functions:
- Linear Regulator (A) - Provides a stable output voltage with minimal noise.
- Switching Regulator (B) - Efficiently converts different voltage levels.
- Zener Diode (C) - Maintains a constant voltage across its terminals.

Matching Answers:
- A -> Provides a stable output voltage
- B -> Efficiently converts different voltage levels
- C -> Maintains a constant voltage

Puzzle 5: UPS Components Identification

Objective: Identify the components of a UPS.

Components:
- Battery (A) - Stores energy.
- Inverter (B) - Converts DC to AC.
- Charger (C) - Recharges the battery.
- Transfer Switch (D) - Switches between mains power and battery power.

Matching Answers:
- A -> Stores energy
- B -> Converts DC to AC
- C -> Recharges the battery
- D -> Switches between mains power and battery power

UNIT V: LINEAR AND DIGITAL ELECTRONICS

Puzzle 1: OP-AMP Maze

Objective: Navigate through a maze to find the correct OP-AMP configuration.

Description:
- Create a maze with paths representing different OP-AMP configurations.
- Choose the path that forms an inverting amplifier circuit.

Example Path:
- Start -> Inverting Input -> Resistor -> Output -> End

Puzzle 2: Logic Gates Crossword

Clues and Answers:
- Across:
    1. Gate that outputs true only when both inputs are true (AND)
    2. Gate that inverts the input (NOT)
- Down: 2. Gate that outputs true when at least one input is true (OR) 4. Gate that outputs true only when inputs are different (XOR)

Crossword Grid:

1 A N D

2 O R

 3 N O T

4 X O R

Puzzle 3: Adder Calculation

Objective: Calculate the sum and carry of a half adder.

Problem:
- Input A = 1
- Input B = 1

Calculation:
- Sum = 0
- Carry = 1

Puzzle 4: Flip-Flop Match-Up

Objective: Match the flip-flop types to their characteristics.

Types and Characteristics:
- SR Flip-Flop (A) - Set and Reset inputs.
- JK Flip-Flop (B) - Toggle feature with J and K inputs.
- D Flip-Flop (C) - Data input with a single clock pulse.
- T Flip-Flop (D) - Toggles the output on each clock pulse.

Matching Answers:
- A -> Set and Reset inputs
- B -> Toggle feature
- C -> Data input with clock
- D -> Toggles output

Puzzle 5: A/D Conversion Identification

Objective: Identify the steps in A/D conversion.

Steps:

- Sampling (A) - Taking discrete samples of the analog signal.
- Quantization (B) - Converting sampled values into discrete levels.
- Encoding (C) - Representing quantized values in binary form.

Matching Answers:
- A -> Taking discrete samples
- B -> Converting sampled values
- C -> Representing in binary form