

ECH301– ELECTRONIC DEVICES AND CIRCUITS

TABLE OF CONTENTS

UNIT NO.	TYPE OF QUESTION				PAGE NO.
UNIT 1	ELECTRONIC COMPONENTS				
	PART A	1	Multiple Choice Questions (MCQs)	21 (per unit)	3
		2	Multiple Choice Questions (MCQs) – Analytical Type	9 (per unit)	5
	PART B	3	Descriptive-Type Questions	5 (per unit)	7
		4	Analytical Questions with subdivisions	1 (per unit)	7
UNIT 2	SEMICONDUCTOR DIODES				
	PART A	1	Multiple Choice Questions (MCQs)	21 (per unit)	10
		2	Multiple Choice Questions (MCQs) – Analytical Type	9 (per unit)	12
	PART B	3	Descriptive-Type Questions	5 (per unit)	14
		4	Analytical Questions with subdivisions	1 (per unit)	14
UNIT 3					
	PART A	1	Multiple Choice Questions (MCQs)	21 (per unit)	18
		2	Multiple Choice Questions (MCQs) – Analytical Type	9 (per unit)	20
	PART B	3	Descriptive-Type Questions	5 (per unit)	22
		4	Analytical Questions with subdivisions	1 (per unit)	23
UNIT 4	ELECTRONIC COMPONENTS				
	PART A	1	Multiple Choice Questions (MCQs)	21 (per unit)	25
		2	Multiple Choice Questions (MCQs) – Analytical Type	9 (per unit)	27
	PART B	3	Descriptive-Type Questions	5 (per unit)	29

		4	Analytical Questions with subdivisions	1 (per unit)	29
UNIT 5	ELECTRONIC COMPONENTS				
	PART A	1	Multiple Choice Questions (MCQs)	21 (per unit)	32
		2	Multiple Choice Questions (MCQs) – Analytical Type	9 (per unit)	34
	PART B	3	Descriptive-Type Questions	5 (per unit)	38
		4	Analytical Questions with subdivisions	1 (per unit)	38

UNIT I- ELECTRONIC COMPONENTS

PART – A

Multiple Choice Questions (MCQs)

21 (per unit)

Q1. Active components are those which:

- A) Store energy B) Control or amplify current C) Block current D) Reduce voltage

Answer: B) Control or amplify current

Q2. Passive components are those which:

- A) Require external power source B) Amplify signals C) Do not produce energy D) Increase gain

Answer: C) Do not produce energy

Q3. Which of the following is a passive component?

- A) Transistor B) Diode C) Resistor D) MOSFET

Answer: C) Resistor

Q4. The unit of resistance is:

- A) Henry B) Ohm C) Farad D) Ampere

Answer: B) Ohm

Q5. Wire-wound resistors are suitable for:

- A) Low power circuits B) High frequency applications C) High power applications
D) Logic circuits

Answer: C) High power applications

Q6. Variable resistors are also called:

- A) Capacitors B) Inductors C) Potentiometers D) Relays

Answer: C) Potentiometers

Q7. Capacitors store energy in the form of:

- A) Magnetic field B) Electric field C) Mechanical energy D) Current

Answer: B) Electric field

Q8. The unit of capacitance is:

- A) Ohm B) Henry C) Farad D) Joule

Answer: C) Farad

Q9. Electrolytic capacitors are generally:

- A) Non-polarized B) Polarized C) Variable D) Mechanical

Answer: B) Polarized

Q10. Ceramic capacitors are mostly used in:

- A) High frequency circuits B) Power circuits C) Memory chips D) Relays

Answer: A) High frequency circuits

Q11. Inductors store energy in the form of:

- A) Heat B) Magnetic field C) Electric field D) Current

Answer: B) Magnetic field

Q12. The unit of inductance is:

- A) Ohm B) Farad C) Henry D) Watt

Answer: C) Henry

Q13. Air core inductors are mainly used in:

- A) Power supplies B) High frequency circuits C) Relays D) Transformers

Answer: B) High frequency circuits

Q14. Iron core inductors are mainly used in:

- A) Low frequency applications B) High frequency circuits C) Relays D) MEMS

Answer: A) Low frequency applications

Q15. Inductors in parallel:

- A) Increase total inductance B) Decrease total inductance C) Stay same D) Infinite inductance

Answer: B) Decrease total inductance

Q16. The basic function of a switch is to:

- A) Amplify B) Store charge C) Open or close a circuit D) Regulate voltage

Answer: C) Open or close a circuit

Q17. SPDT switch stands for:

A) Single Pole Double Throw B) Single Point Double Time C) Small Pole Dual Throw D) Switch Pole Double Turn

Answer: A) Single Pole Double Throw

Q18. A DPDT switch means:

A) Dual Power Double Throw B) Double Pole Double Throw C) Double Point Direct Throw D) None of these

Answer: B) Double Pole Double Throw

Q19. Electromagnetic switch works on:

A) Electric field B) Magnetic field C) Mechanical force D) Static charge

Answer: B) Magnetic field

Q20. A relay is an example of:

A) Mechanical switch B) Electromagnetic switch C) Electronic switch D) Solid state device

Answer: B) Electromagnetic switch

Q21. Relays are used to:

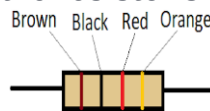
A) Store energy B) Switch higher currents C) Regulate voltage D) Act as sensors

Answer: B) Switch higher currents

Multiple Choice Questions (MCQs) – Analytical Type

9 (per unit)

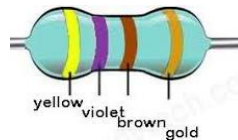
1. Identify the resistance value of the resistor shown below. (1 mark)



- a) $270 \text{ k}\Omega \pm 5\%$ b) $1 \text{ k}\Omega \pm 5\%$ c) $27 \text{ k}\Omega \pm 5\%$ d) $330 \Omega \pm 5\%$

Ans: Option (b)

2. Identify the resistance value of the resistor shown below. (1 mark)



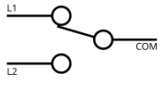
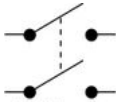
- a) $270 \text{ k}\Omega \pm 5\%$ b) $1 \text{ k}\Omega \pm 5\%$ c) $27 \text{ k}\Omega \pm 5\%$ d) $470 \Omega \pm 5\%$

3. Which resistor type is used for temperature sensing? (1 mark)

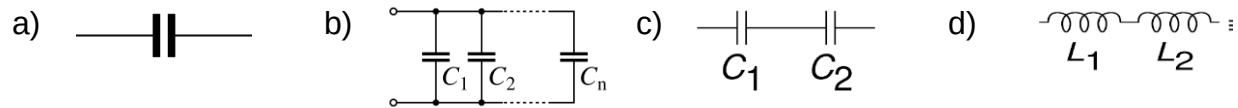
- a)  b)  c)  d) 

Ans: Option ©

4. Which switch shown is electromagnetically operated?(1 mark)

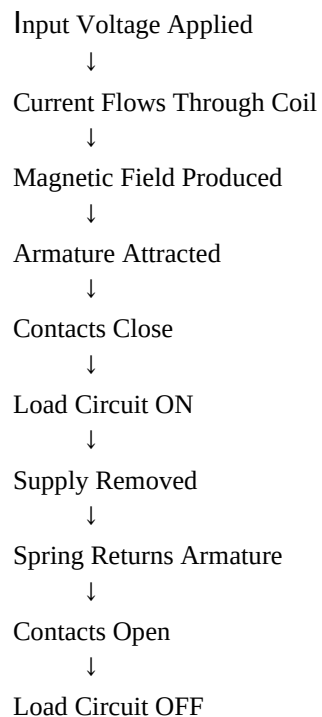
- a)  b)  c)  d) 

5. Which arrangement reduces total capacitance? (1 mark)



Ans: Option (c) Series diagram

6. Study the flowchart below showing a sequence of operation, and identify which electrical device follows this principle. (1 Mark)



Answer: Electromagnetic Relay

7. It is an electrical device used to make (ON) or break (OFF) an electrical circuit. It controls the flow of current and can also be used to select a circuit, change the current path, or control electrical and electronic devices.” (2 Marks)

A. Resistor

B. Switch

C. Capacitor

D. Inductor

Answer: B. Switch

8. Identify the device based on the following description:

“It is a three-terminal variable resistor with a movable wiper. It is commonly used for volume control, voltage division, and tuning circuits.”



- A. Potentiometer B. Thermistor C. Capacitor D. Inductor

Answer: A. Potentiometer

9. Observe the device shown in the image and identify its name.



- A. Potentiometer B. Trimmer C. Thermistor D. Rheostat

Answer: B. Trimmer

Part – B

Descriptive-Type Questions (10 MARKS)

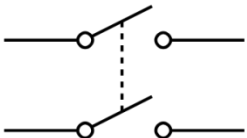
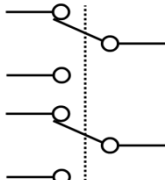
1. What are resistors? List their types and applications.
2. Explain the working and uses of variable resistors (potentiometers).
3. What are capacitors? Mention different types of capacitors and their uses.
4. What are inductors? Explain their types and applications.
5. What is a relay? Explain its principle of operation with applications

Analytical Questions with subdivisions

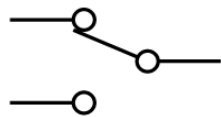
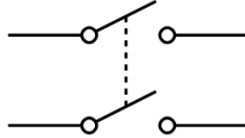
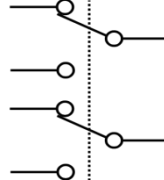
1 (per unit)

- 1. a) Fill in the Blanks – Switch Types (5 Marks)**

(Each correct blank carries 0.5 mark. Fill in the missing terms.)

Switch Type	Full Form	Poles	Throws	Symbol
SPST	-----	1	-----	-----
SPDT	-----	1	---	-----
DPST	-----	-----	1	
DPDT	Double Pole Double Throw	-----	-----	

Answers

Switch Type	Full Form	Poles	Throws	Symbol
SPST	Single Pole Single Throw	1	1	
SPDT	Single Pole Double Throw	1	2	
DPST	Double Pole Single Throw	2	1	
DPDT	Double Pole Double Throw	2	2	

1 .b) Three resistors of values $R_1 = 10 \Omega$, $R_2 = 20 \Omega$, and $R_3 = 30 \Omega$ are connected in a circuit. Calculate the total (equivalent) resistance when they are connected:

(i) in Series (1 Mark)

(ii) in Parallel (2 Mark)

(iii) Three capacitors of values $C_1 = 2 \mu\text{F}$, $C_2 = 3 \mu\text{F}$, and $C_3 = 6 \mu\text{F}$ are connected in parallel. Find the total capacitance. (2 Mark)

Answer:

(a) Series connection

Formula:

$$R = R_1 + R_2 + R_3$$

$$= 10 + 20 + 30$$

$$\mathbf{R \text{ total} = 60 \text{ ohm}}$$

(b) Parallel connection

Formula:

$$1/R = 1/R_1 + 1/R_2 + 1/R_3$$

$$= 6/60 + 3/60 + 2/60 = 11/60$$

$$\mathbf{R \text{ total} = 60/11 = 5.45 \text{ ohm}}$$

Parallel capacitor connection

Formula:

$$C \text{ total} = C_1 + C_2 + C_3$$

$$= 2 + 3 + 6$$

$$\mathbf{C \text{ total} = 11 \mu\text{F}}$$

UNIT II- SEMICONDUCTOR DIODES

PART – A

Multiple Choice Questions (MCQs)

21 (per unit)

Q1. A half-wave rectifier conducts for _____ of the input cycle.

- A) Full cycle B) Half cycle C) Quarter cycle D) None

Answer: B) Half cycle

Q2. The device used for converting AC to DC is called a _____.

- A) Amplifier B) Rectifier C) Filter D) Oscillator

Answer: B) Rectifier

Q3. In a full-wave rectifier, conduction takes place during _____.

- A) Positive half cycle only B) Negative half cycle only C) Both half cycles D) None

Answer: C) Both half cycles

Q4. A bridge rectifier requires _____ diodes.

- A) 2 B) 3 C) 4 D) 6

Answer: C) 4

Q5. Rectifiers are classified based on _____.

- A) Diodes only B) Number of phases C) Half wave & full wave D) Both B and C

Answer: D) Both B and C

Q6. A disadvantage of half-wave rectifier is _____.

- A) Low efficiency B) High output DC C) Less ripple D) High cost

Answer: A) Low efficiency

Q7. The function of a filter is to _____.

- A) Amplify signal B) Remove ripples C) Increase frequency D) Store charge

Answer: B) Remove ripples

Q8. An LC filter is a combination of _____.

- A) Resistor and Capacitor B) Inductor and Capacitor C) Diode and Resistor D) Inductor and Diode

Answer: B) Inductor and Capacitor

Q9. A clipper is used to _____.

- A) Store charge B) Remove part of waveform C) Shift waveform D) Convert DC to AC

Answer: B) Remove part of waveform

Q10. A positive clipper removes _____ part of input signal.

- A) Positive B) Negative C) Both D) None

Answer: A) Positive

Q11. The efficiency of a full-wave rectifier is about _____.

- A) 40% B) 60% C) 81% D) 100%

Answer: C) 81%

Q12. Clampers are also known as _____ circuits.

- A) Wave-shaping B) Limiting C) DC restorer D) Amplifying

Answer: C) DC restorer

Q13. A positive clamper shifts the signal _____.

- A) Upward B) Downward C) Sideways D) None

Answer: A) Upward

Q14. Zener diode operates in _____ region.

- A) Forward bias B) Reverse breakdown C) Cutoff D) Active

Answer: B) Reverse breakdown

Q15. The main application of Zener diode is _____.

- A) Amplification B) Voltage regulation C) Rectification D) Oscillation

Answer: B) Voltage regulation

Q16. A Zener diode maintains _____.

- A) Constant voltage B) Constant current C) Constant frequency D) None

Answer: A) Constant voltage

Q17. Zener breakdown occurs due to _____.

- A) Impact ionization B) High doping C) Low temperature D) Forward bias

Answer: B) High doping

Q18. LED stands for _____.

- A) Light Emission Device B) Light Emitting Diode C) Linear Electronic Device D) Low Energy Diode

Answer: B) Light Emitting Diode

Q19. LED works under _____ bias.

- A) Reverse B) Forward C) Both D) None

Answer: B) Forward

Q20. The color of LED depends on _____.

- A) Voltage B) Current C) Band gap of material D) Temperature

Answer: C) Band gap of material

Q21. Special purpose diodes include _____.

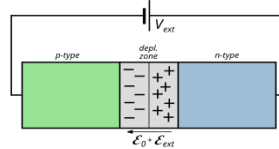
A) LED, Zener, Tunnel B) PN diode only C) Rectifier only D) SCR only

Answer: A) LED, Zener, Tunnel

Multiple Choice Questions (MCQs) – Analytical Type

9 (per unit)

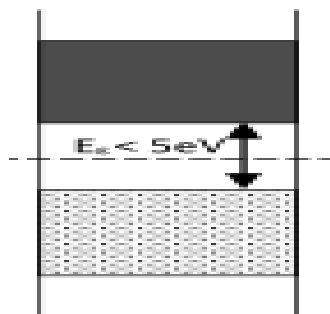
1. The depletion region is shown in the image. This corresponds to:



A) Forward bias B) Reverse bias C) No bias D) Breakdown region

Answer: B) Reverse bias

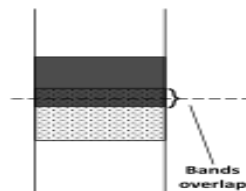
2. The image shows an energy band diagram with a small gap. This corresponds to:



A) Metal B) Semiconductor C) Conductor D) Insulator

Answer: B) Semiconductor

3. The image shows the energy band diagram of a material.

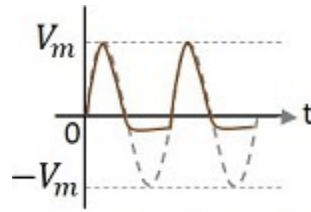


Based on the band gap, identify the type of material:

A) Metal B) Semiconductor C) Insulator D) None of the above

Answer: A) Metal

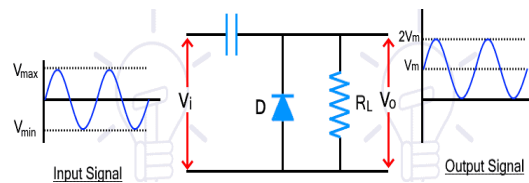
4. The image shows diode clipping negative half. It is:



- A) Negative clipper B) Positive clipper C) Clamper D) Rectifier

Answer: A) Negative clipper

5. The circuit in image shifts waveform upwards. Identify:



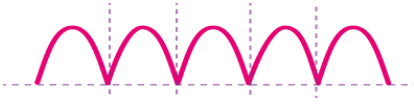
- A) Positive clamper B) Negative clamper C) Positive clipper D) Negative clipper

Answer: A) Positive clamper

6. Each correct answer carries 1 mark. Complete the following table by filling in the blanks: (5 Marks)

Parameter	Half-Wave Rectifier	Bridge Rectifier
Number of Diodes	1	-----
AC Cycles Used	One Half Cycle	-----
Rectification Efficiency	40.6%	-----
Ripple Factor	-----	0.482
Output waveform		-----

Answer:

Parameter	Half-Wave Rectifier	Bridge Rectifier
Number of Diodes	1	4
AC Cycles Used	One Half Cycle	Both Half Cycles
Rectification Efficiency	40.6%	81.2%
Ripple Factor	1.21	0.482
Output waveform		

Part – B

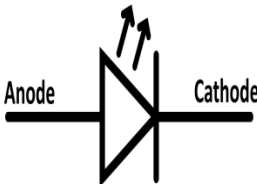
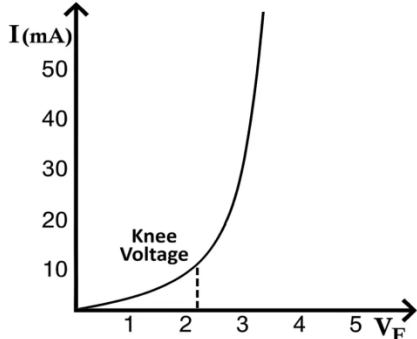
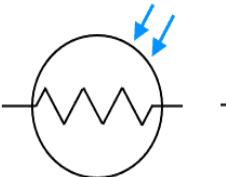
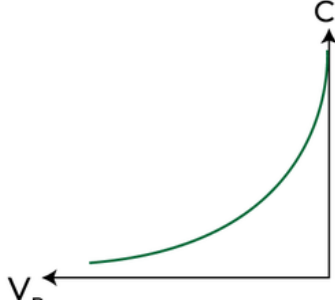
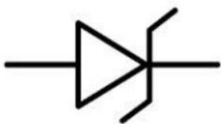
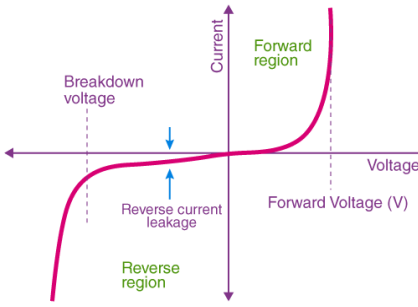
Descriptive-Type Questions

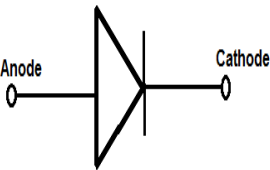
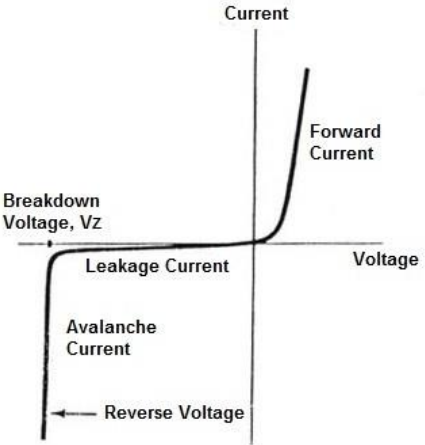
1. Explain the working of a Bridge Rectifier and mention one of its applications.
2. Explain the working of a full-wave center-tapped rectifier and mention one of its applications.
3. Explain the working of a half-wave rectifier and mention one of its applications.
4. Explain the working of a Zener diode under forward bias and reverse bias conditions.
5. Explain the working of a Zener diode as a voltage regulator.

Analytical Questions with subdivisions

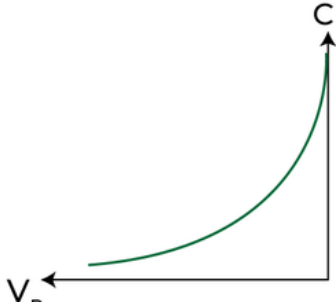
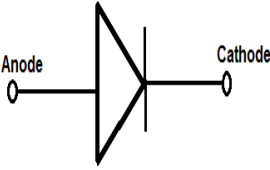
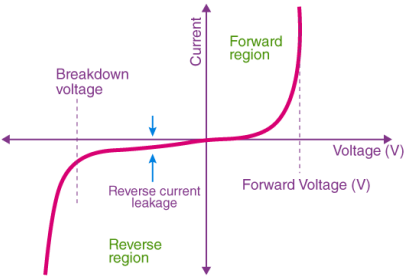
1 (per unit)

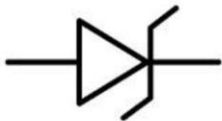
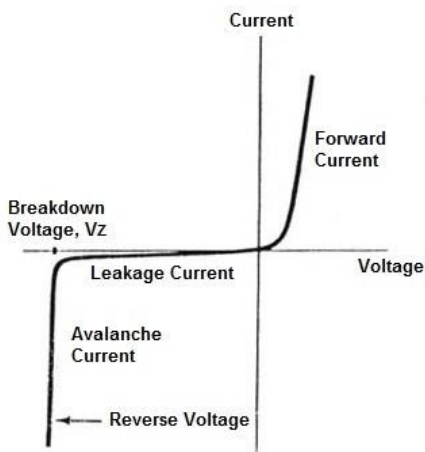
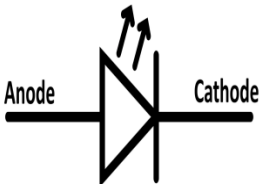
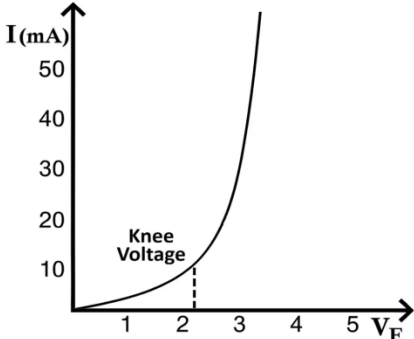
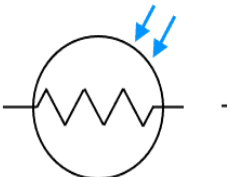
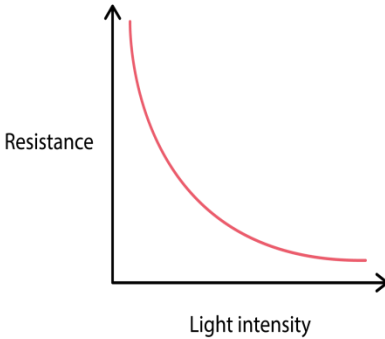
1. Match the **Diode/Device** in Column A with its correct **Symbol Description** in Column B and its correct **V-I Characteristic** in Column C. **(10 Marks)**

S.No	Diode (A)	Symbol (B)	VI Characteristics (C)
1	Varactor Diode		
2	PN Junction Diode		
3	Zener diode		
4	LED		

5	LDR		
---	-----	---	---

Correct Answer

S.No	Diode	Symbol	VI Characteristics
1	Varactor Diode		
2	PN Junction Diode		

3	Zener diode		
4	LED		
5	LDR		

UNIT III BJT AND UJT

PART – A

Multiple Choice Questions (MCQs)

21 (per unit)

1. In a BJT, current conduction is due to _____.

- A) Only electrons B) Only holes C) Both electrons and holes D) None of these

Answer: C) Both electrons and holes

2. The three terminals of a BJT are _____.

- A) Source, Drain, Gate B) Anode, Cathode, Gate C) Emitter, Base, Collector
D) Input, Output, Ground

Answer: C) Emitter, Base, Collector

3. In an NPN transistor, the majority carriers are _____.

- A) Holes B) Electrons C) Both holes and electrons D) None

Answer: B) Electrons

4. In common emitter configuration, the output is taken across _____.

- A) Base–Collector B) Collector–Emitter C) Base–Emitter D) Emitter–Ground

Answer: B) Collector–Emitter

5. The common collector configuration is also called a _____.

- A) Voltage amplifier B) Power amplifier C) Emitter follower D) Current regulator

Answer: C) Emitter follower

6. The configuration most widely used for amplification is _____.

- A) Common base B) Common emitter C) Common collector D) All of these

Answer: B) Common emitter

7. In common collector configuration, the voltage gain is approximately _____.

- A) Less than 1 B) Greater than 1 C) Zero D) Infinite

Answer: A) Less than 1

8. BJT used as a switch operates in _____ region.

- A) Active B) Cutoff and Saturation C) Reverse D) Forward

Answer: B) Cutoff and Saturation

9. BJT as an amplifier operates in _____ region.

- A) Cutoff B) Active C) Saturation D) Breakdown

Answer: B) Active

10. The need for biasing in a BJT is to _____.

A) Amplify signal B) Stabilize operating point C) Increase power D) Reduce frequency

Answer: B) Stabilize operating point

11. If a transistor is not properly biased, it may lead to _____.

A) Amplification B) Distortion C) Oscillation D) Power loss

Answer: B) Distortion

12. Thermal runaway in a transistor is caused by increase in _____.

A) Base current B) Collector current C) Emitter current D) Voltage

Answer: B) Collector current

13. The device which exhibits negative resistance characteristic is _____.

A) BJT B) UJT C) MOSFET D) SCR

Answer: B) UJT

14. The most commonly used biasing method is _____.

A) Fixed bias B) Self bias C) Voltage divider bias D) Thermal bias

Answer: C) Voltage divider bias

15. In CE amplifiers, the output signal is taken from the _____.

A) Collector B) Base C) Emitter D) Source

Answer: A) Collector

16. UJT stands for _____.

A) Universal Junction Transistor B) Unijunction Transistor C) Unilateral Junction Transistor D) None

Answer: B) Unijunction Transistor

17. The terminals of a UJT are _____.

A) Collector, Base, Emitter B) Anode, Cathode, Gate C) Emitter, Base1, Base2 D) Source, Gate, Drain

Answer: C) Emitter, Base1, Base2

18. The UJT is used mainly as a _____.

A) Power amplifier B) Relaxation oscillator C) Current amplifier D) Rectifier

Answer: B) Relaxation oscillator

19. The UJT exhibits a _____ resistance region.

A) Positive B) Negative C) Infinite D) None

Answer: B) Negative

20. The UJT is a _____ device.

- A) Current controlled B) Voltage controlled C) Frequency controlled D) Power controlled

Answer: B) Voltage controlled

21. A common application of UJT is in _____.

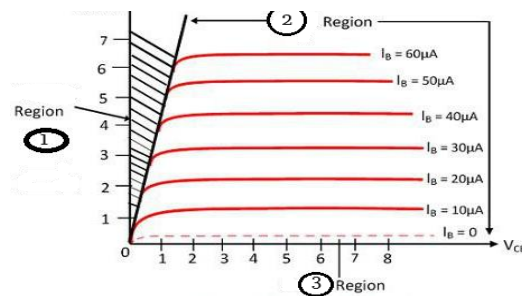
- A) Triggering SCRs B) Amplification C) Rectification D) Filtering

Answer: A) Triggering SCRs

Multiple Choice Questions (MCQs) – Analytical Type

9 (per unit)

1. Identify the cut-off region of a BJT from the curve shown below. (1 marks)



- a) Region 1 b) Region 2 c) Region 3 d) None

Ans: Option ©

2. In a Common Emitter (CE) configuration, the current gain (β) of a transistor is 100. If the base current (I_B) is $40\mu\text{A}$, calculate the collector current (I_C). (2 marks)

- a) 10mA b) 20mA c) 4mA d) 5mA

Answer: c) 4mA

Given:

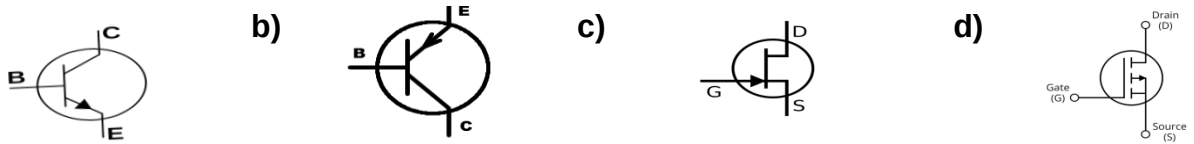
- $\beta = 100$
- $I_B = 40\mu\text{A} = 0.04\text{mA}$

Formula:

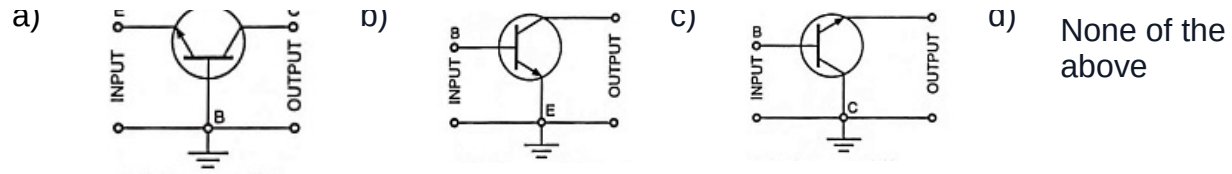
$$I_C = \beta I_B$$

$$I_C = 100 \times 0.04 = 4\text{mA}$$

3. Identify the symbol of an NPN transistor.

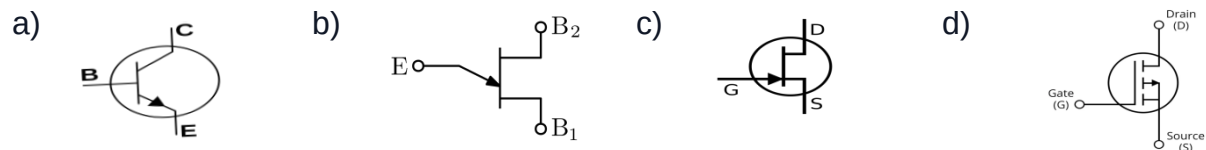


4. Which circuit configuration is Common Base (CE)?



Ans: Option (b)

5. Which of the following is the UJT symbol?



Ans: Option (b)

Arrange the following steps of transistor action in the correct sequence. (3 Marks)

Collector Attracts Electrons
 ↓
 Large Collector Current Flows
 ↓
 Most Electrons Reach Collector Junction
 ↓
 Few Electrons Recombine in Base Region
 ↓
 Emitter-Base Junction Forward Biased
 ↓
 Electrons Injected from Emitter to Base

↓
Transistor Action Occurs

6. Write the first step. (1 Mark)

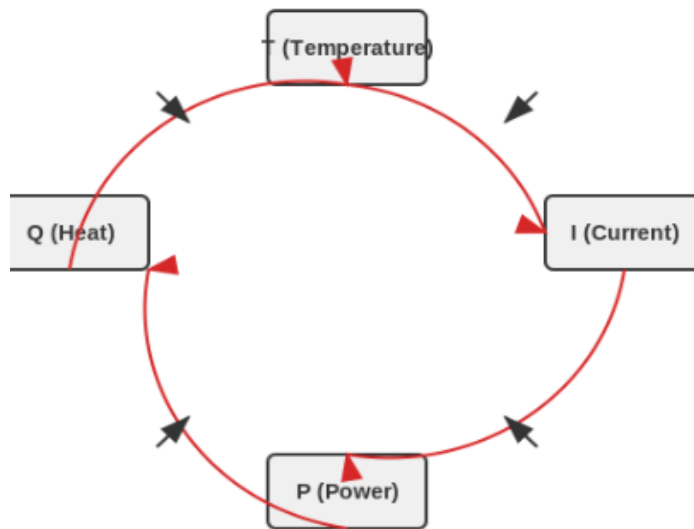
7. Write the fourth step. (1 Mark)

8. Write the sixth step. (1 Mark)

Answers

6. Emitter-Base Junction Forward Biased
7. Most Electrons Reach Collector Junction
8. Large Collector Current Flows

9. Observe the following flowchart and answer the questions. What phenomenon is represented by the above flowchart? (1 Mark)



Answer: Thermal Runaway in BJT

Part – B

Descriptive-Type Questions

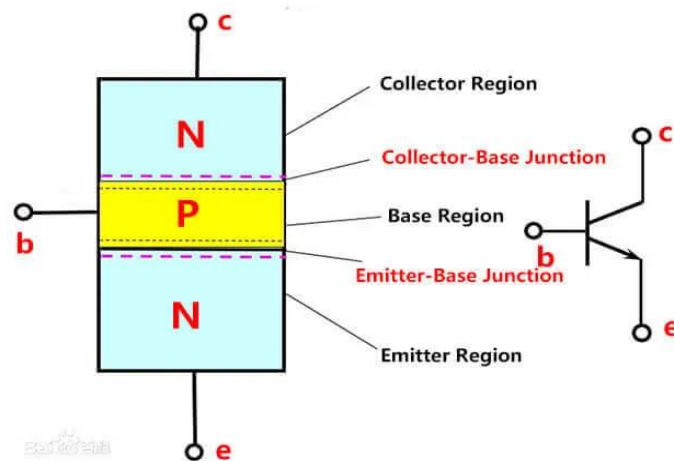
1. Explain the Common Emitter (CE) with circuit diagrams.
2. Explain the Common Base (CB) with circuit diagrams.
3. Explain the Common Collector (CC) configurations with circuit diagrams.

4. Explain the operation of the Voltage Divider Bias circuit with a neat circuit diagram. Discuss the role of the emitter resistor (R_E) in achieving thermal stability.
5. Explain the construction and operation of UJT with a neat diagram.

Analytical Questions with subdivisions

1 (per unit)

1. A Bipolar Junction Transistor (BJT) operates in different regions depending on the biasing conditions of the emitter-base junction (J1) and collector-base junction (J2).



Analyze the given biasing conditions and complete the following table by filling in the appropriate operating region, biasing condition, or application. (10 mark)

S.No	J1 (Emitter-Base Junction)	J2 (Collector-Base Junction)	Operating Region	Application
1	_____	_____	_____	Amplifier
2	Reverse Biased	Forward Biased	_____	_____
3	_____	_____	_____	OFF Switch
4	Forward Biased	Forward Biased	_____	_____

Answer

S.No	J1 (Emitter-Base Junction)	J2 (Collector-Base Junction)	Operating Region	Application
1	<u>Forward Biased</u>	<u>Reverse Biased</u>	<u>Active Region</u>	Amplifier
2	Reverse Biased	Forward Biased	<u>Reverse Active Region</u>	<u>Attenuator</u>
3	<u>Reverse Biased</u>	<u>Reverse Biased</u>	<u>Cut-off Region</u>	OFF Switch
4	Forward Biased	Forward Biased	<u>Saturation Region</u>	<u>ON Switch</u>

UNIT IV-FET

PART – A

Multiple Choice Questions (MCQs)

21 (per unit)

1. The JFET is a _____ device.

- A) Bipolar B) Unipolar C) Thermal D) Optical

Answer: B) Unipolar

2. The voltage applied between Gate and Source in JFET is usually kept _____.

- A) Forward biased B) Reverse biased C) Zero bias D) Positive bias

Answer: B) Reverse biased

3. MOSFET stands for _____.

- A) Metal Oxide Semiconductor Field Effect Transistor
B) Metal Oxide Silicon Field Emission Transistor
C) Metallic Oxide Semiconductor Functioning Transistor
D) Metalized Oxide Semiconductor FET

Answer: A) Metal Oxide Semiconductor Field Effect Transistor

4. The region of JFET operation where current becomes constant is called _____.

- A) Ohmic region B) Cutoff region C) Saturation region D) Breakdown region

Answer: C) Saturation region

5. In a MOSFET, the channel is controlled by:

- A) Gate voltage B) Drain voltage C) Source voltage e D) Drain current

Answer: A) Gate voltage

6. Common Source amplifier has a phase shift of _____.

- A) 0° B) 90° C) 180° D) 270°

Answer: C) 180°

7. The FET is preferred over BJT because of its _____.

- A) Low input impedance B) High noise C) High input impedance D) Low gain

Answer: C) High input impedance

8. In a JFET, the drain current is controlled by ____.

A) Input Current B) Gate Voltage C) Drain Voltage D) Source Resistance

Answer: B) Gate Voltage

9. The pinch-off voltage in a JFET corresponds to ____.

A) Maximum current B) Drain current saturation C) Cutoff of current D) Gate voltage zero

Answer: B) Drain current saturation

10. The MOSFET can operate in ____ modes.

A) Depletion only B) Enhancement only C) Depletion and Enhancement D) Cutoff only

Answer: C) Depletion and Enhancement

11. The insulated gate of a MOSFET is made of ____.

A) Silicon B) Metal C) Oxide D) Germanium

Answer: C) Oxide

12. The input resistance of JFET is typically ____.

A) Low B) Moderate C) High D) Zero

Answer: C) High

13. FET is classified as a ____ device.

A) Voltage controlled B) Current controlled C) Power controlled D) Frequency controlled

Answer: A) Voltage controlled

14. MOSFET offers ____ input impedance than JFET.

A) Lower B) Higher C) Same D) Moderate

Answer: B) Higher

15. The region of FET operation used for amplification is ____.

A) Ohmic region B) Cutoff region C) Saturation region D) Breakdown region

Answer: C) Saturation region

16. The FET has ____ thermal stability than BJT.

A) Better B) Worse C) Same D) None

Answer: A) Better

17. MOSFETs are preferred in high frequency circuits because of ____.

A) Low input capacitance B) High gate resistance C) High gain D) Fast switching

Answer: D) Fast switching

18. The primary advantage of FETs over BJTs is:

A) Higher current gain B) Higher input impedance C) Higher output impedance
D) Faster switching speed

Answer: B) Higher input impedance

19. The common Drain amplifier is also called ____.

A) Source Follower B) Voltage Follower C) Both A & B D) None

Answer: C) Both A & B

20. The gate of a MOSFET is isolated from the channel by:

A) An oxide layer B) A P-N junction C) A metal layer D) A dielectric material

Answer: A) An oxide layer

21. FETs are mainly used in circuits where ____ is important.

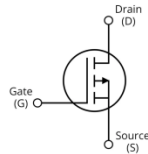
- A) High noise B) Low input resistance C) High input impedance D) High current

Answer: C) High input impedance

Multiple Choice Questions (MCQs) – Analytical Type

9 (per unit)

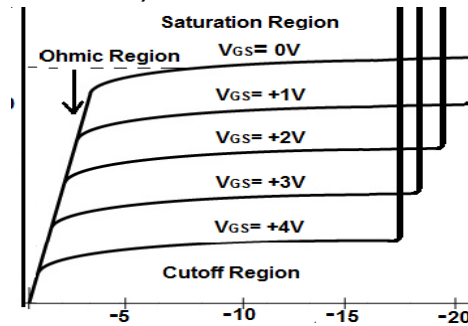
1. The symbol shows a MOSFET with an arrow pointing outwards. Identify it.



- a) N-channel MOSFET b) P-channel MOSFET c) JFET d) LED

Ans: a) N-channel MOSFET

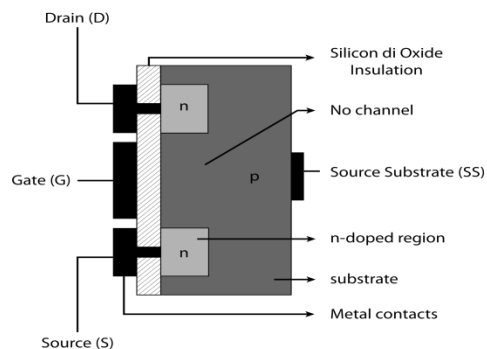
2. In the JFET transfer characteristic, the curve shows the relation between:



- a) ID vs VGS b) ID vs VDS c) IG vs VGS d) IC vs VCE

Answer: a) ID vs VGS

3. In the given MOSFET structure, which layer forms the channel?



- a) P-type b) N-type c) Insulator d) Metal

Answer: b) N-type

Refer the table

VGS Condition	Channel Width	Drain Current
0 V	Wide	Maximum
-1 V	Reduced	Decreases
VP	Almost Closed	Nearly Zero

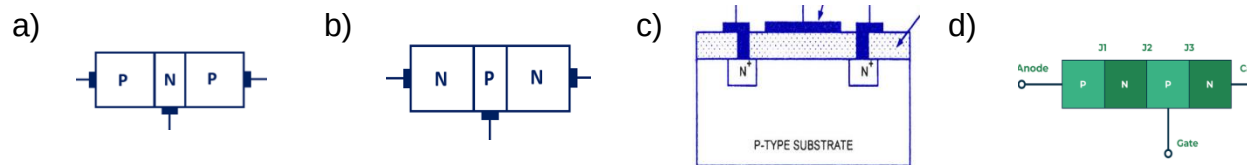
4) At which condition is the drain current maximum? (1mark)

Answer: $V_{GS} = 0 \text{ V}$

5) Identify the condition where the channel almost closes. (1mark)

Answer: Pinch-off Voltage (V_P)

6. In the given MOSFET structure, which layer forms the channel?



a) P-type

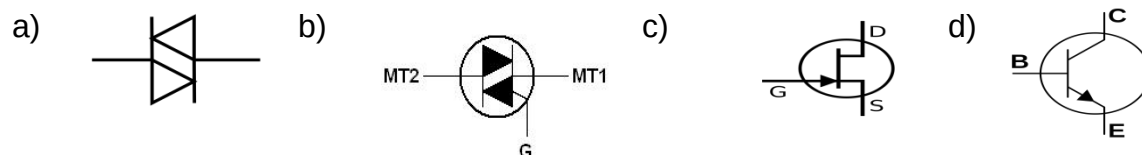
b) N-type

c) Insulator

d) Metal

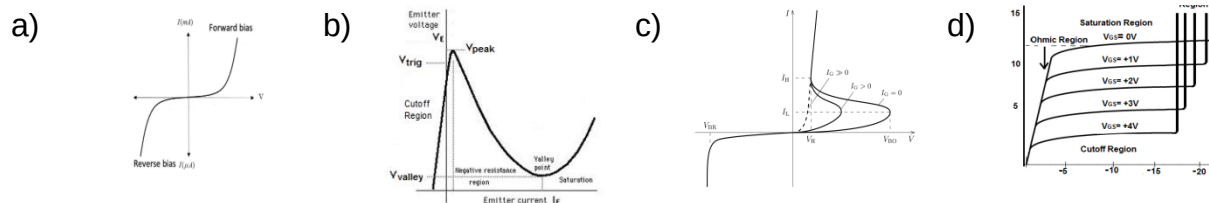
Ans: b) N-type

7. In the comparison diagrams, which device is voltage-controlled?



Ans: Option (c)

8. Which diagram represents the transfer characteristic (I_D vs V_{GS}) of JFET?



Part – B

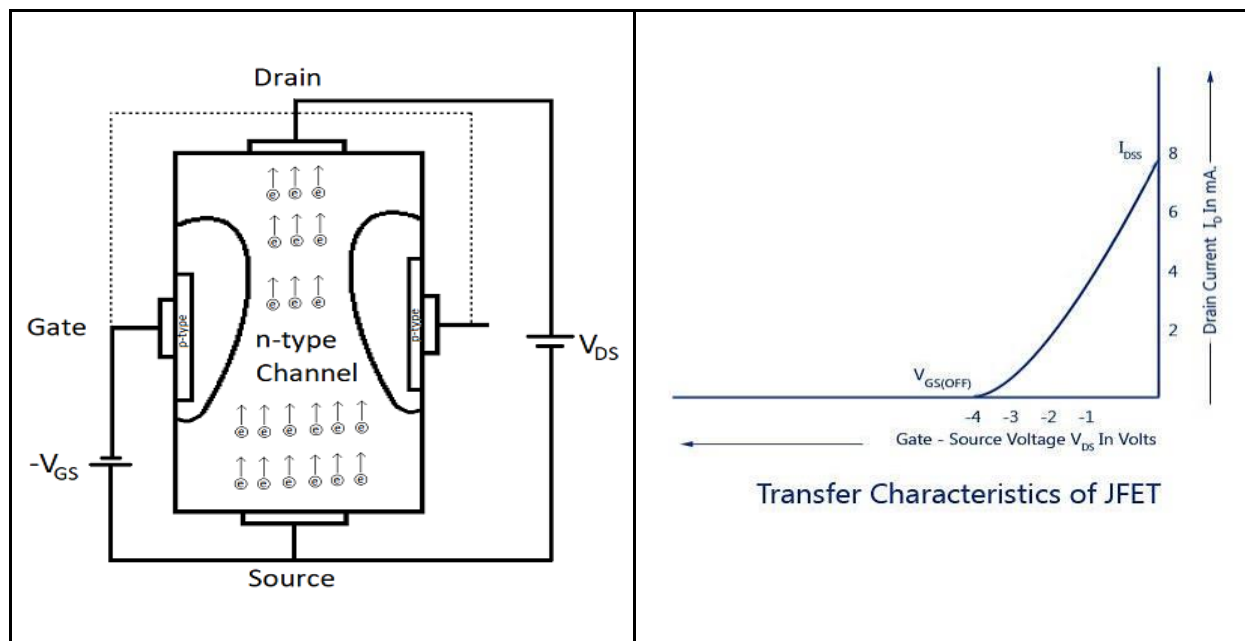
Descriptive-Type Questions

1. Explain the construction of a **MOSFET in depletion mode** and describe how it works.
2. Draw and explain the construction, transfer **characteristics**, **Drain Characteristics of a JFET**.
3. Compare **FET and BJT** in terms of structure, operation, input impedance, and applications.
4. Explain the **common source amplifier** configuration using FET and derive its voltage gain.

Analytical Questions with subdivisions

1 (per unit)

A student performs an experiment on an **N-Channel JFET**.



- Initially, $V_{GS}=0$ and the drain current is maximum.
- Later, V_{GS} is made negative.
- Finally, V_{GS} reaches the pinch-off voltage.

Based on the above information, answer the following.

1) State the drain current at $V_{GS}=0$. (1Mark)

Answer:

Drain current is **maximum** ($I_D = I_{DSS}$).

2) What happens to the channel width when V_{GS} becomes negative? (1Mark)

Answer:

The **channel width decreases**.

3) State the operating condition at pinch-off voltage. (2marks)

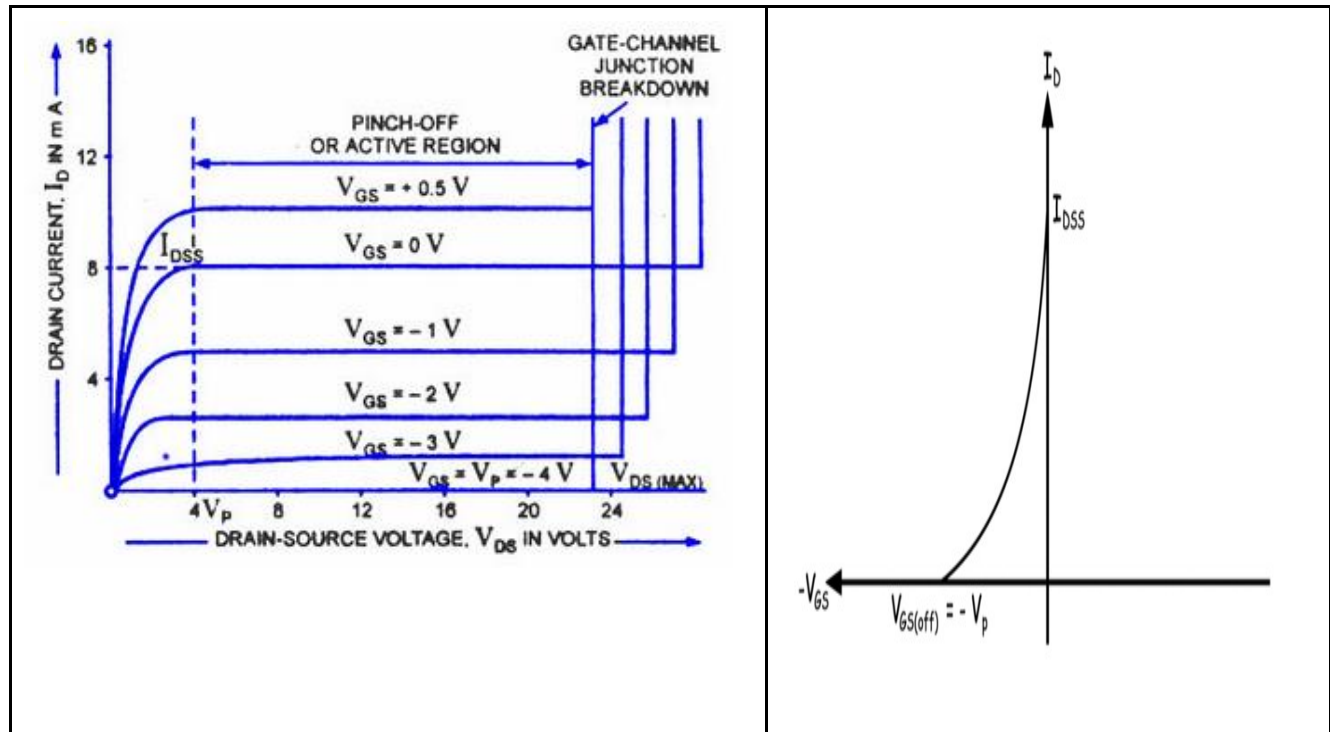
Answer:

- Channel is almost closed.
- Drain current becomes nearly zero (Cut-off region)

Refer to the

- **Drain Characteristics**
- **Transfer Characteristics**
- **Applications**

Answer the following.



4) Which region is used as a variable resistor? (1)

Answer:

Linear (Ohmic) Region

5) Which region provides constant current? (1)

Answer:

Saturation Region

6) Compare drain characteristics and transfer characteristics. (2)

Answer:

Drain Characteristics:

- Graph between I_D and V_{DS}

Transfer Characteristics:

- Graph between I_D and V_{GS}

UNIT V- THYRISTOR AND OPTOELECTRONIC DEVICES

PART – A

Multiple Choice Questions (MCQs)

21 (per unit)

Q1. The number of PN junctions in an SCR is:

A) One B) Two C) Three D) Four

Answer: C) Three

Q2. The transistor analogy of SCR uses:

A) 2 transistors B) 3 transistors C) 4 transistors D) 5 transistors

Answer: A) 2 transistors

Q3. In inverter circuits, SCR is used as:

A) Amplifier B) Switch C) Oscillator D) Filter

Answer: B) Switch

Q4. Commutation of SCR refers to:

A) Turning ON by gate B) Turning OFF after conduction C) Increasing holding

current D) Reducing leakage current

Answer: B) Turning OFF after conduction

Q5. The full form of SCR is:

A) Silicon Current Rectifier B) Silicon Controlled Rectifier C) Semiconductor Current Regulator D) Silicon Circuit Resistor

Answer: B) Silicon Controlled Rectifier

Q6. Which method is commonly used to trigger an SCR?

A) Voltage triggering B) Gate triggering C) Thermal triggering D) Radiation triggering

Answer: B) Gate triggering

Q7. DIAC is mostly used for triggering:

A) MOSFET B) BJT C) TRIAC D) UJT

Answer: C) TRIAC

Q8. The VI characteristic of DIAC is:

A) Symmetrical B) Asymmetrical C) Linear D) Constant

Answer: A) Symmetrical

Q9. TRIAC is:

A) Unidirectional device B) Bidirectional device C) Only rectifier D) Only amplifier

Answer: B) Bidirectional device

Q10. TRIAC is equivalent to:

- A) Two SCRs in parallel
- B) Two SCRs in series
- C) Two SCRs in inverse parallel
- D) Two SCRs in cascade

Answer: C) Two SCRs in inverse parallel

Q11. TRIAC conducts for:

- A) Half cycle
- B) Full cycle
- C) No cycle
- D) Only in reverse bias

Answer: B) Full cycle

Q12. TRIAC can be used in:

- A) DC power control
- B) AC motor speed control
- C) Voltage regulation only
- D) Rectifier only

Answer: B) AC motor speed control

Q13. The breakover voltage of DIAC is typically:

- A) 1–2 V
- B) 5–10 V
- C) 20–40 V
- D) 100–200 V

Answer: C) 20–40 V

Q14. DIAC is also called as:

- A) Trigger diode
- B) Shockley diode
- C) Varactor diode
- D) PIN diode

Answer: A) Trigger diode

Q15. A photodiode operates under:

- A) Forward bias
- B) Reverse bias
- C) Zero bias
- D) Both forward & reverse bias

Answer: B) Reverse bias

Q16. Solar panel works on:

- A) Photoemission effect
- B) Photovoltaic effect
- C) Photoconductive effect
- D) Thermal emission

Answer: B) Photovoltaic effect

Q17. An optocoupler is used for:

- A) Amplification
- B) Electrical isolation
- C) Signal distortion
- D) Power amplification

Answer: B) Electrical isolation

Q18. LED emits light due to:

- A) Recombination of electrons & holes
- B) Thermal emission
- C) Photovoltaic effect
- D) Avalanche breakdown

Answer: A) Recombination of electrons & holes

Q19. Seven-segment displays are used in:

- A) Power amplifiers
- B) Counters and calculators
- C) AC power control
- D) Memory chips

Answer: B) Counters and calculators

Q20. A solar panel converts:

- A) Electrical to light
- B) Light to electrical
- C) Mechanical to electrical
- D) Heat to electrical

Answer: B) Light to electrical

Q21. An optocoupler typically contains:

- A) LED + Photodiode B) SCR + TRIAC C) LCD + LED D) Solar cell + LED

Answer: A) LED + Photodiode

Q22. LED colors depend on:

- A) Current B) Voltage C) Bandgap of material D) Packaging

Answer: C) Bandgap of material

Q23. LED used in optocoupler works as:

- A) Light source B) Light sensor C) Amplifier D) Oscillator

Answer: A) Light source

Q24. The wavelength of light emitted by LED depends on:

- A) Doping material B) Applied voltage C) Current rating D) Packaging

Answer: A) Doping material

Q25. The output of solar panel is:

- A) AC B) DC C) Pulsating DC D) None

Answer: B) DC

Q26. Optoelectronic devices are widely used in:

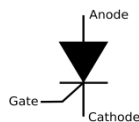
- A) Communication systems B) Power plants C) Transformers D) Motors

Answer: A) Communication systems

Multiple Choice Questions (MCQs) – Analytical Type

9 (per unit)

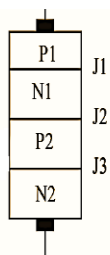
1. Identify the device shown in the symbol diagram



- a) DIAC b) TRIAC c) SCR d) BJT

Ans: c) SCR

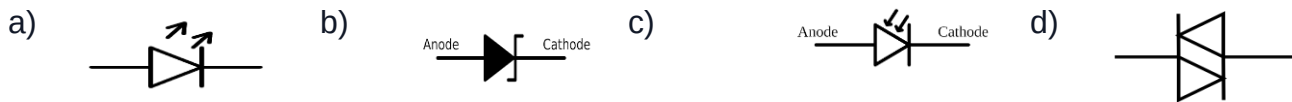
2. Where is the gate terminal given in the SCR construction?



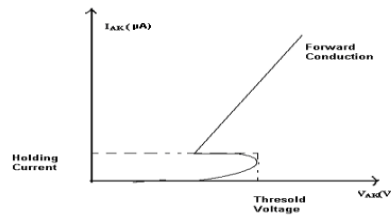
- a) P1 b) N1 c) P2 d) N2

Ans: c) P2

3. Which device in the image is bidirectional?



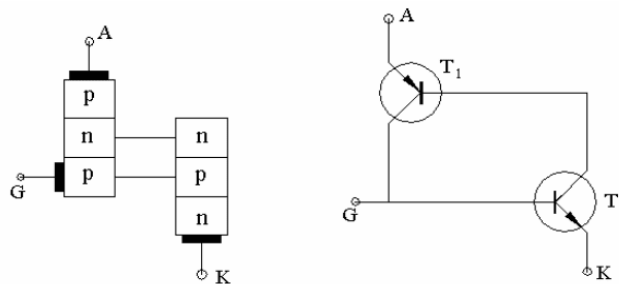
4. Given this characteristic curve, identify the device.



- a) PN DIODE b) ZENER DIODE c) SCR d) LDR

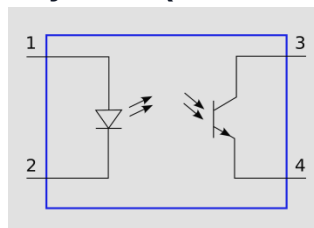
Ans: c) SCR

5. The diagram shows two transistors connected back-to-back. This is an analogy of:



- a) DIAC b) TRIAC c) SCR d) Photo diode

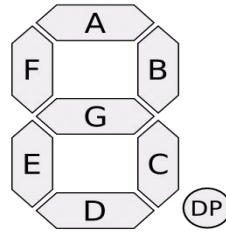
6. Identify the symbol: (LED + Phototransistor in the same package).



- a) Photodiode b) Optocoupler c) SCR d) LCD

Ans: b) Optocoupler

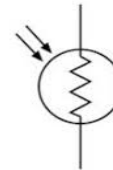
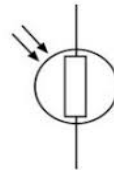
7. The figure shows a, c, d, f, g segments. Which digit is displayed?



- a) 3 b) 4 c) 5 d) 6

Ans: c) 5

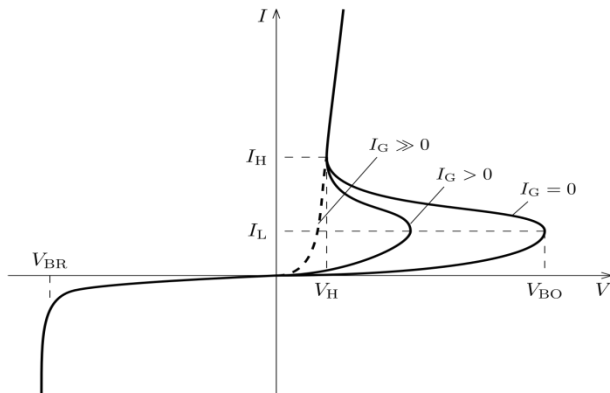
8. Identify the device that is ON when light falls and OFF when dark.



- a) Photodiode b) Solar cell c) LDR d) LCD

Ans: c) LDR

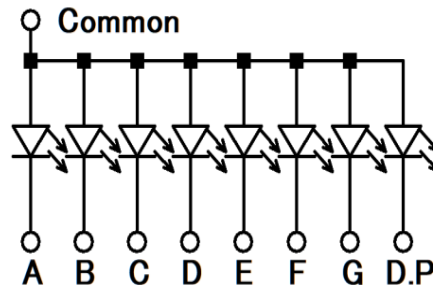
9. Which device characteristic shows holding current and latching current?



- a) SCR b) DIAC c) Photodiode d) Zener diode

Ans: a) SCR

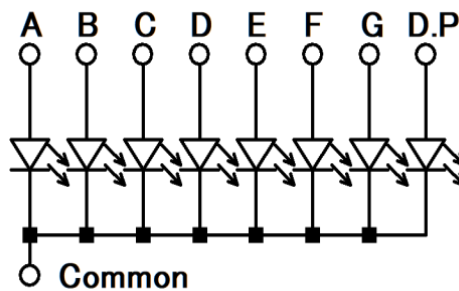
10. The figure shows 7-segment display connections. Which type is this?



- a) Common cathode b) Common anode c) Photodiode d) Optocoupler

Ans: b) Common anode

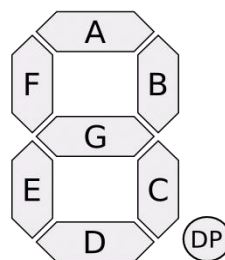
11. The figure shows 7-segment display connections. Which type is this?



- a) Common cathode b) Common anode c) Photodiode d) Optocoupler

Ans: a) Common cathode

12. The figure shows **segments a, b, c, d, f, g glowing**. Which digit is displayed?



- a) 6 b) 8 c) 9 d) 0

Ans: c) 9

Part – B

Descriptive-Type Questions

1. Explain the construction and working principle of an SCR with a neat diagram.
2. Explain the construction and VI characteristics of a DIAC.
3. With a neat diagram, describe the working of a TRIAC and list its applications.
4. Explain the working principle and characteristics of a photodiode.
5. Explain the construction and working of a seven-segment display. How is it used in digital systems?

Analytical Questions with subdivisions

1 (per unit)

1. Match the following **opto-electronic devices** with their **principle/functionality** and **application**. Each correct answer carries 1 mark. (10 Mark)

Name of the Component	Principle / Functionality	Application
1. Photodiode	a. Converts light energy into electrical energy	p. Electrical isolation
2. Solar Panel	b. Detects light and converts it into electrical current	q. Digital clocks and counters
3. Optocoupler	c. Controls light transmission using liquid crystals	r. Solar power generation
4. LCD	d. Transfers signals using light while providing electrical isolation	s. Light detection and sensing
5. Seven-Segment Display	e. Displays numerical digits using illuminated segments	t. Digital displays

Correct Answer

- 1 – b – s
- 2 – a – r
- 3 – d – p
- 4 – c – t

$$5 - e - q$$