



**POSTAL
BOOK PACKAGE**

2025

CONTENTS

**ELECTRICAL
ENGINEERING**

Objective Practice Sets

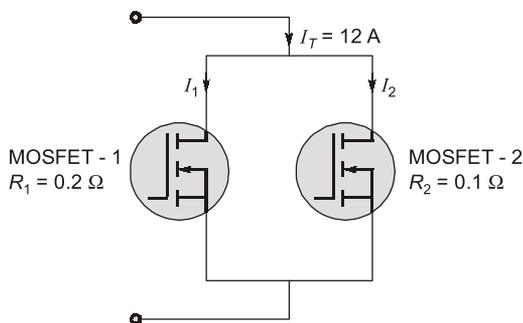
Power Electronics

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Power Semiconductor Diode and Transistor

MCQ and NAT Questions

- Q.1** The correct sequence of the among semiconductor devices is (decreasing order) of speed
- Power BJT, Power MOSFET, IGBT, SCR
 - IGBT, Power MOSFET, Power BJT, SCR
 - SCR, Power BJT, IGBT, MOSFET
 - MOSFET, IGBT, Power BJT, SCR
- Q.2** Turn-on and turn-off times of transistor depend on
- static characteristic
 - junction capacitances
 - current gain
 - none of the above
- Q.3** The power loss in MOSFET-1 and MOSFET-2 for the circuit shown below are respectively

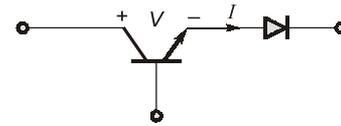


- 6.4 W and 3.2 W
 - 2.8 W and 7.2 W
 - 3.2 W and 6.4 W
 - 7.2 W and 2.8 W
- Q.4** A diode and a FET is anti-parallel combination blocks:
- Bidirectional voltage of passes unidirectional current.
 - Bidirectional voltage and passes bidirectional current.
 - Unidirectional voltage and passes unidirectional current.
 - Unidirectional voltage and passes bidirectional current.
- Q.5** For MOSFET:
- they are easy for parallel connection for higher current.

- leakage current is relatively high.
- have more linear characteristics.
- overload and peak current handling capability are high.

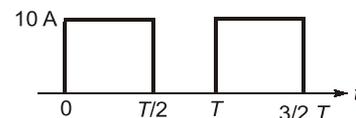
- Q.6** For which transistor the symmetry is obtained as the emitter and collector or source and drain can be interchanged?
- BJT
 - IGBT
 - SCR
 - MOSFET

- Q.7** The V-I characteristics for the switch shown is (Devices are ideal)



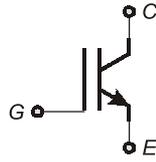
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- Q.8** A MOSFET rated for 20 A, carries a periodic current as shown in the figure. The on-state resistance of the MOSFET is 0.2 ohm. What is the average on-state power loss of device per cycle?



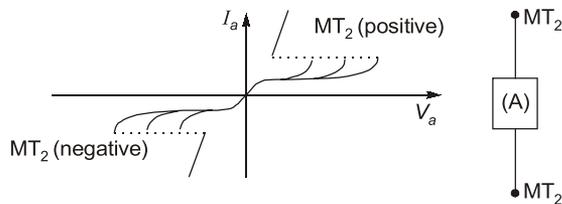
- 20 W
 - 15 W
 - 10 W
 - 5 W
- Q.9** For a BJT as a power control switch by biasing it in the cut-off region (off state) or in the saturation region (on state). In the on state, for the BJT (B-Base, E-Emitter, C-Collector)

Q.39 Which of the following option(s) is/are correct regarding the device whose symbol is shown below:

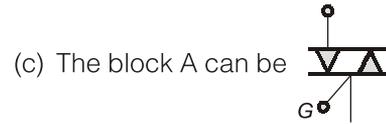


- (a) The device is power MOSFET.
- (b) The device is known as metal oxide insulated gate transistor.
- (c) It has high input impedance.
- (d) It has low on state power loss.

Q.40 The static VI characteristics of a device is shown. The correct option(s) regarding the device can be



- (a) The device is UJT
- (b) The device is bidirectional in nature.



- (d) The device is extensively used for heat control, speed control of single phase induction motors.



Answers Power Semiconductor Diode and Transistor

1. (d) 2. (b) 3. (c) 4. (d) 5. (b) 6. (d) 7. (c) 8. (c) 9. (d)
 10. (c) 11. (a) 12. (a) 13. (c) 14. (b) 15. (a) 16. (a) 17. (d) 18. (c)
 19. (213.33) 20. (a) 21. (d) 22. (0.027) 23. (c) 24. (960) 25. (d) 26. (1.265) 27. (b)
 28. (a) 29. (b) 30. (0) 31. (c) 32. (75) 33. (b) 34. (a) 35. (c) 36. (200)
 37. (a,c) 38. (a,c) 39. (b,c,d) 40. (b,c,d)

Explanations Power Semiconductor Diode and Transistor

1. (d)

MOSFET has the highest operating speed (frequency).

2. (b)

Turn-on and turn-off times of transistor depend on junction capacitance.

Because of charging and discharging of junction capacitance a transistor does not turn-on and turn off instantly.

3. (c)

During on state, MOSFET can be replaced resistors.

∴ Using current divider rule,

$$I_1 = \left(\frac{R_2}{R_1 + R_2} \right) I_T$$

or
$$I_1 = \left(\frac{0.1}{0.3} \right) \times 12 = 4 \text{ A}$$

and
$$I_2 = I_T - I_1 = 12 - 4 = 8 \text{ A}$$

 ∴
$$P_1 = I_1^2 \cdot R_1 = 4^2 \times 0.2 = 3.2 \text{ W}$$

 and
$$P_2 = I_2^2 \cdot R_2 = 8^2 \times 0.1 = 6.4 \text{ W}$$

4. (d)

If device has one antiparallel diode, entire circuit allows the bidirectional current and at the same time it blocks the unidirectional voltage.

5. (b)

Leakage current is relatively high.

35. (c)

Voltage blocking capability is determined by the drift layer of IGBT.

36. Sol.

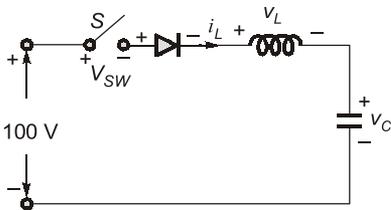
$$V_{SW} + V_D + V_L + V_C - V_{dc} = 0$$

When SW → ON; D → ON

$$V_{SW} = V_D = 0$$

$$\therefore V_{dc} = 100 = \frac{L di}{dt} + \frac{1}{C} \int i dt$$

$$\text{Applying Laplace} = \frac{100}{s} = LSI(s) + \frac{1}{CS} I(s)$$



Solving $i(t) = I_p \sin \omega t$ where

$$I_p = 100 \sqrt{\frac{C}{L}}$$

$$\omega = \frac{1}{\sqrt{LC}}$$

Now,

$$V_L = \frac{L di(t)}{dt} = LI_p \omega \cos \omega t = 100 \cos \omega t$$

$$\therefore V_C = V_S - V_L = 100(1 - \cos \omega t) \text{ Volts}$$

At steady, state i.e. at $i = 0 \Rightarrow \omega t = \pi$

$$V_C = 100(1 - \cos \pi) = 200 \text{ V}$$

37. (a, c)

- Triac, RCT → bidirectional current capability where RCT (reverse conducting thyristor).
- GTO, IGBT, diode, SCR, BJT are unidirectional current devices.

38. (a, c)

- Power MOSFET has lower switching losses but conduction losses are more.
- Due to positive temperature coefficient for resistance, parallel operation of MOSFETs are easy and also secondary breakdown does not occur.

39. (b, c, d)

- The device is IGBT and is also known as MOSGIT.
- It combines the advantages of both MOSFET and BJT as it has high input impedance like MOSFET and low on state power loss as in a BJT.

40. (b, c, d)

- The device is TRIAC, and conducts in both directions.

