

B.Tech DEGREE EXAMINATION, NOVEMBER 2023

Third Semester

18ECC211J - SOLID STATE SEMICONDUCTOR DEVICES*(For the candidates admitted during the academic year 2020 - 2021 & 2021 - 2022)***Note:**

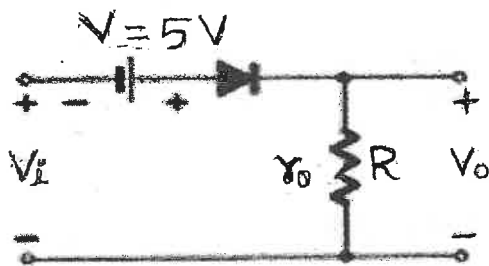
- i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours**Max. Marks: 100****PART - A (20 × 1 = 20 Marks)**

Answer all Questions

	Marks	BL	CO
1. Select, which of the following is the normal operating region of Zener diode (A) forward-bias region (B) reverse-bias region (C) zero-crossing region (D) reverse-breakdown region.	1	1	1
2. What is the knee voltage of the silicon diode (A) 0.2 V (B) 0.7 V (C) 0.8 V (D) 1.0 V	1	1	1
3. When the diode is forward biased, it is equivalent to..... (A) An off-switch (B) An On-switch (C) A high resistance (D) A negative resistance	1	1	1
4. A forward potential of 10V is applied to a Si diode. A resistance of 1 KΩ is also in series with the diode. Calculate the current (A) 10 mA (B) 0.01 mA (C) 0.7 mA (D) 0 mA	1	1	1
5. Schottky diodes are also known as (A) PIN diodes (B) Hot carrier diodes (C) Photo diodes (D) Laser diodes	1	1	2
6. Which of the following diode is used in TV tuners (A) Tunnel diodes (B) Zener diode (C) Varactor diodes (D) PN junction diode	1	1	2
7. Which of the following diode is used in optical sources (A) PIN diode (B) PIN photodiode (C) step recovery diode (D) LED	1	1	2
8. Select, the diode which has negative resistance property (A) LED (B) step-recovery diodes (C) hot carrier diodes. (D) tunnel diodes.	1	1	2
9. Select, the condition of the transistor to operate it in the active region (A) Emitter Base junction should be forward biased and Collector Base junction should be reverse biased (B) Emitter Base junction should be reverse biased and the Collector Base junction should be forward biased (C) Emitter Base junction should be forward biased and Collector Base junction should be forward biased (D) Emitter Base junction should be reverse biased and Collector Base junction should be reverse biased	1	1	3

10. Calculate collector current for the given base current is 1mA and the emitter current is 20mA
 (A) 1mA (B) 3mA
 (C) 19mA (D) 4mA
11. Calculate β of CE configuration for the given value of BJT ($I_b=1\text{mA}$ and $I_c=2\text{mA}$)
 (A) 1 (B) 2
 (C) 0.5 (D) 0.2
12. Tell, What is h_{ob} of BJT ?
 (A) Input resistance of CE configuration (B) output resistance of CB configuration
 (C) bias resistance of CB configuration (D) Output admittance of CB configuration
13. Recall, MOSFET is ----- device
 (A) Current controlled (B) Voltage controlled
 (C) Current limiter (D) Voltage slicer
14. When $V_{gs}=0$, what is the current flow of enhancement MOSFET
 (A) Maximum (B) Minimum
 (C) Zero (D) Medium
15. What type of FETs are preferred for Power electronics?
 (A) P-channel depletion (B) N-channel depletion
 (C) Enhancement MOSFET (D) MESFET
16. Select the state of the channel in Enhancement MOSFET
 (A) No channel (B) Channel is present
 (C) Channels are combined (D) Channels are extended to drain region
17. For a sinusoidal input of $20 V_{\text{peak}}$ to the given circuit, what is the peak value of the output waveform?



- (A) 20V (B) 25V
 (C) 0V (D) -25V
18. In full-wave rectification, if the input frequency is 50 Hz then output frequency is...
 (A) 50 Hz (B) 100 Hz
 (C) 200 Hz (D) 400 Hz
19. what is the ripple factor of a full wave rectifier
 (A) 0.1 (B) 0.6
 (C) 0.58 (D) 0.48
20. What is the drain current of N-Channel EMOSFET if $V_{gs}=0$
 (A) +VGS (B) -VGS
 (C) $V_{GS} < V_{TH}$ (D) Zero

PART - B ($5 \times 4 = 20$ Marks)
 Answer any 5 Questions

Marks BL CO

21. A Si sample is doped with 10^{17} as atoms/cm ³ . What is the equilibrium hole concentration p_0 at 300K? where is E_F relative to E_i	4	3	1
22. Show the position of Fermi level in N type and P type semiconductors and explain.	4	2	1
23. What is the valley model theory? How it is possible in direct band gap material	4	1	2
24. Mention the need and type of transistor biasing?	4	2	3
25. Inspect why it is necessary to stabilize the operating point of transistor.	4	1	3
26. Compare the clipper and the clamper circuit	4	1	5
27. Draw the circuit diagram for switching of MOSFET and BJT	4	1	5

PART - C (5 × 12 = 60 Marks)

Answer **all** Questions

Marks BL CO

28. (a) (i) Review the expression for current through the PN junction diode (ii) Explain the V-I characteristics of Zener diode and Analyze between Avalanche and Zener breakdowns. (OR) (b) Illustrate about the switching characteristics and diode modelling of PN junction diode with suitable diagrams.	12	2	1
29. (a) What is direct bandgap material? Draw the structure and explain (i) LED (ii) Laser (OR) (b) Explain the following diodes i) IMPATT diode ii) Tunnel diode	12	2	2
30. (a) Why transistor is considered as current controlled device? b) For a transistor α is 0.99, what is β ? c) What do you mean by Punch-Through or Reach-Through effect? (OR) (b) Draw and explain the Eber's Mol model of BJT	12	2	3
31. (a) Draw and explain the construction and operation of CMOSFET with its Characteristics. (OR) (b) The MOSFET amplifier circuit includes voltage divider bias, the two resistors like $R_1 = 2.5 \text{ M Ohm}$ & $R_2 = 1.5 \text{ M Ohm}$ respectively, then what is the R_{in} value?	12	2	4
32. (a) Draw the circuit diagram and compose the working of full wave bridge rectifier with output filter and derive the expression of average output current, voltage, efficiency, ripple factor, PIV and TUF. (OR) (b) Explain the integrated resistor and capacitor	12	2	5

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