R20 Regulation *Subject code:* 3E2AH

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech II Semester Regular/Supplementary Examinations, October 2022

SEMICONDUCTOR DEVICES & CIRCUITS

(Common to EEE,CSE,CSE(AI&ML),CSE(DS) and IT)

Maximum Marks: 70 Date:15.10.2022 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 Define Doping.
2 What is load line analysis?
3 Write any two differences between Zener breakdown and Avalanche breakdown.
4 What is varactor diode and how does it work?
5 Define rectifier.
6 What are the types of filters?
7 What are the biasing conditions of a transistor to operate in active region and cut off region?
8 In a transistor, the base current and collector current is 60 μA and 1.75 mA respectively. What will be the emitter current? Calculate the value of α of transistor.
9 Why the input impedance of FET is more than that of a BJT?
10 Compare Depletion MOSFET and enhancement MOSFET.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 a) Discuss about ideal versus practical diode. (5 Marks)
b) What is a Diode? Explain about the working Principle of Diode. (5 Marks)

OR

12 A silicon diode is asymmetrically doped at $N_D = 10^{19}$ cm $^{-3}$ and $N_A = 10^{16}$ cm $^{-3}$. (Note that at $N_D = 10^{19}$ the semiconductor is on the edge of degeneracy, but we can assume that non--degenerate carrier statistics are close enough for this problem) Assume that the minority electron and hole lifetimes are $\tau_n = \tau_p = 10^{-6}$ s. The lengths of the N and P regions are L = 500 μm and $L >> x_p, x_n$.

i) Estimate the applied forward bias at which the P-region enters high-level injection.
ii) Compute the current density at the onset of high-injection. (10 marks)

13 a) For the Zener diode voltage regulator with $V_S = 20$ V, $R_S = 100\ \Omega$, $V_Z = 12$ V, $R_L = 680\Omega$, determine

i. Load voltage.

ii. Voltage drop across series resistance R_S.

iii. Current through the Zener diode. (5 Marks)

b) Discuss the working of a Zener diode as a voltage regulator. (5 Marks)

OR

14 a) Draw the basic structure of a SCR and explain its characteristics. (5 Marks)

b) What is varactor diode? What are the differences between a tunnel diode & an ordinary PN junction diode? (5 Marks)

15 a) Explain the working of Bridge rectifier. Give the expressions for RMS current, PIV, ripple factor and efficiency. (5 Marks)

b) The applied input AC power to a half-wave rectifier is 100 watts. The DC output power obtained is 40 watts.

(i) What is the rectification efficiency?

(ii) What happens to remaining 60 watts? (5 Marks)

OR

16 a) Explain the working of π- section Filters. (7 Marks)

b) Why Pi filters are not suitable for varying loads? (3 Marks)

17 a) Distinguish between the different types of transistor configurations with necessary circuit diagrams. (5 Marks)

b) Explain input and output characteristics of CE configuration. (5 Marks)

OR

18 If the common-emitter h –parameters of a transistor are given by $h_{ie} = 2000\ \Omega$, $h_{fe} = 49$, $h_{re} = 5.5 \times 10^{-4}$ and $h_{oe} = 2.5 \times 10^{-5}$. The source and load resistances of a CE amplifier are equal to 2 kΩ. Compute A_V, R_i and R_O. Also find the common base h-parameters of the transistor. (10 Marks)

19 Explain the operation of N-Channel JFET with its characteristics and explain the different regions in transfer characteristics? (10 Marks)

OR

20 Describe the construction and explain the operation of depletion mode N-Channel MOSFET. Also draw the static characteristics. (10 Marks)