

Code No: 182AG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech I Year II Semester Examinations, September - 2023

ELECTRONIC DEVICES AND CIRCUITS

(Common to ECE, EIE, CSE (AI&amp;ML), CSE (IOT), AI&amp;DS, AI&amp;ML)

Time: 3 Hours

Max. Marks: 60

**Note:** This question paper contains two parts A and B.i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

**PART - A****(10 Marks)**

- What is diffusion length (L)? [1]
- Define Cut-in voltage. Give the cut-in voltage of Si and Ge diodes. [1]
- Classify clipper circuits based on the connection of the active device. Mention their uses. [1]
- State Clamping Circuit Theorem. [1]
- Show that  $(1/\alpha) - (1/\beta) = 1$ . [1]
- Mention different modes of operation of BJT. [1]
- Define pinch off voltage? [1]
- List the classification of FETs. [1]
- Draw the symbols of Schottky Diode and Photo diode. [1]
- List the applications of SCR. [1]

**PART - B****(50 Marks)**

- Explain the temperature dependence of VI characteristics of PN junction diode. [5+5]
  - Explain break down mechanisms in semiconductor diodes. [5+5]
- OR**
- In a typical n-type semiconductor, the Fermi level lies 0.5 eV below the conduction band at 300K. Find its new position when temperature is increased to 600K.
  - A Diode operating at 300 K at a forward voltage of 0.4V carries a current of 10 mA when voltage is changed to 0.42 V the current becomes thrice. Calculate the value of reverse leakage current and  $\eta$  for the diode. (Assume  $V_T = 26$  mv). [4+6]
- Explain half-wave rectifier and derive its ripple factor expression.
  - An AC supply of 230 V is applied to a half-wave rectifier circuit through transformer of turns ratio 5:1. Assume the diode is an ideal one. The load resistance is 300  $\Omega$ . Find:
    - DC output voltage
    - PIV
    - Maximum and average values of power delivered to the load. [5+5]

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**OR**

5.a) Give the circuit of different types of shunt clippers and explain their operation with the help of their transfer characteristics.

QA b) Explain the principle of clamping and discuss the effect of source impedance, shunt resistance and cut in voltage. [5+5]

6.a) Compare the typical characteristics of CE, CB and CC configuration.

b) Calculate the values of  $I_E$ ,  $\beta_{dc}$  and  $\alpha_{dc}$  for a transistor with  $I_C=12.427\mu A$ ,  $I_B=200\mu A$ ,  $I_{CBO}=7\mu A$ . Also determine the new level of  $I_C$  which will result from reducing  $I_B$  to  $150\mu A$ . [5+5]

**OR**

QA 7.a) Explain the working of NPN and PNP transistor.

b) With necessary circuit and waveform, explain the switching characteristics of a transistor in detail. [5+5]

8.a) Explain the working of a P channel JFET and draw the VI characteristics of it.

b) Explain with the help of neat diagrams, the structure of an N-channel MOSFET and its Volt-ampere characteristics. In what ways it is different from a bipolar transistor. [5+5]

QA 9.a) Explain the performance of FET as a voltage variable resistor.

b) Define and explain the three parameters of a JFET give the relation between them. [5+5]

10.a) Design and draw a Zener regulator circuit to meet the following specifications Load voltage= 8 V, Input Voltage =30V, Load Current = 0-50mA,  $I_{zmin} = 5mA$ ,  $P_z = 1Watts$ .

b) Explain Varactor Diode with its characteristics and list the applications. [5+5]

**OR**

QA 11.a) With neat energy band diagrams, explain the operation and characteristics of Tunnel Diode.

b) A Zener voltage Regulator circuit is to maintain constant voltage at 60 V, over a current range from 5 to 50 mA. The input supply voltage is 200V. Determine the value of resistance R to be connected in the circuit for voltage regulation from load current  $I_L = 0$  mA to  $I_{Lmax}$ , the maximum possible value of  $I_L$ . What is the value of  $I_{Lmax}$ ? [5+5]

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