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Roll No.

328353(28)

B. E. (Third Semester) Examination, April-May 2021

(New Scheme)

(Et&T Engg. Branch)

ELECTRONIC DEVICES and CIRCUITS

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Attempt all questions. Part (a) of each question is compulsory and carries 2 marks. Attempt any two parts from part (b), (c) & (d) which carries 7 marks each.

Unit-I

1. (a) Define law of Mass Action.

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(b) Explain the process of generation & recombination

of charge carriers. Prove that $\frac{dp'}{dt} = -\frac{p'}{\tau_p}$ 7

(c) Why an electric field must exist in a graded semiconductor? Derive the expression for contact

potential as $E_0 = K_T \ln \left[\frac{N_A N_D}{N_i^2} \right]$ 7

(d) The mobility of free electrons and holes in pure silicon are 0.13 and 0.05 m²/v.s. The corresponding value for pure germanium are 0.38 and 0.18 m²/v.s. if $n_i = 2.5 \times 10^{19} / \text{m}^3$ for Ge and $n_i = 1.5 \times 10^{16} / \text{m}^3$ for Si at room temp. Then find the values of intrinsic conductivity for both the materials. 7

Unit-II

2. (a) Define rectifier efficiency. 2

(b) With the help of diode characteristics, explain the static and dynamic resistance of diode for the forward & reverse direction. 7

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(c) Derive the diode equation 7

$$I = I_0 (e^{v/\eta V_T} - 1)$$

(d) Explain the construction and working of Bridge rectifier with necessary waveforms. 7

Unit-III

3. (a) Explain the doping level of emitter, base and collector of a transistor. 2

(b) Explain the transistor as an amplifier. 7

(c) Sketch the input, output and transfer characteristics of CB configuration. Also indicate the cutoff, active & saturation region. 7

(d) In a CE germanium transistor amplifier, the various parameters are $V_{CC} = 16 \text{ V}$, $R_C = 3 \text{ k}\Omega$, $R_E = 2 \text{ k}\Omega$, $R_1 = 56 \text{ k}\Omega$, $R_2 = 20 \text{ k}\Omega$ and $\alpha = 0.985$. Determine the following (i) The operating point. (ii) The stability factor S . 7

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Unit-IV

4. (a) Why FET is called a voltage operated device? 2
- (b) Sketch the typical drain characteristics for a n -channel JFET. Explain the shape of the characteristics and identify the region. 7
- (c) Draw the equivalent circuit of CS JFET amplifier and explain the significance of each components of the circuit. 7
- (d) A JFET has parameters of $V_{GS(off)} = -20$ V and $I_{DSS} = 12$ mA. Plot the transconductance curve for the device using the V_{GS} values of 0 V, -5 V, -10 V, -15 V and -20 V. 7

Unit-V

5. (a) Differentiate between JFET & MOSFET. 2
- (b) Explain the feedback biasing arrangement in E-MOSFET. 7
- (c) Explain the construction, working, VI chase & transfer characteristics of n -ch D -MOSFET. 7

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- (d) The data sheet for a certain E-MOSFET reveals that $I_{D(on)} = 10$ mA at $V_{GS} = -12$ V and $V_{GS(Th)} = -3$ V. Is this device is p -channel or n -channel. Find the values of I_D when $V_{GS} = -6$ V. 7