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B028312(028)

B. Tech. (Third Semester) Examination, Nov.-Dec. 2020

(New Scheme)

(Electronics and Telecommunication Engg. Branch)

ELECTRONICS DEVICES

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Part (a) is compulsory. Attempt any two parts from (b), (c) and (d). Draw neat, labeled diagrams wherever necessary.*

Unit-I

1. (a) (i) Define mobility and conductivity. 2

(ii) What is difference between diffusion and drift currents? 2

(b) Define a graded semiconductor. Explain why an electric field must exist in a graded semiconductor? Derive the expression for potential variation in graded semiconductor. 8

(c) (i) State Mass-Action law as an equation and in words 2

(ii) Discuss the potential variation, electric field and charge density inside depletion layer of p-n junction. 6

(d) (i) Determine the concentration of free electronics and holes in a sample of germanium at 300°K which has a concentration of Donor atoms equal to 2×10^{14} atoms/cm^3 and concentration of acceptor atoms equal to 3×10^{14} atoms/cm^3. Is this a p-type or n-type Ge. In other words is the conductivity due primarily to holes or to electronics. 5

(ii) Repeat part (i) for equal donor and acceptor concentration of 10^{15} atoms/cm^3. Is this p-type or n-type Ge? 3

Unit-II

2. (a) (i) Draw V-I characteristics of ideal and practical p-n junction silicon diode. 2

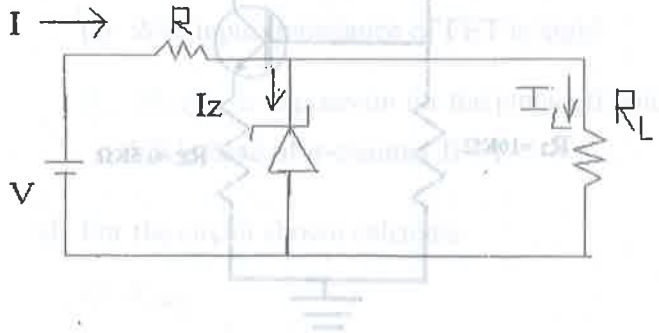
(ii) Define peak inverse voltage. 2

(b) Draw the circuit diagram of full-wave bridge rectifier and derive the efficiency, ripple factor, PIV, TUF. 8

(c) Explain zener diode as voltage regulator. Derive equations for variable source and load. 8

(d) (i) The Avalanche diode shown regulates at 50 V from 5 to 40 mA current. The supply voltage V is 200 V. Calculate R to allow voltage regulation from $I_L = 0$ to $I_L = I_{L\,max}$. What is $I_{L\,max}$? 4

(ii) If R is set as above but I_L is fixed at 25 mA then what is the permissible range of V. 4



Unit-III

3. (a) (i) What is a transistor? Why is it so called? 2

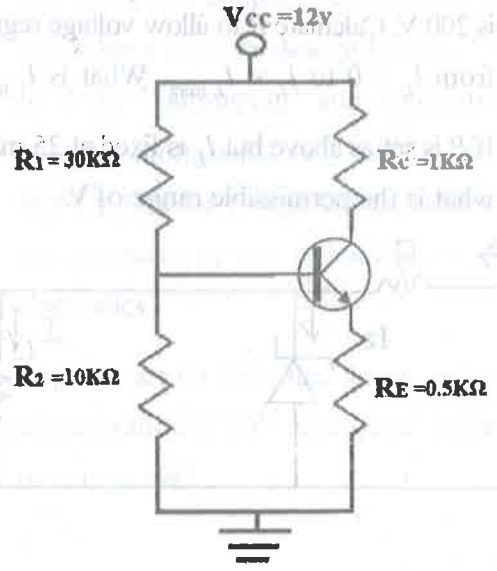
(ii) What is thermal runaway? 2

(b) Draw Eber-Moll model of a transistor for a npn transistor and explain the same. 8

(c) For the circuit shown : 8

(i) Find the operating point.

(ii) What is the stability factor of the circuit. Given $\beta = 50$, $V_{BE} = 0{\cdot}7\ v$? 8



(d) Draw the circuit for transistor in CE configuration and draw the input output characteristics of common emitter configuration. Explain in characteristics the transistor active region, saturation and cut off region giving one application each. 8

Unit-IV

4. (a) (i) FET is a voltage controlled device. Justify. 2

(ii) Define pinch off voltage. 2

(b) Explain the construction and working of a n-channel JFET with drain current equation. Also draw drain and transfer characteristics. 8

(c) (i) Explain why does the drain current ID not reduced to zero even after the channel is pinched off?

(ii) Why input impedance of FET is high?

(iii) Obtain the expression for the pinch off voltage VP in case of *n*-channel JFET. 8

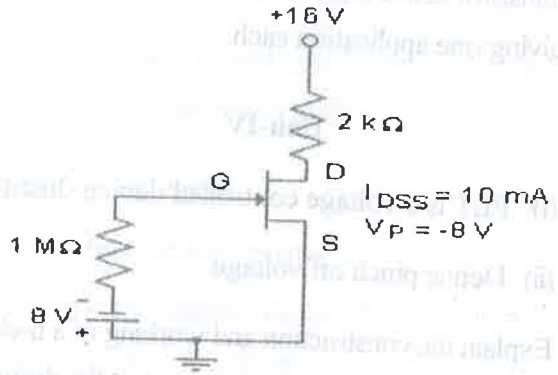
(d) For the circuit shown calculate : 8

(i) V_{GSQ}

(ii) I_{DQ}

(iii) V_{DS}

(iv) V_D



Unit-V

5. (a) (i) Draw symbol of *n*-channel E-MOSFET and *n*-channel D-MOSFET. 2

(ii) Why is MOS transistor devices are commercially more important than JFET? 2

(b) Draw and explain the typical volt ampere drain characteristics and the transfer characteristics of an *n*-channel MOSFET transistor operated both in enhancement mode and depletion mode. 8

(c) Explain the construction and working of enhancement MOSFET with neatly labeled diagrams. 8

(d) Write short notes on : 4×2=8

(i) Sub threshold conduction

(ii) MOS switch