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BT-1/DX: 8022

EL-101-E: Elements of Electronics Engineering

Time : Three Hours   Maximum Marks : 75

Note:-   Attempt any FOUR questions, with at least ONE from each section A, B, C and D. Section E is compulsory.

SECTION-A

Q.1. a) Explain the mechanisms of breakdown in p-n diodes. Describe the use of Zener diode as a voltage regulator.   7.5

b) A specimen of intrinsic Germanium at 300 °K, having a concentration of carriers of 2.5×10^{13} cm^{-3} is doped with impurity atoms of one for every million germanium atoms. Assuming that all the impurity atoms are ionized and that the concentration of Ge atoms is 4.4×10^{22} cm^{-3}, find the resistivity of doped material.

(μ_n for Ge is 3600 cm²/volt-sec).   7.5

Q.2. a) Draw the circuit of a Full wave and bridge rectifier and centre tap transformer rectifiers, with the help of waveforms explain their operation.

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Also discuss their diodes PIV values. 7.5

b) What value of series resistance is required when 10W, 10V, 1000mA zener diodes are connected in series to obtain 20 V regulated output from a 35 V dc source? 7.5

SECTION-B

Q.3. a) Define α of a transistor. Show that it is always less than unity. 7.5

Show that $\beta = \dfrac{\alpha}{1-\alpha}$

b) The transistor in the circuit of figure 1 has $\beta = 80$ exhibits a V_{BE} of 0.7V. Find all the terminal voltage and current. 7.5
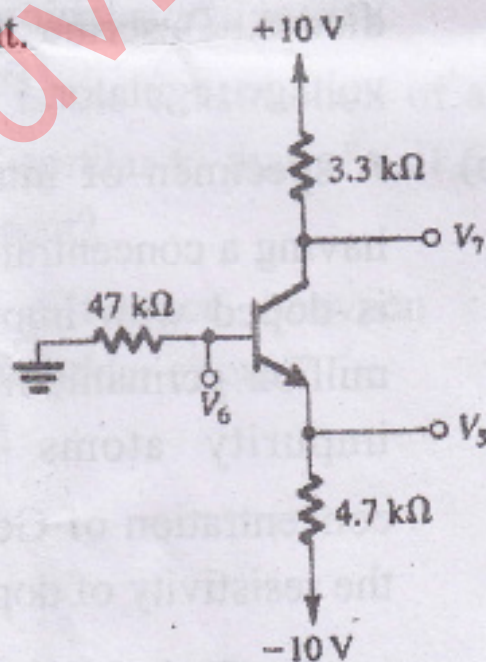
Q.4. a) Explain the working of a transistor as a switch. 5

b) Draw the various basing circuits and explain their operations. Calculate the stability factor in each case. Why emitter divider bias is better than the two other techniques. 7.5

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SECTION-C

Q.5. a) An amplifier with open loop voltage gain $A_v = 1000 \pm 100$ is available. It is necessary to have an amplifier whose voltage gain varies by no more than 0.1%. Find the reverse transmission factor β of the feedback network used. 7.5

b) Discuss IC741 with its complete pin diagram. 7.5

Q.6. a) Draw the circuit of OPAMP as following and derive its output in case of its use as

i) Scale changer

ii) Differentiator

iii) Draw the inverting and non-inverting amplifier circuits of an Opamp in closed loop configurations. Obtain an expression for closed loop gain in these circuits.

SECTION-D

Q.7. a) Prove that the transconductance g_m of a JFET is given by

$$g_m = \frac{2}{|V_P|} \sqrt{I_{DS} \, I_{DSS}}$$

Where V_P= Pinch off voltage, I_{DS} = Drain current I_{DSS} = Maximum value of I_{DS} corresponding to V_{GS} = 0 volts. 7.5

b) Discuss how JFET acts as a voltage amplifier. Draw the waveforms. 10

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Q.8. a) Explain the working relaxation oscillator using UJT. 5

b) Explain the working of a digital CRO with the help of a block diagram. 10

SECTION-E

6. Draw Energy band diagram of p-n junction at equilibrium, forward bias condition and reverse bias condition. 3

7. How can you check the polarity of the diode, if the mark on its body is rubbed off or not visible? 3

8. Sketch a circuit that will clip all levels of a sinusoidal signal above-5V. The peak to peak voltage of sinusoidal signal is 20V 3

9. IN what ways is the construction of a depletion-type MOSFET similar to that of a JFET? In what ways is it different? 3

10. What is the difference between a summing amplifier and an adder circuit? 3