Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Examination May 2011

Subject code: 131101 **Subject Name: Basic Electronics**

Date:30/05/2011 **Time: 10.30am to 1.00pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Prove that the minority carrier concentration, in an n-type semiconductor bar which was momentarily illuminated, decreases exponentially with time. **07**

(b) Derive continuity equation and explain its importance. **07**

Q.2 **(a)** When a diode is driven from forward condition to reverse condition, draw and explain waveforms for (1) minority carrier concentration at the junction of the diode (2) current flowing through the diode circuit, and (3) voltage across the diode. Assume resistance (R_L) is present in series with diode. **07**

(b) A symmetrical 5-kHz square wave whose output varies between +10 V and -10 V is impressed upon the clipping circuit shown in Fig. 1. Assume diode forward resistance (R_f) as zero, diode reverse resistance as (R_r) 2M, diode cut-in voltage (V_γ) as zero. Sketch the steady-state output waveform, indicating numerical values of the maximum, minimum, and constant portions. **07**

OR

(b) Design a Zener regulator (Fig. 2) for following specifications: load current $I_L = 20$ mA, output voltage $V_o = 5$ V, Zener wattage $P_Z =$ 500 mW, Input voltage $V_i =$ 12 ± 2 V, and $I_{Z(min)} = 8$ mA. **07**

Q.3 **(a)** A silicon transistor with $V_{BE,\,sat} = 0.8$ V, $\beta = h_{FE} = 100$, $V_{CE,\,sat} = 0.2$ V is used in the circuit shown in Fig. 3. Find the minimum value of R_C for which the transistor remains in saturation. **07**

(b) Derive expressions for A_I, R_i, A_V, and Y_o in terms of CE h-parameters for emitter-follower circuit. **07**

OR

Q.3 **(a)** Represent/derive CC h-parameters (h_{ic} and h_{fc}) in terms of CE h-parameters . **07**

(b) Explain the base-width modulation and its effect on minority-carrier concentration in the base region of a transistor as well as on the common-base input characteristics of a typical p-n-p transistor. **07**

Q.4 **(a)** Define stabilization factors: S, S', and S". Derive expressions for S and S' for self-bias transistor circuit. **07**

(b) Derive an expression for voltage gain (A_V) for CS amplifier with an bypassed source resistance R_S. **07**

OR

Q.4 **(a)** The fixed-bias circuit is given in Fig. 4 and it is subjected to an increase in temperature from 25 °C to 75 °C. If β = 100 at 25 °C and β = 125 at 75 °C, determine the percentage change in Q point values (V_{CE}, I_C) over the temperature range. Neglect any change in V_{BE}. Take $V_{BE} = 0.7$ V. **07**

(b) Draw a structure of p-channel MOSFET. Explain its working for enhancement type. Also draw and explain drain characteristics and transfer curve for the same device. **07**

Q.5 **(a)** Illustrate how the energy levels of isolated atoms in group IV A (e.g., C, Si, Ge, Sn) are split into energy bands when these atoms are brought into close proximity to form a crystal. Draw necessary energy band diagrams. **07**

(b) Show that the upper limit of the conversion efficiency (η) for the series-fed class A amplifier is 25 %. **07**

OR

Q.5 **(a)** Draw class B push-pull system and show that the maximum conversion efficiency (η) is 78.5 % for this system. **07**

(b) Draw and explain working of the circuit for compensation of V_{BE} using diode. **07**

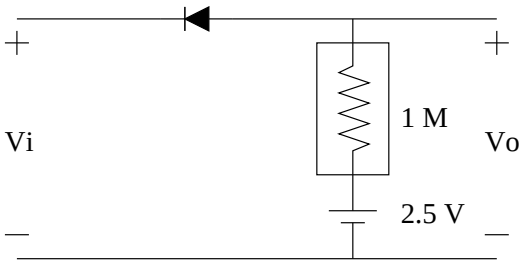

Figure 1 Q:2 (b)

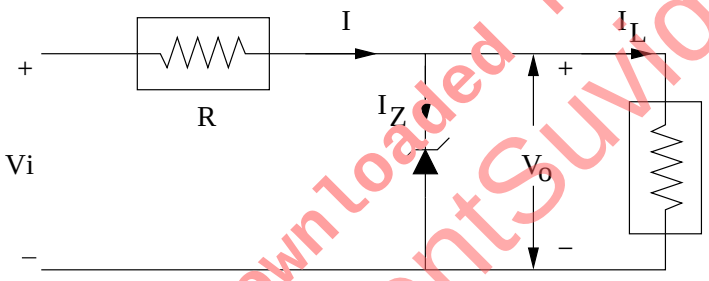

Figure 2 Q:2 (b) OR

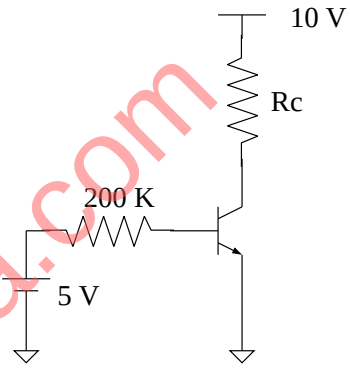

Figure 3 Q:3 (a)

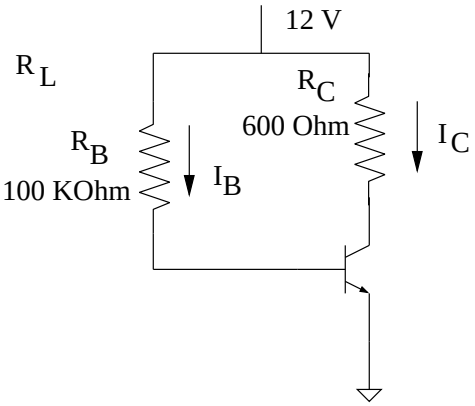

Figure 4 Q:4(a) OR

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