Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech

Branch	**: ECE**	**Semester**	**: IV**
Title of the Course	**: ANALOG ELECTRONICS**	**Course Code**	**: ECB 206**

Time: 3 Hours **Maximum Marks: 50**

- **Answers should be CLEAR AND TO THE POINT. All parts of a single question must be answered together. ELSE QUESTION SHALL NOT BE EVALUATED.**

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1. A p-n-p Ge transistor is used in the self-biasing arrangement given in figure 1, where V_{cc}= 4.5 V, R_c= 1.5 KΩ, R_e=0.27 KΩ, R_2= 2.7 KΩ, R_1= 27 KΩ and $|V_{BE}|$=0.2 V. If β = 44, find: [1+2+2]
   (a) The stability factor, S (b) the Q-point, (c) recalculate these values (S and Q-pt) if the base spreading resistance of 690 Ω is taken into consideration.

2. In the Darlington stage, shown in figure 2, V_{cc}=24 V, β_1=24, β_2=39, V_{BE}=0.6 V, R_c=330 Ω and R_e=120 Ω. If at the Q-point of second transistor, V_{CE2}= 6 V, determine (a) resistance value, R, (b) stability factor 'S' defined as $S=dI_C/dI_{CO}$. [5]

3. Consider second collector to first emitter feedback pair configuration in figure 3. Calculate (a) Av_1 (b) Av_2 (c) Av (d) β (e) Av_f (f) R_o (g) R_{of} and (h) R_{if} for the amplifier configuration. Assume, R_s=0, h_{fe}=50, h_{ie}=1.1 K, $h_{re}=h_{oe}$=0 and all transistors are identical. [8x2]

4. The transistor in following figure 4, is connected as CE amplifier and the h-parameters are given in the following table. If $R_s=R_L$=1KΩ, find (a) Av (b) A_{vs} (c) A_I and (d) A_{IS}. [4]

Parameters	Values
$h_{11}=h_i$	1100 Ω
$h_{12}=h_r$	$2.5\text{x}10^{-4}$
$h_{21}=h_f$	50
$h_{22}=h_o$	25μA/V
$1/h_o$	40 K

5. Show that the overall h parameters of the accompanying two-stage cascaded amplifier, shown in figure 5, are: [5]

   (a) $h_{11}=h_{11}'-\frac{h_{12}'h_{21}'}{1+h_{22}'h_{11}''}h_{11}''$ (b) $h_{12}=\frac{h_{12}'h_{12}''}{1+h_{22}'h_{11}''}$

   (c) $h_{21}=\frac{h_{21}'h_{21}''}{1+h_{22}'h_{11}''}$ (d) $h_{22}=h_{22}''-\frac{h_{12}''h_{21}''}{1+h_{22}''h_{11}''}h_{22}'$

6. Write true (T)/ false (F) against each statement. [10x0.5]

(a) Compensation circuits refer to resistive biasing circuits.

(b) Negative feedback is more suitable for amplification.

(c) Tentatively Q-point for a self-bias circuit will be at the middle of load line.

(d) Q-point should be fixed with $V_{CEQ}<V_{CC}/2$ in order to avoid thermal runway.

(e) The term low frequency implies the range of frequencies of the input signal in which effects of internal capacitances are considered.

(f) CC amplifier provides current gain instead of voltage gain.

(g) A CE transistor stage connected in series with a CB transistor stage provides the cascode combination.

(h) Difference amplifier is used to amplify the difference between two signals.

(i) At α-cut off frequency, the high frequency α falls to 0.707 α_0.

(j) At high frequency operation, h-parameters are real numbers.

7. Write brief notes on followings: [2+2]

(a) CB physical model of transistor with early feedback generator and base spreading resistance.

(b) Transistor two port device and hybrid model.

8. Opt for the correct option only. [6x1]

(a) In a self-bias circuit, the stability increases, as the base resistance **increases/decreases/ remains constant.**

(b) An amplifier supplies output current proportional to the signal voltage and independent of R_S and R_L known as- **trans-resistance/ trans-conductance/ current** amplifier.

(c) Physical model of transistor includes **early feedback generator/base spreading resistance /both**.

(d) Operation of feedback network is **unidirectional/bi-directional/omni-directional**.

(e) For an oscillator, the source of electrical input is **D.C. supply/ac source/generated noise**.

(f) From a circuit design point of view, more practical parameter to measure **transistor gain/transistor gain with feedback/transistor gain with feedback and including source.**

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