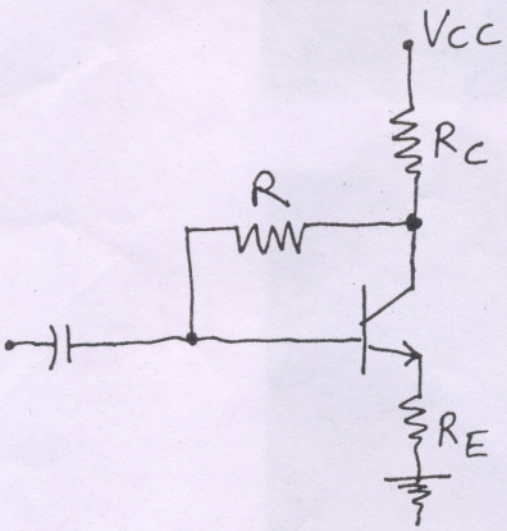
(3 Hours) [Total Marks : 100

N.B. (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** from the remaining questions.
(3) Assume **suitable** data if **necessary**.

1. (a) Derive the expression for stability factor S for collector to base bias and self bias circuit. 12
(b) In the circuit shown below, V_{CC} = 24 V, R_C = 10 K and R_E = 270 Ω. If a silicon transistor is used with β = 45 and if under quiescent conditions V_{CE} = 5 V, determine — (i) R (ii) the stability factor S. 8



2. (a) For dual input balanced output differential amplifier find out expressions for I_{CQ}, V_{CEQ}, differential mode voltage gain, input and output resistances. 10
(b) The following specifications are given for the dual input, balanced output bipolar differential amplifier :— 10

R_C = 2·2 K, R_E = 4·7 K, R_S = 50 Ω, V_{CC} = 10 V, V_{EE} = −10 V, β = 100, V_{BE} = 0·7 V.

Determine —
(i) I_{CQ} and V_{CEQ}
(ii) Differential mode voltage gain
(iii) Input and output resistances.

3. (a) Explain current limit and current foldback protection of LM 723 using suitable diagrams. 8
(b) Design a regulator using LM 723 for V_0 = 9 V, I_0 = 3 Amp. 12

4. (a) Draw the functional block diagram of IC 555 timer and explain function of each pin. Also explain how reference voltage is generated. 10
(b) Design a symmetrical square wave generator using IC 555 for output 1 KHz. 10

5. (a) Draw and explain the functional block diagram of voltage controlled oscillator IC. Explain any one application of VCO. 10
(b) Derive the equation for frequency of oscillation and condition for oscillation for RC phase shift oscillator. 10

6. (a) Explain the flash conversion and successive approximation technique. What are their limitations ? 10
(b) Draw the circuit diagram of practical differentiator using Op-Amp. Give the advantages of basic differentiator. 10

7. Write short notes on any **two** :— 20
(a) Second order Butterworth active filter.
(b) Instrumentation Amplifier using Op-Amp.
(c) Digital to Analog converter using R—2R resistors.
(d) Zero-crossing detector using Op-Amp working and applications.