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B. Tech. IV Semester Examination 2022

Subject Name: Analog Circuits | Branch: EC | Subject Code: TEC-242

Time: 3 Hours | M. M: 120

Q1. Answer the following questions (very short answers): **(5x2=10 Marks)**

(a) For a silicon npn transistor, the base-to-emitter voltage (V_{BE}) is 0.7V and collector- to-base voltage is 0.2V, then write the region of operation of the transistor.

(b) A bipolar transistor is operating in the active region with collector current of 1mA. Assuming that the β of the transistor is 100 and the thermal voltage (V_T) is 25mV. What are the value of transconductance (g_m) and input resistance (r_π) of the transistor in the common –emitter configuration.

(c) For a voltage series feedback, what is the effect on input and output resistances with feedback when compared to without feedback?

(d) In an LC oscillator, if the value of L is increased five times then what will be the change in its frequency of oscillation?

(e) A high frequency amplifier has midband gain of 40 dB and higher cut-off frequency of 560 MHz. Find the gain of amplifier at 560 MHz frequency.

Q2. Answer the following questions (short answers): **(5x4=20 Marks)**

(a) Why bootstrapping is required in emitter follower?

(b) How noise performance is affected with application of negative feedback in amplifiers?

(c) The circuit shown in fig.1 has an ideal op-amp. Find the oscillation frequency and condition to sustain the oscillations.

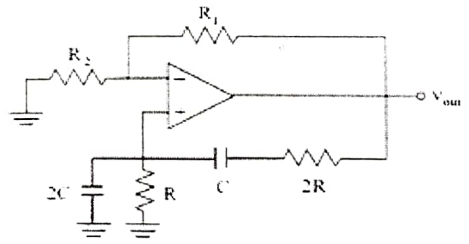

Fig.1

(d) Write the characteristics of Ideal Op-Amp.

(e) Explain the early effect in the NPN BJT with proper diagram?

Q3. All questions from UNIT-I. Parts (a) is compulsory and attempt any one part from part (b) or part (c).

(a) Find the overall voltage gain of the amplifier circuit given the Fig.2. Assume following parameters hie=1.1k, hfe=50 and $V_A=\infty$. **6 Marks**

5K6 = 5·6K
3K3 = 3·3K

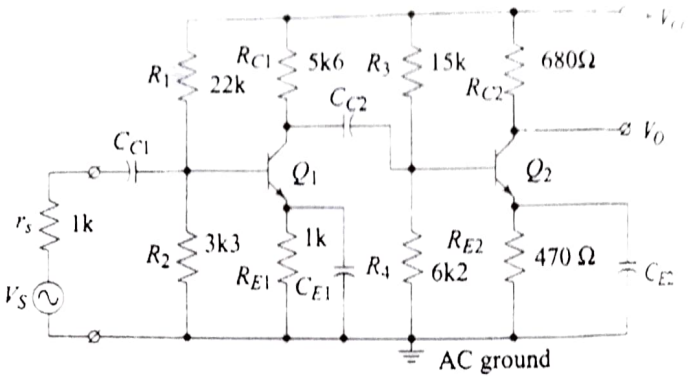

Fig.2

(b) Derive the expression for voltage gain, input impedance and output impedance of Common emitter amplifier with degenerate resistance R_E. **(12 Marks)**

(c) Derive the expression for voltage gain, input impedance and output impedance for the common base amplifier. **(12 Marks)**

Q4. All questions from UNIT-I. Parts (a) is compulsory and attempt any one part from part (b) or part (c).

(a) Write the properties of negative feedback. **(6 Marks)**

(b) Derive the expression for voltage gain, input impedance and output impedance of a current shunt feedback connection. **(12 Marks)**

(c) Fig-3 depicts the bipolar feedback amplifier. Assuming R1+R2 is not very large, $<<\beta<\infty$ and $V_A=\infty$, Determine the closed-loop voltage gain, input impedance and output impedance. **(12 Marks)**

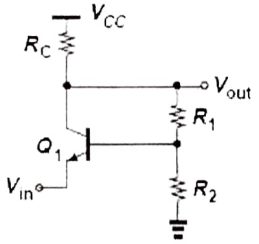

Fig.3

Q5. All questions from UNIT-I. Parts (a) is compulsory and attempt any one part from part (b) or part (c).

(a) How oscillations are started in a sinusoidal oscillator? Give the necessary conditions for sinusoidal oscillations. **(6 Marks)**

(b) Derive the expression for oscillation frequency of an RC phase shift oscillator using Op-amp. Further, find the condition to sustain the oscillations. **(12 Marks)**

(c) With the help of a circuit diagram, explain the working of a monostable multivibrator. **(12 Marks)**

Q6. All questions from UNIT-IV. Parts (a) is compulsory and attempt any one part from part (b) or part (c).

(a) A BJT has h_{fe}=150, C_e=2pF, C_c=0.3pF and biased at I_c=0.5mA. Find the short circuit current gain cut-off frequency and unity current gain frequency of the transistor. **(6 Marks)**

(b) Draw the small signal high frequency equivalent circuit of the common emitter amplifier circuit and find the voltage gain using inspections by poles of the given circuit in terms of g_m, R_L, R_S, C_μ, $C\pi$ and C_{CS}. **(12 Marks)**

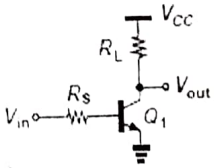

Fig-4

(c) Derive the expression for cut-off frequency and unity gain bandwidth for the common emitter high frequency hybrid- π model **(12 Marks)**

Q7. All questions from UNIT-IV. Parts (a) is compulsory and attempt any one part from part (b) or part (c).

(a) Define output offset voltage, input bias current, input offset current and common mode rejection ratio **(6 Marks)**

(b) Explain the operation of a class A power amplifier and derive the expression for maximum power efficiency. **(12 Marks)**

(c) Find the gain V_O / V_i for the given circuit **(12 Marks)**

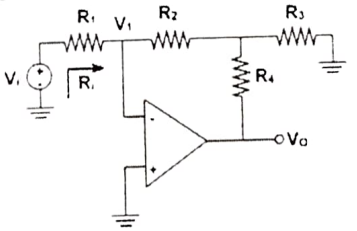

Fig.5.