CBCS SCHEME

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15EC32

Third Semester B.E. Degree Examination, June/July 2023
Analog Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive the expression for Z_{in}, Z_o, A_V and A_I for voltage divider bias CE amplifier with R_E bypassed using r_e model. **(10 Marks)**

b. Write an explanatory note on hybrid π model. **(06 Marks)**

OR

2 a. For an emitter bias circuit with R_B = 470 KΩ, R_C = 2.2 KΩ, R_E = 0.56 KΩ, $C_{C1} = C_{C2}$ = 10 μF, h_{fe} = 120, r_o = 40 KΩ and V_{CC} = 20 V. Find r_e, A_V, Z_{in} and Z_o if R_E is bypassed. Also write the hybrid model. **(08 Marks)**

b. Derive the expression for Z_{in}, Z_o, A_V and A_I for common collector configuration amplifier using approximate hybrid model. **(08 Marks)**

Module-2

3 a. Explain the working principle of JFET. Determine JFET parameters from characteristics. **(06 Marks)**

b. Derive an expression for output resistance and voltage gain of fixed bias FET amplifier. **(06 Marks)**

c. Calculate the voltage gain of a self biased FET amplifier. The circuit uses R_D = 2 KΩ, R_S = 1 KΩ, r_d = 40 KΩ, g_m = 2 mA/V and R_G = 2 MΩ. **(04 Marks)**

OR

4 a. Explain the construction and working principle of enhancement type MOSFET. **(06 Marks)**

b. Derive an expression for output impedance, input impedance, and voltage gain of a common gate amplifier. **(07 Marks)**

c. Distinguish between JFET and enhancement type MOSFET. **(03 Marks)**

Module-3

5 a. Describe Miller effect and derive an expression for Miller input and output capacitance. **(08 Marks)**

b. Discuss the low frequency response of BJT amplifier and give expressions for low frequency due to input and output coupling capacitance. **(08 Marks)**

OR

6 a. Discuss the high frequency response of FET amplifier and derive the expressions for cut-off frequencies defined by input and output circuits (f_{Hi} and f_{Ho}). **(08 Marks)**

b. For a CE amplifier using voltage divider bias, the circuit elements are R_S = 1 KΩ, R_1 = 40 KΩ, R_2 = 10 KΩ, R_E = 2 KΩ, R_C = 4 KΩ, R_L = 2.2 KΩ, C_S = 10 mF, C_C = 1 mF, C_E = 20 mF, h_{fe} = 100, r_0 = ∞, V_{CC} = 20 V, β = 100 with the addition of $C_\pi(C_{be})$ = 36 PF, $C_\mu(C_{bc})$ = 4 PF, C_e = 1 PF, C_{Wi} = 6 PF and C_{Wo} = 8 PF.
(i) Determine f_{Hi} and f_{Ho} (ii) Find f_β and f_T **(08 Marks)**

Module-4

7 a. Determine the input and output resistances of a voltage series feedback amplifier. **(06 Marks)**

b. Briefly explain the characteristics of negative feedback amplifier. **(06 Marks)**

c. An amplifier has a bandwidth of 300 kHz and voltage gain of 100. A negative feedback of 10% is introduced. Determine the gain bandwidth with feedback. Also determine the amount of feedback required if the bandwidth is limited to 800 kHz. **(04 Marks)**

OR

8 a. Explain FET phase shift oscillator with neat circuit diagram and necessary equations. **(06 Marks)**

b. Explain the working of Wein bridge oscillator. **(06 Marks)**

c. Calculate the oscillator frequency for an FET Hartley oscillator with tank circuit elements $C = 250$ PF; $L_1 = 1.5$ mH; $L_2 = 2.5$ mH and $M = 0.5$ mH. **(04 Marks)**

Module-5

9 a. Derive the expression for second harmonic distortion. **(06 Marks)**

b. Discuss the classification of power amplifiers. **(06 Marks)**

c. Calculate the input power, output power and efficiency of a series fed class A power amplifier with the following specifications: $V_{CC} = 20$ V, $R_B = 1$ KΩ, $R_C = 20$ Ω. The input voltage results in a base current of 10 mA peak. Assume $\beta = 25$. **(04 Marks)**

OR

10 a. Derive an expression for the conversion efficiency of class B push pull amplifier with neat circuit diagram and waveforms. **(08 Marks)**

b. Define voltage regulator. Explain the series voltage regulator using transistor. **(05 Marks)**

c. Calculate the Total Harmonic Distortion (THD), fundamental power component and total power given $D_2 = 0.1$, $D_3 = 0.02$, $D_4 = 0.01$ with $I_1 = 4$A and $R_C = 8\Omega$. **(03 Marks)**

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