CBCS SCHEME

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18EC42

Fourth Semester B.E. Degree Examination, July/August 2022
Analog Circuits

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the working of voltage dividing bias circuit using BJT. **(08 Marks)**

b. Design MOSFET drain to gate feedback circuit to establish $I_D = 0.5$ mA and $V_{DD} = 5V$. MOSFET parameters are : $V_t = 1$ V, $K_n'(W/L) = 1$ mA/V^2 and $\lambda = 0$. Use Standard resistor values and actual values obtained for I_D and V_D. **(06 Marks)**

c. Derive an expression for voltage gain A_V of small signal CE BJT amplifier. **(06 Marks)**

OR

2 a. Explain with neat circuit diagram the MOSFET drain to gate feedback resistor biasing. **(06 Marks)**

b. Design a voltage divider bias network using a supply of 24V, $\beta = 110$ and $I_{CQ} = 4$ mA, $V_{CEQ} = 8V$. Choose $V_E = V_{CC}/8$. **(08 Marks)**

c. Explain with neat circuit diagram MOSFET circuit using fixing V_G. **(06 Marks)**

Module-2

3 a. Derive the expression for characterizing parameters of CS MOSFET amplifier without source resistor using hybrid-π equivalent circuit. **(06 Marks)**

b. A phase shift oscillator is to be designed with FET having $g_m = 5000$ µs, $r_d = 40$ kΩ while the resistance in the feedback circuit is 9.7 kΩ. Select the proper value of C and R_D to have the frequency of oscillations as 5 kHz. **(08 Marks)**

c. Write a note on three basic configurations of MOSFET amplifier. **(06 Marks)**

OR

4 a. State Barkhausen criteria. **(04 Marks)**

b. A Quartz crystal has constants L = 50 mH, $C_1 = 0.02$ pF, R = 500Ω and $C_2 = 12$ pF. Find the values of series and parallel resonant frequencies. Also if the external capacitance across the crystal changes from 5 pF to 6 pF, find the change in frequency of oscillations. **(08 Marks)**

c. Draw and explain the frequency response characteristics of CS MOSFET amplifier. **(08 Marks)**

Module-3

5 a. Briefly explain the four basic feedback topologies with necessary block diagram. **(10 Marks)**

b. Show that the maximum efficiency of series fed, directly coupled class A power amplifier is 25%. **(06 Marks)**

c. An amplifier without negative feedback has a voltage gain of 400 with a distortion of 10%. Determine the amplifier voltage gain and distortion, when a negative feedback is applied with feedback ratio of 0.01. **(04 Marks)**

OR

6 a. With neat circuit diagram, explain the operation of a class B pushpull amplifier with relevant waveforms. Show that the maximum conversion efficiency of class B pushpull amplifier is 78.5%. **(10 Marks)**

b. For a class C tuned amplifier with load resistance of 10 kΩ and V_{CC} = 30V. Calculate
(i) Output power if the output voltage is 30 V_{pp}.
(ii) DC input power if current drain is 0.5 mA.
(iii) Efficiency. **(04 Marks)**

c. Derive the expression for input resistance for a voltage shunt feedback amplifier. **(06 Marks)**

Module-4

7 a. State the ideal characteristics of op-Amp. **(08 Marks)**

b. For a Schmitt trigger shown in the Fig.Q7(b) calculate threshold voltage levels and hysteresis. Assume $V_{sat} = 0.9\ V_c$.

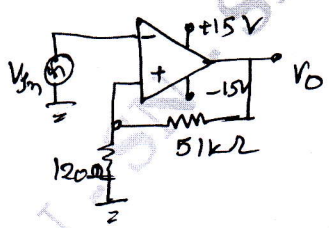

Fig.Q7(b) **(04 Marks)**

c. Draw a practical inverting amplifier and derive the expression for closed loop voltage gain, input resistance and output resistance. **(08 Marks)**

OR

8 a. Draw the circuit of 3 op-Amp instrumentation amplifier and derive expression for its output voltage. **(08 Marks)**

b. Explain the working of zero crossing detector. **(06 Marks)**

c. For a non-inverting amplifier, the values of R_1 and R_f are 1 kΩ and 10 kΩ respectively. The various op-Amp parameters are, open loop gain = 2×10^5, Input resistance = 2MΩ, Output resistance = 75Ω, Single break frequency = 5 Hz , Supply voltages = ±12V , Calculate the closed loop gain, input resistance, output resistance with feedback and bandwidth with feedback. **(06 Marks)**

Module-5

9 a. Draw and explain the working of precision full wave rectifier. **(08 Marks)**

b. Design a low pass filter using op-Amp at a cutoff frequency of 1 kHz with pass gain of 2. **(06 Marks)**

c. Explain the working of pulse width modulator using IC555 with waveforms. **(06 Marks)**

OR

10 a. Explain the functional block diagram of IC555. **(08 Marks)**

b. Design a monostable 555 timer circuit to produce an output pulse of 10 sec wide. Draw the circuit diagram. **(04 Marks)**

c. Explain with neat circuit diagram the operation of R-2R digital to analog converter. **(08 Marks)**

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