CBCS SCHEME

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21EC34

Third Semester B.E. Degree Examination, June/July 2023
Analog Electronic 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 classical biasing for BJTs using a single power supply with circuit and relevant equations. How is bias current stabilized? **(08 Marks)**

b. Design collector-to-base feedback resistor circuit to obtain a dc emitter current of 1mA and to ensure $V_{CE} = 2.3V$. Let $V_{CC} = 10V$ and $\beta = 100$. **(04 Marks)**

c. Considering the conceptual circuit of common emitter amplifier, derive the expression for small-signal input resistance between base and emitter resistance. Mention the relation between r_π and r_e. **(08 Marks)**

OR

2 a. Why biasing by fixing V_{GS} is not a good approach? Explain biasing by fixing V_G and connecting a resistance in the source. **(10 Marks)**

b. Design Drain-to-Gate feedback resistor biasing circuit to operate at a dc drain current of 0.5mA. Assume $V_{DD} = 5V$, $K_n' W/L = 1mA/V^2$, $V_t = 1V$ and $\lambda = 0$. Use standard value for R_D and give actual values obtained for I_D and V_D. **(06 Marks)**

c. A BJT having $\beta = 100$ is biased at a dc collector current of 1mA. Find the value of g_m, r_e and r_π. Assume $V_T = 25mV$. **(04 Marks)**

Module-2

3 a. Obtain the expression for characteristic parameters of the CS amplifier with circuit diagram and its equivalent circuit. **(08 Marks)**

b. A CS amplifier utilizes a MOSFET biased at $I_D = 0.25mA$ with $V_{OV} = 0.25V$ and $R_D = 20K\Omega$. The device has $V_A = 50V$. The amplifier is fed with a source having $R_{sig} = 100K\Omega$ and a 20-KΩ load is connected to the output. Find R_{in}, A_{vo}, R_o, A_v and G_v. **(05 Marks)**

c. Explain the internal capacitances of a MOSFET and hence draw the high frequency small signal model of MOSFET. **(07 Marks)**

OR

4 a. Find the mid band gain A_M and the upper 3-dB frequency f_H of a CS amplifier fed with a signal source having an internal resistance $R_{sig} = 100K\Omega$. The amplifier has $R_G = 4.7M\Omega$, $R_D = R_L = 15K\Omega$, $g_m = 1mA/V$, $r_0 = 150K\Omega$, $C_{gs} = 1pF$ and $C_{gd} = 0.4pF$. **(06 Marks)**

b. Explain the working of FET – based RC phase shift oscillator with circuit diagram. In an RC phase shift oscillator, $R = 200K\Omega$ and $C = 200pF$. Find the frequency of the BJT-based oscillator. **(08 Marks)**

c. Explain the working of clapp oscillator with a circuit diagram. **(06 Marks)**

Module-3

5 a. Explain general feedback structure of the feedback amplifier with a signal flow diagram and mathematical expressions. **(08 Marks)**

b. Explain noise reduction with the application of negative feedback in amplifiers. **(08 Marks)**

c. A class B push-pull amplifier is supplied with V_{CC} = 50V. The signal brings the collector voltage down to V_{min} = 5V. The total dissipation from both transistors is 40W. Find the total power and conversion efficiency. **(04 Marks)**

OR

6 a. Explain transconductance amplifier with a neat block diagram. **(06 Marks)**

b. Explain class-B transformer-coupled amplifier. Prove that the maximum conversion efficiency of a class B transformer coupled amplifier is 78.5%. **(08 Marks)**

c. Explain class C output stage with a neat diagram. **(06 Marks)**

Module-4

7 a. Explain inverting amplifier with external offset null circuit and relevant expressions for output voltage and closed loop gain. **(07 Marks)**

b. Explain successive-approximation type A/D converter with a neat diagram. **(07 Marks)**

c. Explain positive small-signal half-wave rectifier circuit with waveforms. **(06 Marks)**

OR

8 a. Explain the working of a second order high pass Butterworth filter with a neat circuit diagram and frequency response. Write the relevant design equations. **(08 Marks)**

b. Design second order low-pass filter at a high cutoff frequency of 1kHz. Choose capacitance value 0.0047μF. **(05 Marks)**

c. Explain the operation of 555 timer as astable multivibrator with relevant expressions. **(07 Marks)**

Module-5

9 a. Explain the classification of power electronic convertors. **(06 Marks)**

b. With the help of elementary circuit and static V-I characteristics, explain the three regions of operation of the SCR. **(08 Marks)**

c. Explain class-A commutation with necessary circuit diagram and waveforms. **(06 Marks)**

OR

10 a. Write a note on basic requirements for the successful firing of a thyristor. **(04 Marks)**

b. Explain RC firing circuit with necessary circuit diagram and waveform. Write the relevant design equations. **(08 Marks)**

c. Explain UJT relaxation oscillator with a neat circuit diagram. Derive the expression for frequency of oscillation. **(08 Marks)**

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