CBCS SCHEME

USN | | | | | | | | | | |

18EC42

Fourth Semester B.E. Degree Examination, Feb./Mar. 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. Obtain the dc conditions for voltage-divider bias circuit for a CE-BJT amplifier and give design constraints along with remark on stability of Q-point. **(08 Marks)**

b. For a CE amplifier circuit, V_{BE} is adjusted to yield a dc collector current of 1mA. Let V_{CC} = 15V, R_c = 10KΩ and β = 150. Find the voltage gain. If V_{be} = 0.002 sin ωt volt, find $V_C(t)$ and $i_B(t)$. **(08 Marks)**

c. A BJT having β = 100 is biased at dc collector current of 0.5mA. Find the value of g_m and r_π at the base point. **(04 Marks)**

OR

2 a. Draw the small signal equivalent circuit model for MOSFET and obtain the expression for voltage gain. **(06 Marks)**

b. Design a circuit to fix V_G and bias using R_S and voltage divider arrangement to establish dc drain current of 0.5mA. The MOSFET is specified to have V_t = 1V, $K_n' \frac{W}{L} = 1$ mA/V^2. Use V_{DD} = 15V. **(08 Marks)**

c. Mention the relation between r_π and r_e. **(06 Marks)**

Module-2

3 a. With a neat circuit diagram and ac equivalent circuit, derive the expressions for R_{in}, A_V and R_o for a CS amplifier with bypassed source resistance. **(08 Marks)**

b. Obtain the expression for R_i, A_V and R_0 for a common drain amplifier or source follower, using suitable ac equivalent circuit. **(08 Marks)**

c. It is required to design a source follower that implements the buffer amplifier shown in FigQ3(c). If the MOSFET is operated with an overdrive voltage of V_{OV} = 0.25V, at what drain current should it be biased and what is the output voltage?

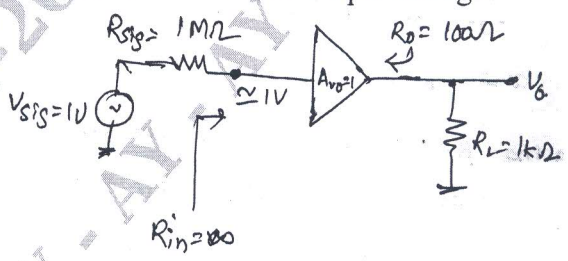

Fig Q3(c) **(04 Marks)**

OR

4 a. Obtain the low frequency response of CS amplifier. **(10 Marks)**

b. Draw the circuit of a RC phase-shift oscillator using MOSFET and explain the working. **(06 Marks)**

c. A 2 MHz quartz crystal is specified to have L = 0.5H, C_S = 0.012pF, C_P = 4pF, R = 120Ω. Find f_s and f_p. **(04 Marks)**

Module-3

5 a. Explain gain desensitivity and effect on bandwidth, with the application of negative feedback in amplifiers. **(12 Marks)**

b. A feedback amplifier produces an output of 10V, with an input of 1V. When the feedback is removed, to produce same output, input required is 0.2V. Determine the voltage gain with and without feedback and the feedback factor. **(04 Marks)**

c. Define different types of power-amplifiers. **(04 Marks)**

OR

6 a. With a neat block diagram, explain the working of a voltage series feedback amplifier. Obtain the expressions for gain, input resistance and output resistance with feedback. **(12 Marks)**

b. Draw the circuit of a transformer coupled class-A power amplifier. Prove that the maximum conversion efficiency is 50%. **(08 Marks)**

Module-4

7 a. Derive the relevant expressions for exact and approximate voltage gain and input resistance for a non-inverting amplifier using op-amp. **(08 Marks)**

b. With à neat circuit diagram, explain the op-amp based inverting summing amplifier and averaging amplifier with the relevant expressions for the output. **(06 Marks)**

c. In the circuit of inverting summing amplifier, $V_a = +1V$, $V_b = +2V$, $V_c = +3V$, $R_a = R_b = R_c = 3K\Omega$, $R_F = 1K\Omega$, $R_{OM} = 270\Omega$ an supply voltages = $\pm 15V$. Assuming that the op-amp is initially nulled, determine the output voltage V_0. **(06 Marks)**

OR

8 a. Draw the circuit and waveforms for an inverting Schmitt Trigger using op-amp, with relevant expressions for V_{ut}, V_{lt} and explain. In this circuit, if $R_1 = 100\Omega$, $R_2 = 3.9K\Omega$, $V_{in} = 500mV$ P-P sine wave and saturation voltage = $\pm 14V$, find V_{ut}, V_{lt} and V_{hy}. **(10 Marks)**

b. The 741C is configured as a non-inverting amplifier and the following data are given for the circuit. $A = 400{,}000$, $R_i = 33M\Omega$, $R_0 = 60\Omega$, $R_1 = 470\Omega$, $R_F = 4.7K\Omega$, supply voltages = $\pm 15V$, UGB = 0.6MHz. Compute the closed – loop parameters A_F, R_{iF}, R_{OF}, f_F. **(10 Marks)**

Module-5

9 a. Explain the working of a second order lowpass Butterworth filter. Write the design equations. Design the circuit for cut-off frequency of 1KHz and draw the frequency response of the circuit. **(12 Marks)**

b. Explain the operation of 2-bit DAC using R-2R circuit. **(08 Marks)**

OR

10 a. What is meant by precision rectification? Explain with a neat circuit diagram, the working of a small signal halfwave precision rectifier using on op-amp. **(08 Marks)**

b. With the help of a neat circuit diagram and relevant waveforms, explain the working of astable circuit operation using 555 timer IC. Derive expression for T_{ON}, T_{OFF} and T. **(12 Marks)**

* * * * *