

# CBCS SCHEME

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21EC34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024

## 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 biasing of BJT by collector to base feedback resistor for a CE amplifier. (08 Marks)
- b. A BJT having  $\beta = 100$  is biased at a DC collector current of 1 mA. Find the value of  $g_m$ ,  $r_c$ ,  $r_\pi$  at the bias point. Assume  $V_T = \frac{1}{40} V$ . (04 Marks)
- c. Draw the small signal equivalent circuit model for MOSFET and obtain the expression for voltage gain. (08 Marks)

OR

- 2 a. Explain biasing of MOSFET using drain to gate feedback resistor. (06 Marks)
- b. What is transconductance of a MOSFET and mention the three different expression used to calculate the  $g_m$ . (06 Marks)
- c. For the circuit shown in Fig. Q2 (c), find the required value of  $V_{GS}$  to establish a dc bias current  $I_D = 0.5$  mA. Device parameters are  $V_t = 1$  V,  $K'_n \frac{\omega}{L} = 1$  mA/V<sup>2</sup> and  $\lambda = 0$ . What is the percentage change in  $I_D$  obtained when the transistor is replaced with another having  $V_t = 1.5$  V. (08 Marks)

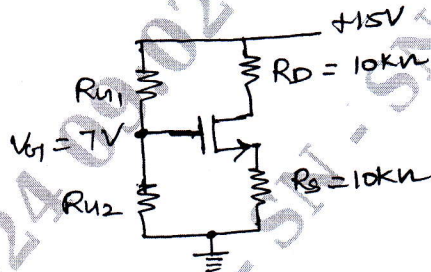


Fig. Q2 (c)

### Module-2

- 3 a. With mathematical equations, explain the different internal capacitances in the MOSFET. (10 Marks)
- b. Explain the high frequency response of a CS amplifier using MOSFET and derive its upper cut off frequency. (10 Marks)

OR

- 4 a. Draw the circuit of a RC phase shift oscillator using MOSFET and explain the working. (06 Marks)
- b. A 2 MHz quartz crystal is specified to have  $L = 0.52$  H,  $C_s = 0.012$  PF,  $C_p = 4$  PF and  $R = 120 \Omega$ . Find  $f_s$ ,  $f_p$ . (04 Marks)
- c. Derive the expression of  $R_{in}$ ,  $R_o$ ,  $A_{V0}$  and  $A_V$  using T model for the common source amplifier with a source resistance circuit. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

**Module-3**

- 5 a. What are the properties of negative feedback and explain it briefly. (10 Marks)  
 b. What are the topologies of basic feedback circuit? (04 Marks)  
 c. For the block diagram, shown in Fig. Q5 (c), a signal of 1 V from the source results in a difference signal of 10 mV being provided to the amplifier (A) and 10 V applied to the load. For this arrangement identify the value of A and  $\beta$  that apply. (06 Marks)

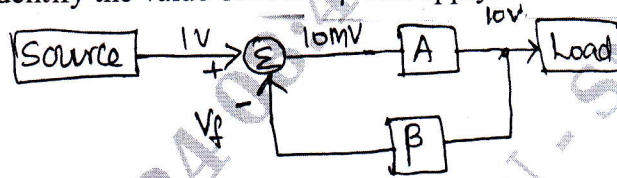


Fig. Q5 (c)

**OR**

- 6 a. Draw the circuit of a transformer coupled class-A power amplifier. Prove that the maximum conversion efficiency is 50%. (08 Marks)  
 b. What is output stage and discuss the classification of output stages based on the collector current? (06 Marks)  
 c. Neatly draw the schematic diagram of class C tuned amplifier and discuss the input and output waveforms at the collector terminal. (06 Marks)

**Module-4**

- 7 a. Derive the expression of output voltage and explain the operation of 4-bit DAC using R-2R circuit. (10 Marks)  
 b. What is meant by precision rectification? Explain with a neat circuit diagram, the working of a small signal half wave precision rectifier using Op-Amp. (10 Marks)

**OR**

- 8 a. With the help of a neat circuit diagram and relevant waveforms, explain the working of astable multivibrator circuit operation using 555 timer IC. Derive expression for  $T_{ON}$ ,  $T_{OFF}$  and T. (10 Marks)  
 b. Explain the working of a second order lowpass butterworth filter. Write the design equations. Design the circuit for cut off frequency of 1 kHz. (10 Marks)

**Module-5**

- 9 a. With the help of the static V-I characteristics, explain the three modes of operation of the thyristor. (10 Marks)  
 b. Explain the working of a UJT firing circuit using SCR with necessary circuit diagram and waveforms. (10 Marks)

**OR**

- 10 a. Discuss various power converter circuits with necessary sketches and applications of each. (08 Marks)  
 b. List different turn on methods, explain all in brief. (08 Marks)  
 c. Enumerate the applications of power electronics. (04 Marks)

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