

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025

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. Derive the expression for Emitter current of a voltage divider bias and also discuss how to make I_E insensitive to variation in β and temperature. (10 Marks)
- b. Design a collector to Base feedback resistor bias to obtain a dc current of 1 mA and to ensure $\pm 2V$ signal swing at the collector with $V_{CE} = 2.3V$. Assume $V_{CC} = 10 V$ and $\beta = 100$. (07 Marks)
- c. What is trans-conductance of BJT and mention its significance? (03 Marks)

OR

- 2 a. Obtain the following expression of a BJT of small signal analysis.
 - i) Total instantaneous collector current
 - ii) Input resistance at the base(10 Marks)
- b. Discuss the following biasing scheme used in MOS
 - i) By fixing V_{GS}
 - ii) By fixing V_{GS} and connecting a resistance in the source.(10 Marks)

Module-2

- 3 a. Discuss the basic configuration of MOSFET. (06 Marks)
- b. For a common source amplifier shown in Fig Q3(b), determine R_{in} , AV_0 , R_0 and G_V

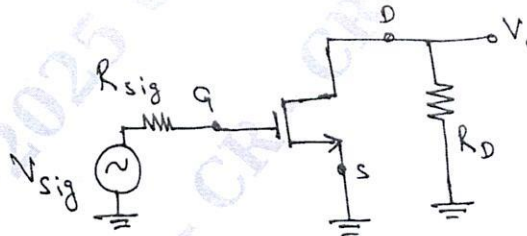


Fig Q3(b)

(14 Marks)

OR

- 4 a. For an n-channel MOSFET with $t_{ox} = 10nm$, $L = 1.0 \mu m$, $W = 10 \mu m$, $L_{OV} = 0.05 \mu m$, $C_{sbo} = C_{dbo} = 10 fF$, $V_0 = 0.6 V$, $V_{SB} = 1 V$ and $V_{DS} = 2 V$. Calculate C_{ox} , C_{ov} , C_{gs} , C_{gd} , C_{sb} and C_{db} . (10 Marks)
- b. Explain the working of FET based phase shift oscillator and also mention the necessary conditions for sustained oscillation. (10 Marks)

Module-3

- 5 a. Explain the following properties of Negative. Feedback.
 i) Gain, De-sensitivity ii) Bandwidth Extension iii) Noise reduction (14 Marks)
- b. A negative feedback amplifier has a $A_f = 100$ and $A = 10^5$. What is the feedback factor? If a manufacturing error results in a reduction of A to 10^3 , what is the closed loop voltage Gain? What is the percentage change in A_f ? (06 Marks)

OR

- 6 a. Explain the working of class B output stage. (08 Marks)
- b. For emitter follower Class A output stage $V_{cc} = 10V$, $I = 100$ mA and $R_L = 100 \Omega$. If the output voltage is an 8 V – peak sinusoid, find :
 i) Power delivered to load
 ii) Average power drawn from the supplies
 iii) Power conversion efficiency ignore the loss on Q_3 and R . (06 Marks)
- c. Explain how cross over distortion can be eliminated to class AB output stage. (06 Marks)

Module-4

- 7 a. For the voltage Seri feedback amplifier, derive the expressions of
 i) Exact voltage Gain ii) Input resistance with feedback iii) Output resistance with feedback (14 Marks)
- b. For the inverting amplifier $R_1 = 470 \Omega$ and $R_F = 4.7$ K Ω . Assume $A = 200000$, $R_i = 2$ M Ω , $R_o = 75 \Omega$ and $f_o = 5$ Hz. Calculate A_F , R_{iF} , R_{oF} and f_{fF} . (06 Marks)

OR

- 8 a. Explain the working of instrumentation amplifier using Transducer bridge with necessary equations. (08 Marks)
- b. Explain the working of Inverting Schmitt trigger with input and output waveforms. (08 Marks)
- c. For a Differential configuration summer $R = 1$ K Ω , $V_a = 2V$, $V_b = 3V$, $V_c = 4V$, $V_d = 5V$ and supply voltage of $\pm 15V$. Determine the output voltage V_o . (04 Marks)

Module-5

- 9 a. Derive the expression of output voltage of a 4-bit Binary weighted resistor type DAC. Mention its disadvantages. (10 Marks)
- b. Draw the block diagram of successive approximation ADC and explain it. (10 Marks)

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- 10 a. Explain the working of First order active Lowpass filter with the help of magnitude voltage gain and also design to get a cutoff frequency of 1 KHz with a passband gain of 2. (10 Marks)
- b. Explain the working of Astable multi-vibration using 555 Timer and also derive the expression of Frequency of oscillation. (10 Marks)
