Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: B.Tech**
Sub_Code: REC3C001

3rd Semester Back Examination: 2024-25
SUBJECT: Analog Electronic Circuits
BRANCH(S): AEIE, BIOMED, ECE, EEE, ELECTRICAL, ELECTRONICS & C.E, ETC
Time: 3 Hours
Max Marks: 100
Q.Code: R594

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Explain, how FETs are unipolar? Draw the V-I Characteristics of an E- MOSFET.
b) Discuss the concept of load line and operating point of a BJT
c) Draw and briefly explain a current mirror circuit using BJT.
d) With suitable diagram, discuss the advantages of cascaded system using MOSFET.
e) With g_m = 50 mA/V, $r_{b'e}$ = 1 KΩ, C_e = 1 pF, and C_c = 0.2 pF, determine the values of f_β and f_T.
f) Differentiate between the negative and positive feedback circuits.
g) Write a short note on class AB amplifier.
h) Discuss the characteristics of an ideal Op-Amp.
i) Write the other functions of differentiator and integrator circuits using OP-AMP.
j) Determine $S(V_{BE})$ for fixed-bias with R_B = 250 KΩ and β = 90.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Explain, why the self-bias is named so? Discuss its advantages.
b) Discuss about the stability of DC bias with voltage feedback in comparison to the self-bias circuit. Determine the quiescent levels of I_C and V_{CE} for the voltage feedback biasing network with β = 90, V_{CC} = 10V, R_C = 4.7 KΩ, R_B = 250 KΩ, R_E = 1.2 KΩ
c) Explain the principle of operation of a P-Channel MOSFET.
d) A MOSFET is to operate at I_D = 0.1 mA and is to have g_m = 1 mA/V. If k_n = 50 μA/V^2, find the required *W/L* ratio and the overdrive voltage.
e) With a neat circuit diagram of a small signal analysis of BJT network, derive the expressions for Z_i, Z_o, A_i, and A_v.
f) For a CS MOSFET amplifier circuit with V_{DD} = +15 V, V_t = 1.5 V, $k'_n(W/L)$ = 0.25 mA/V^2, V_A = 50 V, R_G = 10 MOhm. R_D = 10 KOhm, R_L = 10 KOhm, find I_D, V_D, g_m, and r_o.

g) Consider a voltage divider biased amplifier circuit with V_{CC} = +20 V, R_1 = 80 KΩ, R_2 = 40 KΩ, R_C = 15 KΩ, R_E = 5 KΩ, R_L = 30 KΩ. The used transistor has the following set of h-parameters:
h_{ie} = 2 KΩ, h_{fe} = 50, $h_{re} = 4 \times 10^{-4}$, $h_{oe} = 25 \times 10^{-6}$ Siemens. Determine R_i(base), R_i(overall), r_o, r_o (overall), and A_V.

h) Find the high frequency response parameters of CS-amplifier with source resistance.

i) Write short notes on the principles of sinusoidal oscillators and crystal oscillator circuits.

j) State the Barkhausen criterion for sustained oscillations. Explain the principle of operation of a RC-phase shift oscillator circuit.

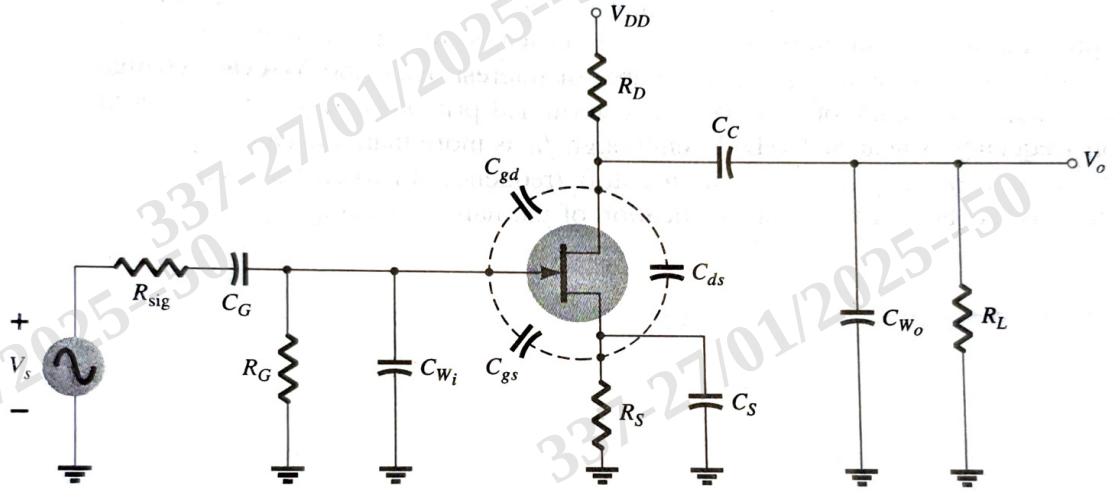
k) Explain about any two non-inverting Configurations of OP-AMP circuits.

l) Write in detail about any two compound configurations.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Describe the three main biasing techniques used in biasing of MOSFET circuits. Extend the discussion on the stability of the techniques. Determine the dc bias voltage V_{CE} and the current I_C and the stability factor for the voltage divider biasing circuit with R_1 = 49 KΩ, R_2 = 4.9 KΩ, R_C = 20 KΩ, R_E = 2.5 KΩ, $C_1 = C_2$ = 10 μF, and β = 100. **(16)**

Q4 Which capacitors affects the high frequency response of a BJT amplifier circuit. Describe in detail. Determine the high cut-off frequencies for the network using the following parameters: **(16)**
C_G = 0.01 μF, C_C = 0.5 μF, C_S = 2 μF, C_{gd} = 2 pF, C_{gs} = 4 pF, C_{ds} = 0.5 pF, C_{wi} = 5 pF, C_{wo} = 6 pF, R_{sig} = 10 KΩ, R_G = 1 MΩ, R_D = 4.7 KΩ, R_S = 1 KΩ, R_L = 2.2 KΩ, I_{DSS} = 8 mA, V_P = –4 V, $r_d = \infty$, V_{DD} = 20 V.



Q5 Write notes on Class A, B, AB, C Power Amplifiers **(16)**

Q6 With suitable diagram, explain in detail the single input balanced output differential circuit, Differentiator and Integrator using OP-AMP. **(16)**