Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENECES
END SEMESTER THEORY EXAMINATIONS NOVEMBER/DECEMBER 2023
III SEMESTER B.Sc. (APPLIED SCIENCES) IN ENGG.

ANALOG ELECTRONIC CIRCUITS [IEC 231 - S2]

Marks: 50   **Duration: 180 mins.**

Answer all the questions.

Missing data, if any, may be suitably assumed

1)

A) For the transistor (Silicon) circuit shown in Fig. Q1a, find the minimum base and collector current required to keep the transistor in saturation. Assume R_{in} =100KΩ, R_L=820Ω, V_{CC}=10Vm ,V_{BE}, sat=0.8V , V_{CE}, sat=0.2V and Neglect I_{CBO}. Also, explain the working principle of the circuit with a neat output waveform.   (5)
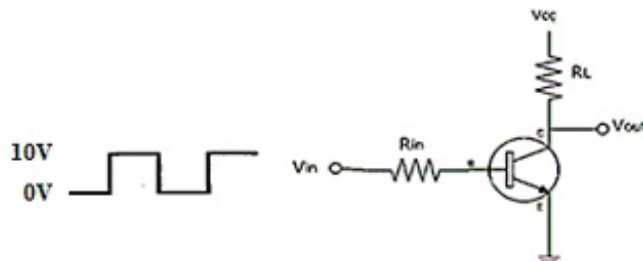

Fig. Q1a.

B) Draw the circuit diagram of RC coupled amplifier with feedback using NPN transistor. Mention the function of each component. Explain the working at low, medium, and high frequencies.   (5)

2)

A) Draw the circuit diagram of a common source amplifier using a NMOSFET, with a source degeneration resistance RS. Draw the small signal model of the circuit. Obtain the expression for the voltage gain λ=0 and output resistance with the λ≠ 0.   (5)

B) Explain the working principle of fixed bias circuit and determine the expressions for the operating point. Perform the load line analysis of the same for variations in V_{CC}, I_B and R_C.   (5)

3)

A) For a fixed bias circuit, V_{cc} = 12 V and R_c = 4kΩ. The Ge transistor used is characterized by β = 50, I_{CEO} = 0 and V_{CEsat} = 0.2 V. Find the value of R_B at the edge of saturation.   (5)

B) With the help of a circuit diagram, explain the working of transformer (5) coupled Class B push pull power amplifier. Derive an expression for the maximum power efficiency. Mention one drawback of this amplifier.

4)

A) The degenerated CS stage of Fig. Q4a must provide a voltage gain of 4 with a (5) bias current of 1 mA. Assume a drop of 200 mV across R_S and $\lambda=0$. If $R_D =1K\Omega$, determine the required value of $W/_L$. Does the transistor operate in Saturation for this choice of $W/_L$? Assume $\mu_n C_{ox} = 200 \frac{\mu A}{V^2}$, $V_{th} = 0.4V$.
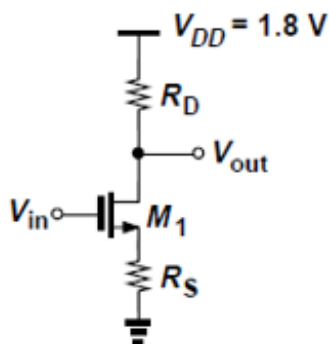

Fig Q4aa.

B) Explain Barkhuasen criteria for sustained oscillations. Write the circuit of (5) RC phase shift oscillator and explain its working. In an RC phase shift oscillator if the value of resistors is $R_1=R_2=R_3=150$ $K\Omega$ and the value of capacitors $C_1=C_2=C_3=0.25$ nF. Determine the frequency of oscillation.

5)

A) NMOS device operating in saturation with $\lambda= 0$ must provide a trans (5) conductance of gm = (1/20) mhos.

(i) Determine W/L if I_D = 1 mA.

(ii) Determine W/L if $V_{GS} - V_{TH} = 0.6$ V.

(iii) Determine I_D if $V_{GS} - V_{TH} = 0.6$ V.

B) The frequency response of an amplifier is shown in Fig. 5b. Find the value (5) of A and B in dB. Also compute the bandwidth.
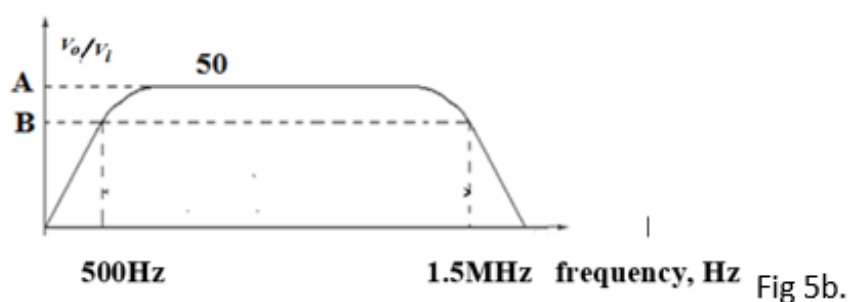

Fig 5b.

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