(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 131401 **Roll No.** | | | | | | | | | | |

B.Tech.

(SEM. IV) THEORY EXAMINATION 2013-14

ELECTRONIC CIRCUITS

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions. Each question carries equal marks.

1. Attempt any **four** of the following : **(5×4=20)**

   (a) What are the characteristics of the ideal Op Amp ? Explain the concept of Virtual Ground.

   (b) Design an inverting Op-Amp circuit to form the weighted sum v_0 of two inputs v_1 and v_2. It is required that $v_0 = -(v_1 + 5\, v_2)$. Choose values for R_1, R_2 and R_f so that for a maximum output voltage of 10 V, the current in the feedback resistor will not exceed 1 mA.

   (c) Design a noninverting amplifier with a gain of 2 at the maximum output voltage of 10 V the current in the voltage driver is to be 10 μA.

   (d) An enhancement-type NMOS transistor with $V_t = 0.7$ V conducts a current $i_D = 100$ μA when $V_{GS} = V_{DS} = 1.2$ V. Find the value of i_D for $V_{GS} = 1.5$ V and $V_{DS} = 3$ V. Also, calculate the value of the drain to source resistance r_{DS} for a small V_{DS} and $V_{GS} = 3.2$ V.

(e) Explain the operation of enhancement-type N-channel MOSFET as V_{DS} is increased.

(f) Consider an n-channel MOSFET with t_{ox} = 20 nm, μ_n = 650 cm²/V-S, V_t = 0.8 V and W/L = 10. Find the drain current when V_{GS} = 5 V and V_{DS} = 1 V.

2. Attempt any **four** of the following : **(5×4=20)**

(a) Calculate β for two transistors for which α = 0.99 and 0.98. For collector currents of 10 mA, find the base current of each transistor.

(b) A BJT having β = 100 is biased at a dc collector current of 1 mA. Find the value of g_m, r_e and r_π at the bias point.

(c) What is the basic principle of Sinusoidal Oscillators ? Explain Barkhausen criterion.

(d) Explain the properties of Negative Feedback.

(e) Describe the structure of an npn transistor and explain the operation in the active mode.

(f) Describe how the performance of an op-amp is affected by the finite open loop gain of amplifier.

3. Attempt any **two** of the following : **(10×2=20)**

(a) Consider the difference-amplifier circuit of fig. 1. for these cases : $R_1 = R_3$ = 2 kΩ and $R_2 = R_4$ = 200 kΩ.

(i) Find the value of differential gain A_d.

(ii) Find the value of differential input resistance R_{id} and the output resistance R_o.

(iii) If the resistor has 1% tolerance (i.e. each can be within ± 1% of its nominal value), find the worst-case common mode gain A_{cm} and the corressponding value of CMRR.

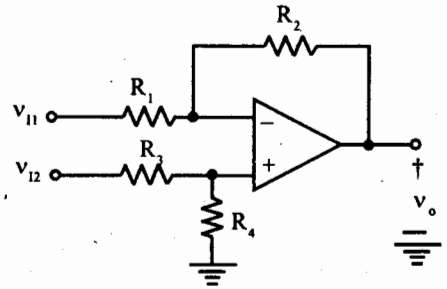

Fig. 1 A Difference Amplifier

(b) Derive the relation between i_D and V_{DS} for NMOS transistor. (Triode region and Saturation region).

(c) Explain the hybrid-π model of the npn transistor.

4. Attempt any **two** of the following : **(10×2=20)**

(a) Draw the high-frequency hybrid-π model and derive an expression for $h_{fe} \equiv \frac{I_c}{I_b}$.

(b) Explain the Four Basic Feedback Topologies.

(c) Draw the Basic structure of single stage BJT amplifier and find out its characteristic parameters.

5. Explain any **two** of the following : **(10×2=20)**

(a) Wein-Bridge Oscillator

(b) MOS differential pair

(c) Write the disadvantages of RC phase shift oscillator. Draw the circuit diagram of RC phase shift oscillator and derive the expression frequency.