

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

PAPER ID : 131402

Roll No.

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B. Tech. (Semester-IV)

SPL. THEORY EXAMINATION, 2014-15

ELECTRONIC CIRCUITS

Time : 3 Hours]

[Total Marks : 100

Note: Attempt all questions. All questions carry equal marks.

- Attempt any four parts of the following : $5 \times 4 = 20$
 - Draw the circuit of Difference Amplifier using OP-AMP and apply superposition to determine the common mode gain expression.
 - Consider the difference amplifier circuit for the case $R_1 = R_3 = 2K\Omega$ & $R_2 = R_4 = 200K\Omega$ of fig 1. Find the value of the differential gain A_d .

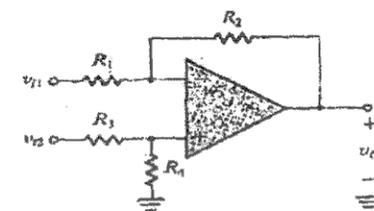


Fig. 1

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- (c) For NMOS transistor, write the drain current expression in Triode region and Saturation region.
- (d) Design the circuit of figure so that the transistor operates at $I_D = 0.4 \text{ mA}$ and $V_D = +0.5 \text{ V}$. The NMOS transistor has $V_t = 0.7 \text{ V}$, $\mu_n C_{ox} = 100 \mu\text{A/V}^2$, $L = 1 \mu\text{m}$ and $W = 32 \mu\text{m}$. Neglect the channel length modulation effect (ie, $\lambda = 0$)

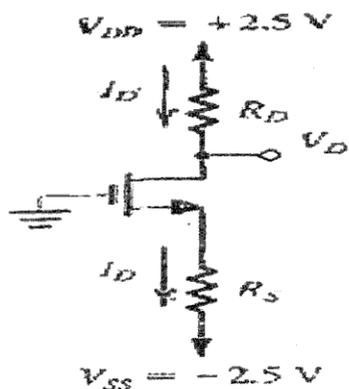


Fig. 2

- (e) Define Trans-conductance and Trans-resistance amplifiers.
- (f) Explain the condition for Oscillation.

2. Attempt any four parts of the following : $5 \times 4 = 20$

- (a) Can a depletion type MOSFET operates in enhancement mode? If yes, why and how, and if no, why?

- (c) (i) A MOS differential pair is operated at a total bias current of 0.8mA using transistor with a W/L ratio of 100, $K' = 0.2 \text{ mA/V}^2$, $V_A = 20 \text{ V}$ and $R_D = 5 \text{ K}\Omega$. Find the value of $V_{GS} - V_t$, g_m , r_o , A_d and A_{cm} .
- (ii) Explain the working of differential amplifier with active load. Explain advantages of an active load.

5. Attempt any two parts of the following : $2 \times 10 = 20$

- (a) Explain the series-series feedback amplifier for the ideal and practical situations. Also derive the expression for gain and resistance of the configuration. Draw block diagram for each of the four basic feedback amplifiers.
- (b) Draw the circuit of Hartley Oscillator and derive the expression for frequency. In the Hartley Oscillator if $L_1 = 0.1 \text{ mH}$, $L_2 = 10 \mu\text{H}$ and mutual inductance $M = 20 \mu\text{H}$. Determine the value of C_1 to obtain frequency of 4110 KHz.
- (c) Write short notes on:
- (i) RC Phase Shift Oscillator
- (ii) Negative Current Feedback

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- (b) A transistor amplifier is fed with a signal source having an open-circuit voltage V_{sig} of 10 mV and internal resistance R_{sig} of 100 $\text{K}\Omega$. The voltage v_i at the amplifier input and output voltage v_o are measured both without and with load resistance $R_L = 10 \text{ K}\Omega$ connected to the amplifier output. The measured results are as follows :

	v_i (mV)	V_o (mV)
Without RL	9	90
With RL connected	8	70

Find all the amplifier parameters.

- (c) Draw the circuit diagram of single stage CE amplifier, implement hybrid $-\pi$ model and T-model for it. Calculate expression for i_e , g_m , and i_b .
- (d) Draw the high frequency equivalent circuit of a MOSFET and explain the significance of the difference elements of the circuit.
- (e) Design a series-series feedback amplifier and calculate expression for A_F , R_{OF} and R_{IF} .
- (f) For the circuit shown in figure 3, calculate the values of I_{DQ} and V_{DSQ} . It is given that $I_{DS(on)} = 6 \text{ mA}$, $V_{GS(on)} = 8 \text{ V}$ and $V_{GS(Th)} = 3 \text{ V}$. $V_{DD} = 12 \text{ V}$, $R_D = 2 \text{ K}\Omega$, $R_G = 10 \text{ M}\Omega$, Capacitors are of value $4.7 \mu\text{F}$.

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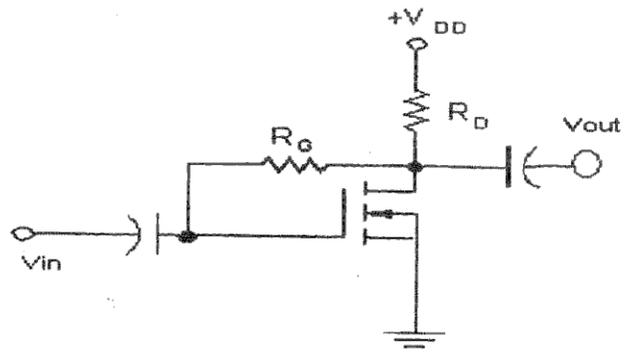


Fig. 3

3. Attempt any two parts of the following : 2×10=20

- (a) Draw the circuit diagram of CE amplifier. Replacing the transistor with hybrid π model, deduce the expression for its voltage gain.
- (b) Discuss various internal capacitances for BJT. Derive the expression given below.

$$f_T = \frac{g_m}{2\pi(C_\pi + C_\mu)}$$

- (c) In the circuit of fig 4 V_{sig} is a small sine wave signal with zero average. The transistor β is 100.
 - (i) Find the value of R_E to establish a dc emitter current of about 0.5mA

- (ii) Find R_C to establish a dc collector voltage of about +5V.
- (iii) For $R_L=10K\Omega$ and the transistor $r_o=200K\Omega$, draw the small signal equivalent circuit of the amplifier and determine its overall voltage gain.

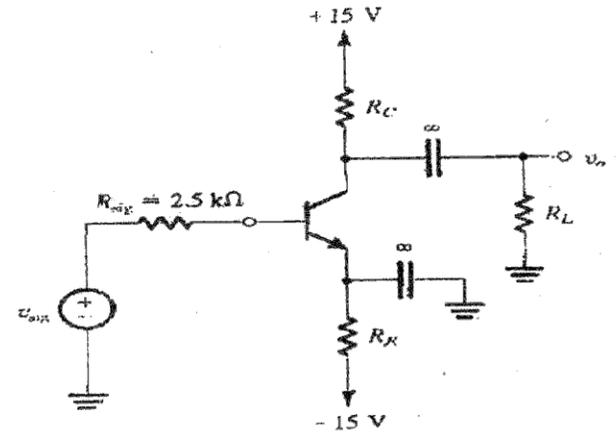


Fig. 4

4. Attempt any two parts of the following : 2×10=20

- (a) What is MOS differential amplifier? Explain its basic operation with the help of suitable diagrams. Also find its differential gain A_d , Common mode gain A_{cm} , and CMRR.
- (b) Explain the small signal operation of the BJT differential amplifier and hence show that the differential input resistance R_{id} is given as :

$$R_{id} = (\beta + 1)(2r_e + 2R_E)$$