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

PAPER ID : 0321 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. IV) THEORY EXAMINATION 2010-11

ELECTRONIC CIRCUITS

Time : 3 Hours *Total Marks : 100*

Note :– (1) Attempt ***all*** questions.

(2) All questions carry equal marks.

1. Attempt any **FOUR** parts of the following :— (4×5)

(a) Draw the circuit of difference amplifier using OP-AMP and apply superposition to determine the common mode gain expression.

(b) Draw the circuit diagram of inverting weighted summer calculate the output voltage for the same.

(c) Derive the expression for closed loop gain of non-inverting configuration of OP-AMP. What are its characteristics ? Discuss the effect of finite open loop gain.

(d) (i) Using non-inverting input draw the practical circuits of

(i) VCVS

(ii) CCVS

(ii) An OP-AMP having 106dB gain at dc and a single pole frequency response with f_1 = 2 MHz is used to design a non-inverting amplifier with nominal dc gain of 100.

Find the 3dB frequency of the closed loop gain.

(e) Define :—

(i) Slew rate

(ii) Half power bandwidth.

An OP-AMP has a rated output voltage of ± 10V and slew rate of 1 V/μS. What is the Half power bandwidth if an input sinusoid with frequency $f = 5\ f_M$ is applied to a unity gain follower constructed using this OP-AMP. What is the maximum possible amplitude that can be accommodated at output without incurring SR distortion ?

(f) What is "Input Bias current" of an OP-AMP ? How its effect can be reduced by connecting a resistance in the non-inverting terminal explain with mathematical expression.

2. Attempt any **TWO** parts of the following :— **(2×10)**

(a) (i) Name the different biasing methods of MOSFET. Describe in detail the biasing using a constant current source. Implement this biasing for the application of current mirror.

(ii) A MOSFET is to operate at $I_D = 0{\cdot}1$ mA and to have $g_m = 1$ mA/V if $K'_n = 50\ \mu A/V^2$. Find the required W/L ratio and overdrive voltage.

(b) Explain the working of common source amplifier with a resistance connected in source lead. Draw its small signal equivalent circuit neglecting r_0 and deduce the expression for overall voltage gain.

(c) (i) Design the circuit given in Fig. 1 to obtain a current I_D of 80 μA. Find the value required for R and find the dc voltage V_D. Let the NMOS transistor have V_t = 0·6 V, $\mu_n \cdot C_{ox}$ = 2000 μA/V², L = 0·8 μm and W = 4 μm. Assume $\lambda = 0$.

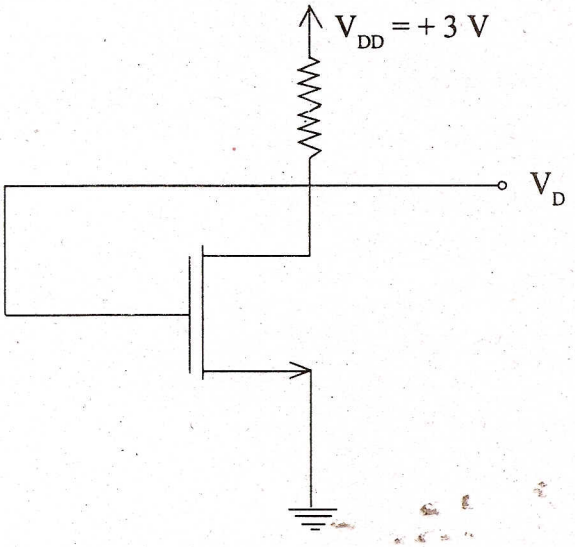

Fig. 1

(ii) Re-design the circuit given in Fig. 1 to double the value of I_D without changing V_D. Give and values of W/L and R.

3. Attempt any **TWO** parts of the following :— **(2×10)**

(a) Draw the circuit diagram of CE amplifier. Replacing the transistor with its hybrid Π model deduce the expression for its voltage gain.

(b) (i) Discuss the various internal capacitances in detail for BJT.

(ii) Draw the high frequency hybrid Π model of BJT. Derive the expression given below :

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

(c) Write the steps through which small signal equivalent circuit model can be used in the analysis of transistor amplifier.

Analyze the transistor amplifier given in Fig. 2 to determine its voltage gain. Assume $\beta = 100$.

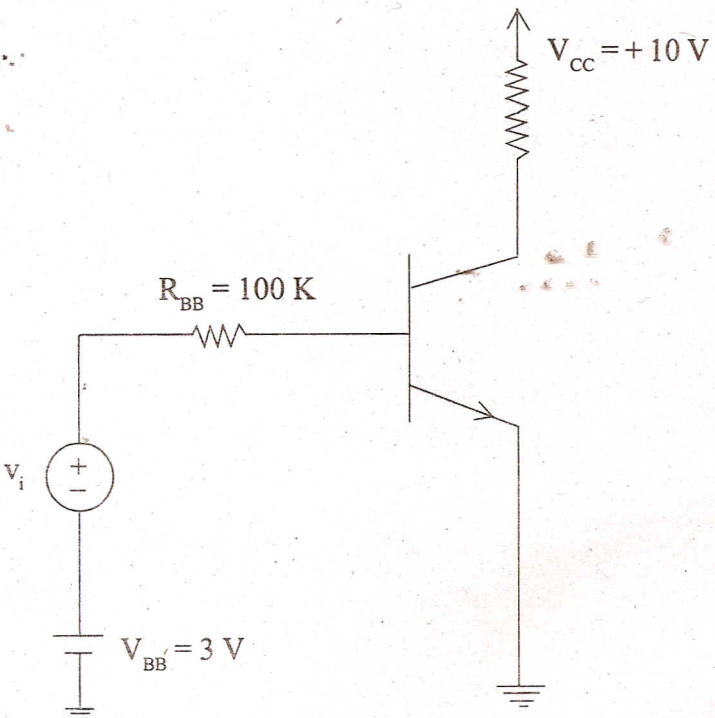

Fig. 2

4. Attempt any **TWO** parts of the following :— **(2×10)**

(a) Write the features of differential amplifier. Draw the circuit of MOS differential pair configuration and describe its common mode operation for the determination of over drive voltage.

(b) For a MOS amplifier with differential input, prove that $g_m = \frac{I}{V_{OV}}$ where symbols have their usual meaning.

(c) (i) Explain the advantages of an active load. Draw a circuit of MOS differential amplifier with active load.

(ii) An N MOS balanced output differential amplifier is operated at a bias tail current of 0·5 mA and has a $\frac{W}{L}$ ratio of 50, $\mu_u C_{O\chi} = 250\ \mu A/V^2$ and $R_D = 4\ k\Omega$. Find g_m and Ad assume $\lambda = 0$.

5. Answer any **FOUR** parts of the following :— **(4×5)**

(a) Mention the advantages of negative feedback and discuss its effect on :

(i) Frequency response and bandwidth expression.

(ii) Non-linear distortion.

(b) Explain the working of trans-conductance amplifier using BJT and derive the expression for closed loop trans-conductance.

(c) For the MOS source follower shown in Fig. 3, calculate the value of A_{vf}, R_{if}, R_{of} and β.

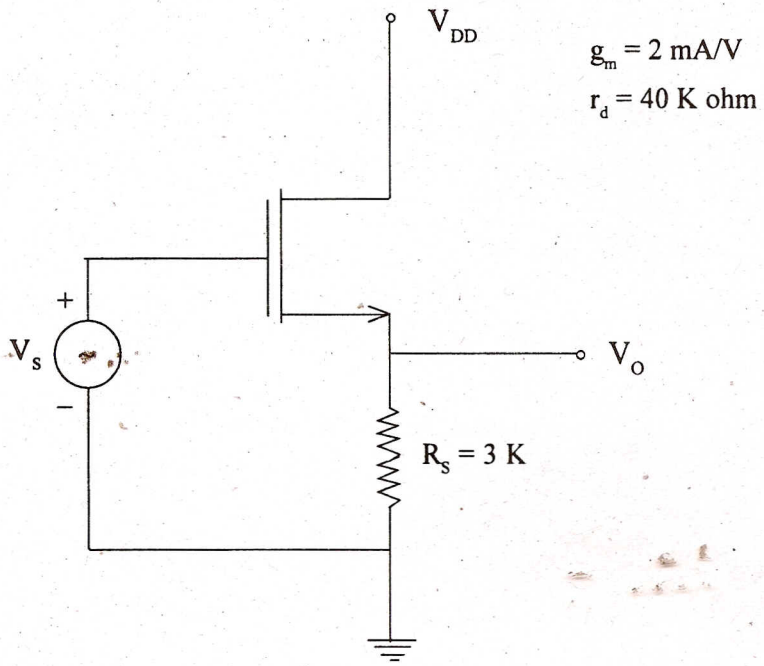

Fig. 3

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

(e) Draw the circuit of colpitts oscillator using MOSFET devices and show that tank circuit capacitors are in the ratio given as

$$\frac{C_2}{C_1} = g_m R.$$

(f) What is piezoelectric crystal ? Derive the expression of the ratio of frequency in series and parallel resonance in a piezoelectric crystal.