QP CODE : 22625

(3 Hours) **Marks: 80**

N.B.: (1) Question No.**1** is **compulsory**.
(2) Solve any **three** questions from **remaining five** questions.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if required and mention the same in the answer sheet.

Q.1 Solve any **five** of the following: - 20

(a) What is cross over distortion? How to overcome the same.

(b) Consider a BJT has parameters f_T =500MHz at I_C = 1mA, β = 100 and $C\mu$ = 0.3pF. Calculate bandwidth of f_β and capacitance $C\pi$ of a BJT.

(c) Implement $Vo = -(3V_1 + 4V_2 + 2V_3)$ using OpAmp.

(d) Define the CMRR of Differential Amplifier. Why constant current source biasing is preferred for Differential Amplifier?

(e) Draw the circuit diagram of widlar current source and derive the relationship between output current and reference current.

(f) A zener voltage regulator as shown in **Fig. 1f** has V_Z = 6.2V. The input voltage varies from 10 V to 15 V and load current is 60 mA. To hold output voltage constant under all conditions what should be the range of series resistance (R_{Smin} and R_{Smax}) (I_{Zmin} = 10 mA, P_{Zmax} = 2W).

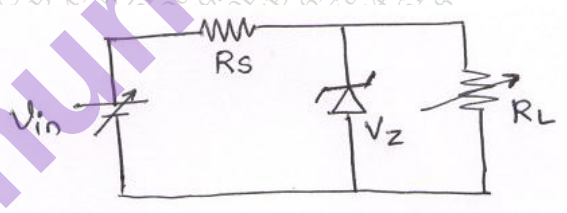

Fig. 1f

Q.2 (a) Determine the corner frequency and maximum gain of a bipolar common-emitter circuit shown in **Fig. 2a**, with an input coupling capacitor. 10

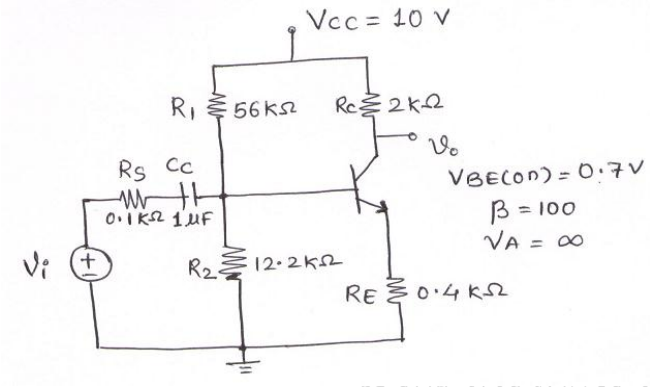

Fig. 2a

(b) Draw the circuits of OpAmp based integrator circuit and derive the expression for output voltage. What are the limitations of integrator circuit and how to overcome the limitations? 10

Q.3 (a) Draw the small signal equivalent circuit of the bipolar differential amplifier. Determine its output voltage in the general form for one sided output $V_O = A_d V_d + A_{cm} V_{cm}$, and hence the expressions for differential mode gain and common mode gain. 10

(b) For the circuit shown in **Fig. 3b**, Transistors parameters are $K_n = 1mA/V^2$, $V_{TN} = 0.7V$, $C_{gs} = 2pF$, $C_{gd} = 0.2pF$, $\lambda = 0$. Find the miller capacitance, mid band voltage gain and upper cut off frequency. 10

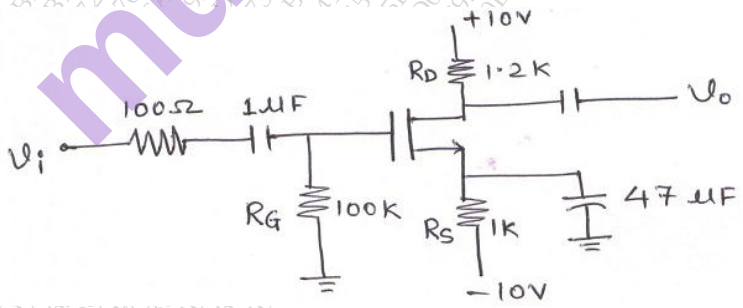

Fig. 3b

Q.4 (a) For the MOSFET differential amplifier shown in **Fig. 4a**, the transistor parameters are $K_{n1} = K_{n2} = 0.1$ mA/V^2, $K_{n3} = K_{n4} = 0.3$ mA/V^2, $V_{TN} = 1V$ for all transistors, $\lambda = 0$ for M_1, M_2 and M_3, $\lambda = 0.01$ V^{-1} for M_4. Determine the bias current I_Q, output resistance of current source, differential-mode voltage gain, common-mode voltage gain and CMRR for the differential amplifier. 10

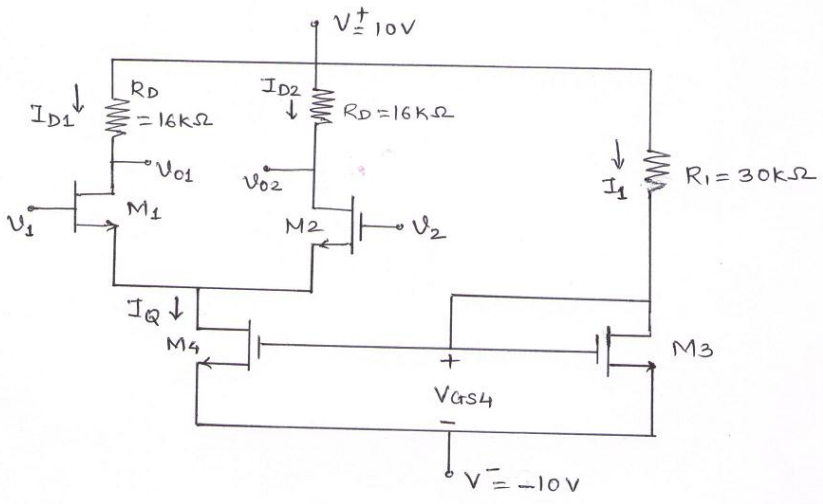

Fig. 4a

(b) Draw circuit diagram of cascode amplifier using BJT and derive expression for voltage gain, input resistance and output resistance. 10

Q.5 a) Draw and explain the working of Class A power amplifier (transformer coupled). Derive the expression for efficiency. 10

(b) For the basic three transistor current source shown in **Fig. 5b**, the parameters are : 10

$V^+ = 10V$, $V^- = 0V$ and $R_1 = 12K\Omega$, for all transistors $V_{BE\ (on)} = 0.7V$, $\beta=100$ and $V_A = \infty$. Calculate value of each current shown in Fig. , i.e. I_{REF}, I_{C1}, I_{B1}, I_{B2}, I_{E3}, I_{B3}.

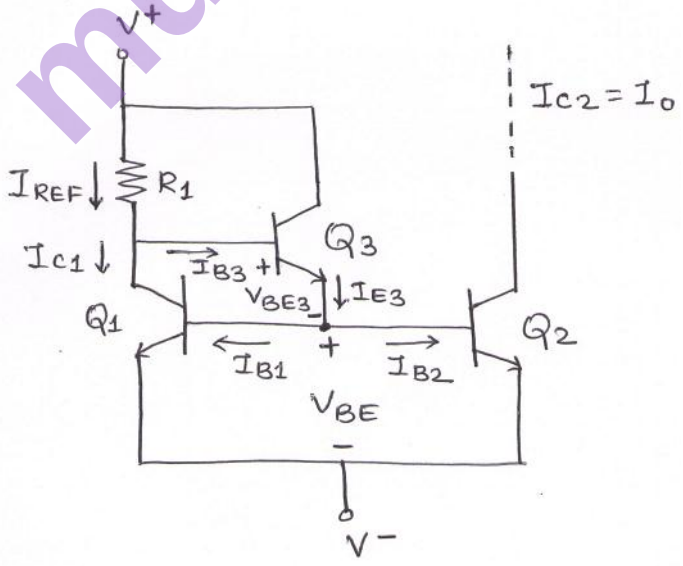

Fig. 5b

Q.6 Write short notes on any **four** of the following :- 20

(a) Millers Theorem.

(b) Active Filters.

(c) Transistorized series regulator

(d) Wilson current source.

(e) Power MOSFET.
