QP Code : 13153

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **three** questions from the **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.

1. Solve any **five** of the following :— **20**
   (a) Draw low pass first order active filter and derive expression for cut-off frequency.
   (b) What is cross over distortion ? How to overcome the same.
   (c) Determine unity gain band width for n-channel MOSFET with parameter kn = 0.25 mA/V^2, V_{TN} = IV, $\lambda = 0$, C_{gd} = 0.05 pf, C_{gs} = 0.25 pf. Assume MOSFET is biased at V_{GS} = 3 V.
   (d) Draw high frequency hybrid-π model and explain significance of each parameter.
   (e) Why Cascode (CE-CB) amplifier provides more bandwidth as campared to CE Amplifier with equal gain.
   (f) Implement Vo = $-(2V_1 + 5V_2 + 7V_3)$ using OpAmp.

2. (a) In common-emitter circuit as shown in **Fig. 2a**, the transistor parameters are $\beta = 120$, **10**
   $V_{BE(on)} = 0.7$ V, $V_A = 100$ V, $C_\mu = 1$ pF and $f_T = 600$ MHz. Determine :
   (i) Cπ and equivalent Miller Capacitance CM.
   (ii) The higher cut-off frequency.
   (iii) Small Signal midband voltage gain.

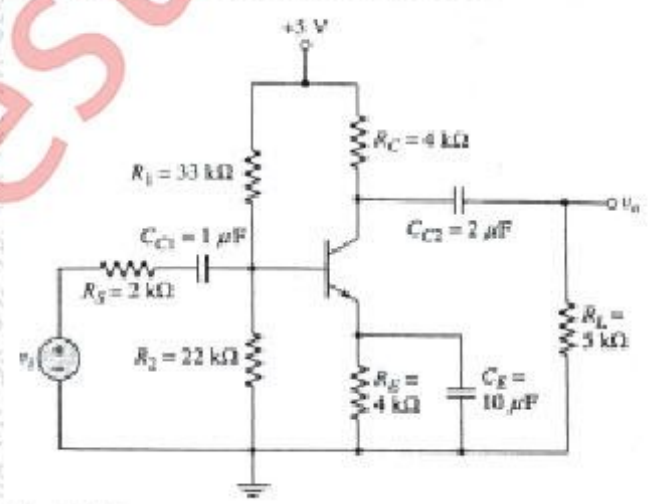

Fig. 2a

[TURN OVER

(b) For the circuit shown in **Fig. 2b** the transistor parameters are kn = 0.5 mA/V^2, $V_{TN} = 2$ V and $C_L = 5$ pF. Determine lower cut-off frequency and small signal voltage gain. **10**

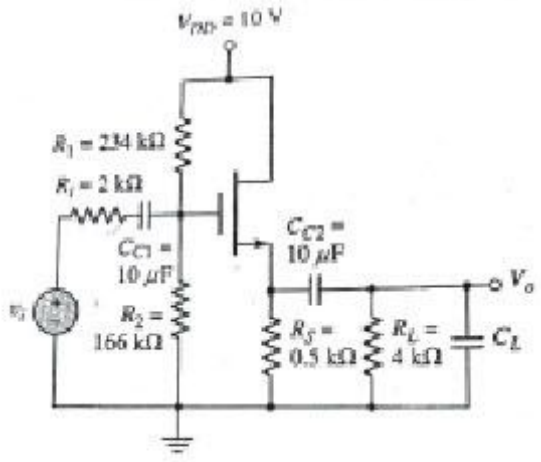

Fig. 2b

3. (a) Draw the circuit diagram of MOSFET based differential amplifier and derive expression for differential voltage gain, common mode gain and CMRR. **10**

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

4. (a) For the basic three transistor current source shown in **Fig. 4a**, the parameters are : $V^+ = 9V$, $V^- = 0V$ and $R_1 = 12$ K, for all transistors $V_{BE(on)} = 0.7$ V, $\beta = 75$ and $V_A = \infty$. Calculate value of each current shown in **Fig. 4a** i.e. I_{REF}, I_{C1}, I_{B1}, I_{B2}, I_{E3}, I_{B3}. **10**

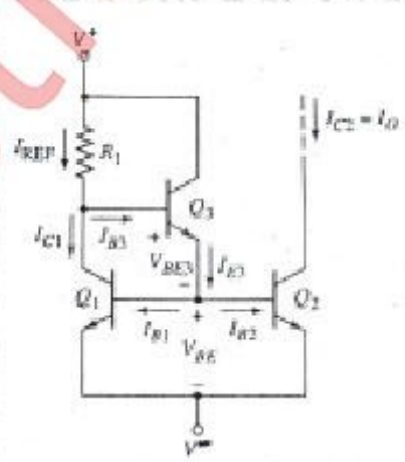

Fig. 4a

(b) Draw the circuit diagram and small signal equivalent circuit of Darlington configuration and derive expression for its input resistance and current gain. **10**

[TURN OVER

5. (a) Draw circuit diagram of class B power amplifier. Explain its working with the help of waveforms and derive expression for power conversion efficiency. **10**

(b) For the circuit shown in **Fig. 5b**, transistor parameters are $\beta = 100$, $V_{BE(on)} = 0.7\,V$ and $V_A = \infty$. **10**

(i) I_{C1}, I_{C2}, I_E, V_{CE1} and V_{CE2}

(ii) Calculate differential voltage gain Ad for one sided output at the collector of Q_2.

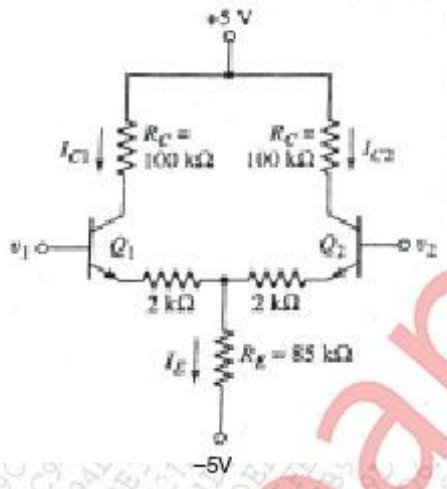

Fig. 5b

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

(a) Power MOSFET

(b) Transistorized shunt regulator

(c) Differentiator using OpAmp

(d) Wilson current source

(e) High frequency model of MOSFET.
