

A.E.I

QP Code : NP-18628

(3 Hours)

[Total Marks : 80]

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

1. Solve any five :—

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- (a) Explain effect of temperature on characteristics of PN junction diode.  
 (b) Why LC oscillators are preferred for high frequency applications ?  
 (c) Find  $R_B$  and  $R_C$  for the circuit shown to obtain  $V_{CE} = 5V$  and  $I_C = 2mA$

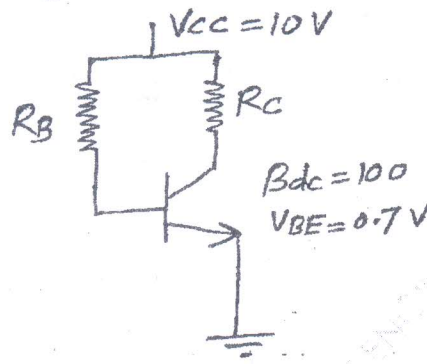


Fig. 1c

- (d) In n-channel MOSFET  $V_{DS} = 5V$ ,  $V_{GS} = 5V$ ,  $V_{BS} = 0$ ,  $W = 10 \mu m$ ,  $L = 5 \mu m$ ,  $k'_n = 100 \text{ mA/V}^2$  and  $V_{TO} = 1V$ . Calculate its drain current for channel length modulation factor  $\lambda$  of 0 and  $0.25 \text{ V}^{-1}$ .  
 (e) Draw and explain small signal hybrid-Pi model of BJT including early effect.  
 (d) Differentiate between BJT and MOSFET.

2. (a) Find  $I_{CQ}$  and  $V_{CEQ}$  for the circuit shown in figure 2a if  $\beta = 100$ 

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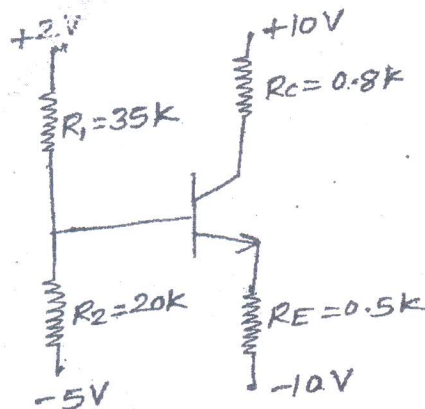
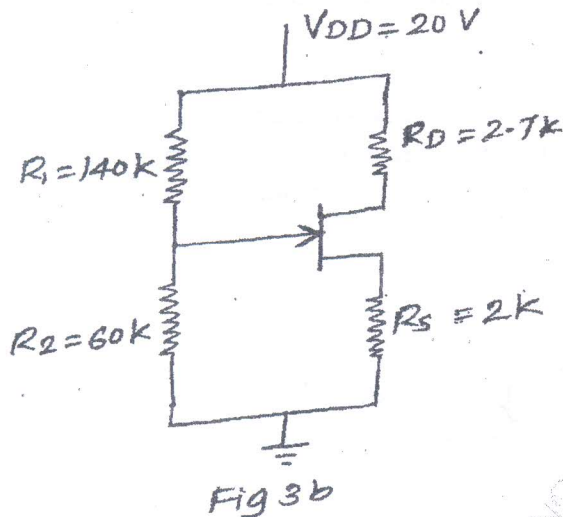


Fig 2a



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- (b) Draw and explain energy band diagram of MOS capacitor in accumulation, depletion and inversion region. 10
3. (a) Draw and explain working of transistorized Wien Bridge Oscillator. 10  
 (b) The JFET shown in figure 3b has parameters  $I_{DSS} = 8\text{mA}$  and  $V_P = -4\text{V}$ . Determine  $V_{GS}$ ,  $I_{DSQ}$ ,  $V_{GSQ}$  and  $V_{DSQ}$ . 10



4. (a) For the common gate circuit shown in figure 4a, the NMOS transistor parameters are  $V_{TN} = 1\text{V}$ ,  $k_n = 3\text{mA/V}^2$  and  $\lambda = 0$ . 10  
 (i) Determine  $I_{DSQ}$  and  $V_{DSQ}$   
 (ii) Calculate  $g_m$  and  $r_o$   
 (iii) Find the small-signal voltage gain  $A_v = \frac{v_o}{v_i}$ . Assume  $C_{c1}$  and  $C_{c2}$  acts as short circuit for small-signal analysis.

