SE EXTC III Analog Electronics-I 31 May 2014 (BGS)

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** :— **20**

(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 $Ic = 2mA$

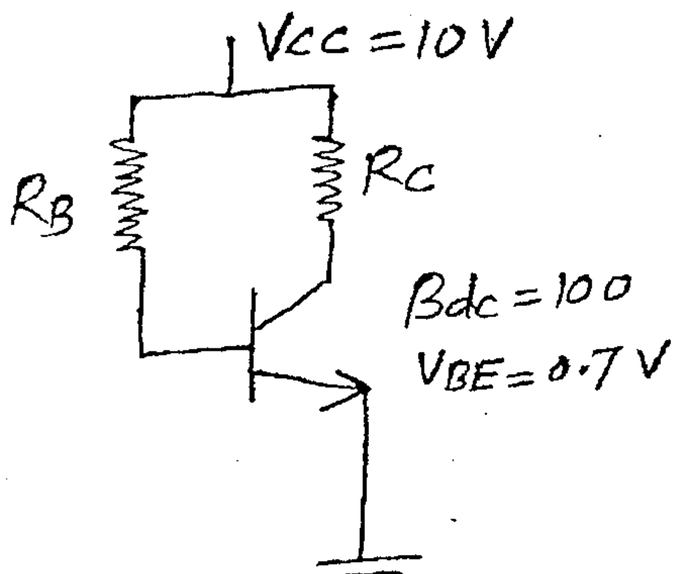

Fig. 1c

(d) In n-channel MOSFET $V_{DS} = 5V$, $V_{GS} = 5V$, $V_{BS} = 0$, $W = 10\ \mu m$, $L = 5\ \mu m$, $k'n=100\ mA/V^2$ and $V_{TO} = 1V$. Calculate its drain current for channel length modulation factor λ of 0 and $0{\cdot}25\ V^{-1}$.
(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 $\beta = 100$ **10**

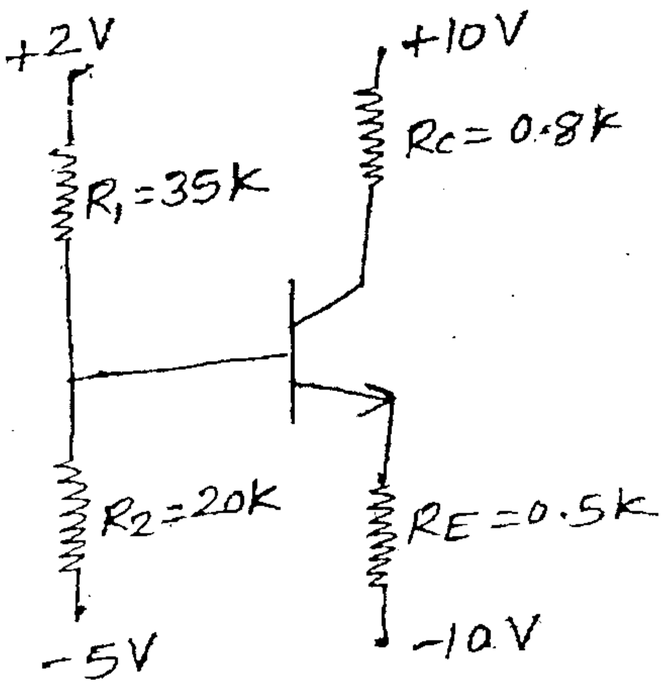

Fig 2a

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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 transisterized Wien Bridge Oscillator. **10**

(b) The JFET shown in **figure 3b** has parameters $I_{DSS} = 8mA$ and $V_P = -4V$. Determine V_G, I_{DSQ}, V_{GSQ} and V_{DSQ}. **10**

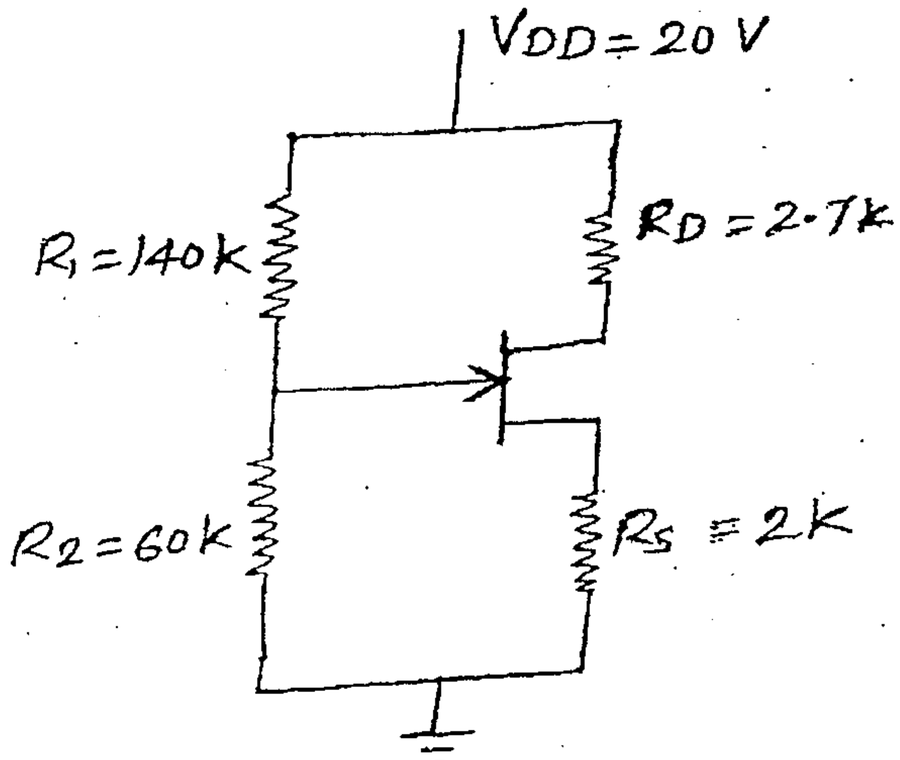

Fig 3b

4. (a) For the common gate circuit shown in **figure 4a**, the NMOS transistor parameters are $V_{TN} = 1V$, $kn = 3\ mA/V^2$ and $\lambda = 0$. **10**

(i) Determine I_{DSQ} and V_{DSQ}

(ii) Calculate gm and ro

(iii) Find the small-signal voltage gain $A_V = \frac{v_0}{v_i}$. Assume Cc_1 and Cc_2 acts as short circuit for small-signal analysis.

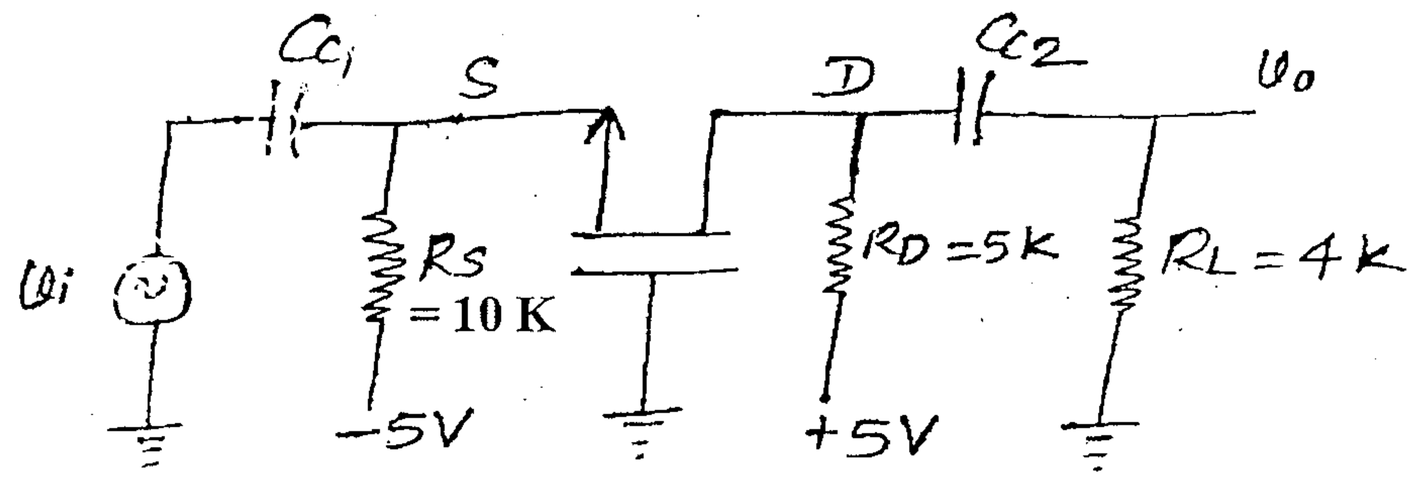

Fig 4a.

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(b) The parameters of the transistor in the circuit shown in **figure 4b** are $\beta = 100$ and $V_A = 100$ V. **10**

(i) Determine the dc voltages at base and emitter terminals.

(ii) Find Rc such that $V_{CEQ} = 3{\cdot}5$V and

(iii) Assuming C_c and C_E act as short circuit, determine small-signal voltages gain

$$Av = \frac{v_0}{v_s}.$$

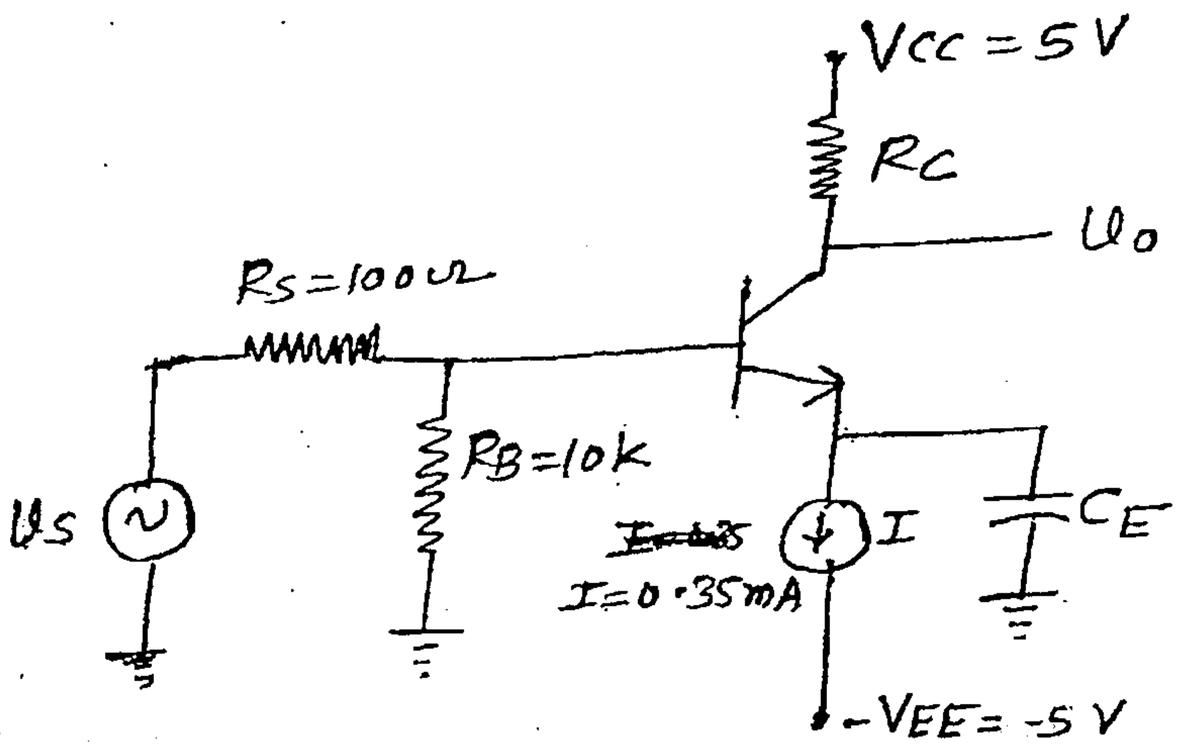

Fig 4b.

5. (a) Derive expression for voltage gain of NMOS source follower circuit. **8**

(b) For the common base amplifier shown in **figure 5b**, derive expression for voltage gain, current gain, input resistance and output resistance using hybrid-π model. **12**

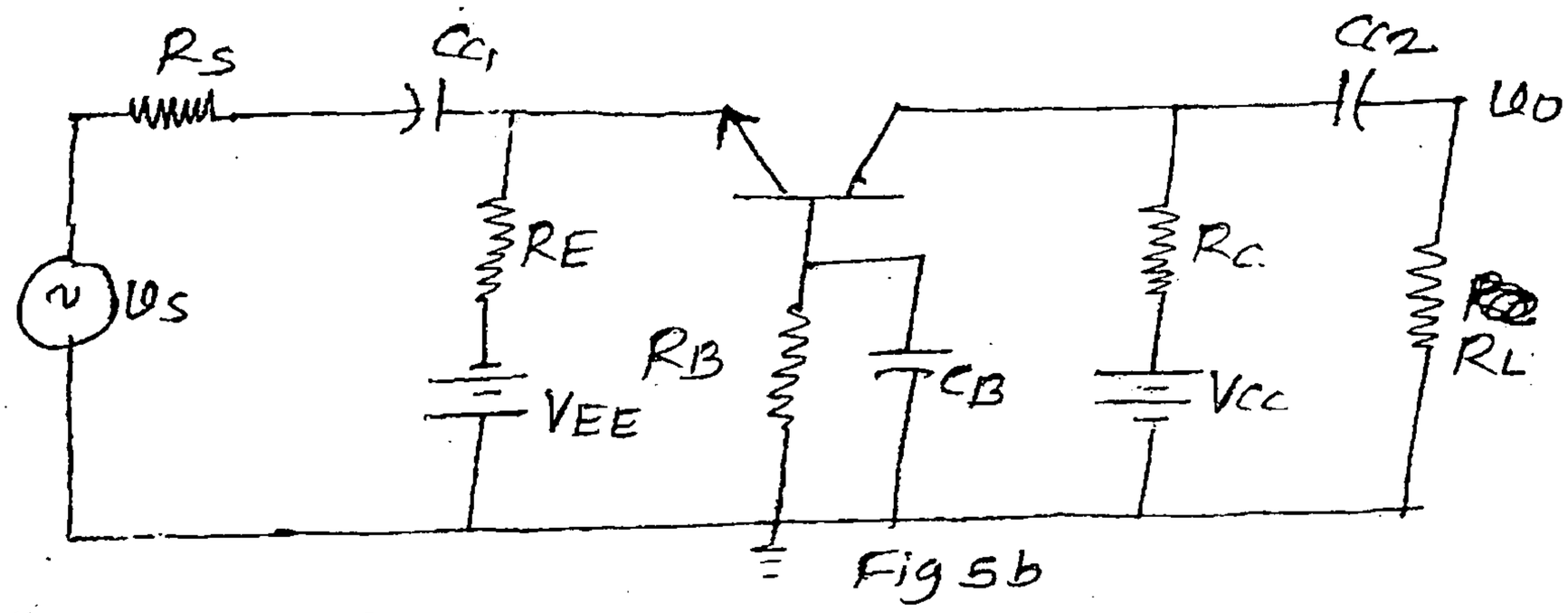

Fig 5b

6. Write short notes on any **three** :— **20**

(a) Series and shunt clippers

(b) Twin-T oscillator

(c) MOSFET operation

(d) Construction and operation of varactor diode.
