SE | EXTC | III (CBGS)
EIM. 3/6/2014

QP Code : **NP-18729**

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

N. B. : (1) Question No. 1 is **compulsory**.
(2) Solve **any three** out of the remaining.
(3) Assume suitable data if necessary.

1. (a) Define transducer and explain the classification of transducer. 5
(b) Explain with diagram principle of operation of frequency selective wave analyzer. 5
(c) Write the applications of Q meter. 5
(d) Describe various types of sweeps used in CRO. 5

2. (a) Explain the principal of operation of dual slope DVM. 10
(b) Explain with neat diagram working principle of LVDT. Give its applications. 10

3. (a) Explain various types of errors in measurement in detail. 10
(b) Explain with example working of successive approximation type ADC. 10

4. (a) Explain in detail "Resistance strain gauges." 10
(b) Compare the temperature transducers RTD, thermistors & thermocouples on the basis of principle, characteristics, ranges & applications. 10

5. (a) Explain performance characteristics of D/A converters. 10
(b) Explain the significance of 3½ and 4½ digit displays. 10

6. (a) Draw & Explain block diagram of digital storage oscillospcoe & mention the modes of operation of DSO. 10
(b) Explain electrodynamometer type of wattmeter. 10

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SE | EXTC | III CBGS 28|5|14

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QP Code : **NP-18690**

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

N.B. (1) Question No. 1 is **compulsory.**
(2) Out of **remaining** questions, attempt any **three** questions.
(3) Assume **suitable** additional data if **required.**
(4) **Figures** in brackets on the **right** hand side indicate **full** marks.

1. Explain the following :– **20**
   (a) For ECL and CMOS logic families define–
   (i) noise margin (ii) fan-in (iii) fan-out.
   (b) Compare Asynchronous and synchronous counter
   (c) Explain static RAM
   (d) Explain Master-Salve J.K Flip-flop.

2. (a) Perform following operation using 2's compliment method– **5**
   (i) $(28)_{10} - (42)_{10}$ (ii) $(52)_{10} - (-18)_{10}$
   (b) Prove the following using Boolean algebra. **5**
   $\overline{A}BC + A\overline{B}C + ABC + AB\overline{C} = AB + BC + CA$
   (c) Design 2 bit comparator. **10**

3. (a) Minimum the following using Quine Mc Clusky method. **10**
   $F(A, B, C, D) = \Sigma m(3, 4, 9, 13, 14, 15) + \Sigma d(5,6)$
   (b) Design synchronous counter using J. K flip-flop for the given sequence — **10**
   0 – 2 – 3 – 5 –7 – 0.

4. (a) Design following Boolean equation using 4 : 1 mux **5**
   $F((A, B, C, D) = \Sigma m(2, 4, 5, 7, 9, 11, 12)$
   (b) Compare EPROM and FLASH memories. **5**
   (c) Explain bidirectional 4 bit universal shift register. **10**

5. (a) Explain 3 : 8 decoder. **5**
   (b) Explain Mealey machine and Moore machine. **5**
   (c) Write VHDL code for 3 bit binary down counter. **10**

6. (a) Explain Architecture and features of FPGA. **10**
   (b) Implement Ex-OR gate using NAND **5**
   (c) Convert (118_{10}) in to (i) BCD (ii) Hexadecimal (iii) octal. **5**

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SE | EXTC | III CBGS
A. M. III

QP Code : **NP-18646**

(3 Hours) [Total Marks : 80

N. B. : (1) Question No. **1** (one) is **compulsory**.
(2) Attempt any **3** (three) questions from the remaining questions.
(3) Assume suitable data, if necessary.

1. (a) Evaluate $\int_0^\infty \frac{(\cos 6t - \cos 4t)}{t} dt$ **5**
(b) Obtain complex form of fourier series for $f(x) = e^{ax}$ in $(-1,1)$ **5**
(c) Find the work done in moving a particle in a force field given by $\overline{F} = 3xy\hat{i} - 5z\hat{j} + 10x\hat{k}$ along the curve $x = t^2 + 1$, $y = 2t^2$, $z = t^3$ from $t = 1$ to $t = 2$. **5**
(d) Find the orthogonal trajectory of the curves $3x^2y + 2x^2 - y^3 - 2y^2 = \alpha$, where α is a constant. **5**

2. (a) Evaluate $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$, $y(o) = 0$, $y'(o) = 0$, by Laplace transform **6**
(b) Show that $J_{5/2} = \sqrt{\frac{2}{\pi x}}\left[\frac{3 - x^2}{x^2}\sin x - \frac{3}{x}\cos x\right]$ **6**
(c) (i) Find the constants a, b, c so that $\overline{F} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + (y + 2z)\hat{k}$ is irrotational. **4**
(ii) Prove that the angle between two surfaces $x^2 + y^2 + z^2 = 9$ and $x^2 + y^2 - z = 3$ at the point $(2,-1,2)$ is $\cos^{-1}\left(\frac{8}{3\sqrt{21}}\right)$ **4**

3. (a) Obtain the fourier series of f(x) given by **6**
$$f(x) = \begin{cases} 0 & , -\pi \le x \le 0 \\ x^2 & 0 \le x \le \pi \end{cases}$$
(b) Find the analylic function $f(z) = u + iv$ where $u = r^2 \cos 2\theta - r \cos\theta + 2$ **6**
(c) Find Laplace transform of **8**
(i) $te^{-3t} \cos 2t.\cos 3t$
(ii) $\frac{d}{dt}\left[\frac{\sin 3t}{t}\right]$

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4. (a) Evaluate $\int J_3(x)dx$ and Express the result in terms of J_0 and J_1 6
   (b) Find half range sine series for 6
   $f(x) = \pi x - x^2$ in $(0, \pi)$
   Hence deduce that $\frac{\pi^3}{32} = \frac{1}{12} - \frac{1}{3^2} + \frac{1}{5^2} - \frac{1}{7^2} + ...$
   (c) Find inverse Laplace transform of 8
   (i) $\frac{1}{s}\tanh^{-1}(s)$ (ii) $\frac{se^{-2s}}{(s^2+2s+2)}$

5. (a) Under the transformation $w + 2i = z + \frac{1}{z}$, show that the map of the circle $|z| =$ 2 is an ellipse in w-plane. 6
   (b) Find half range cosine series of $f(x) = \sin x$ in $0 \le x \le \pi$. 6
   Hence deduce that
   $\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + ... = \frac{1}{2}$
   (c) Verify Green's theorem, for 8
   $\oint_c (3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$ where c is boundary of the region defined by x=0, y=0, and x+y = 1.

6. (a) Using convolution theorem; evaluate 6
   $$L^{-1}\left\{\frac{1}{(s-1)(s^2+4)}\right\}$$
   (b) Find the bilinear transformation which maps the points 6
   $z = 1, i, -1$ onto $w = 0, 1, \infty$
   (c) By using the appropriate theorem, Evaluate the following :– 8
   (i) $\int \overline{F} \cdot d\overline{r}$ where $\overline{F} = (2x - y)\hat{i} - (yz^2)\hat{j} - (y^2z)\hat{k}$
   and c is the boundary of the upper half of the sphere $x^2 + y^2 + z^2 = 4$
   (ii) $\iint_s (9x\hat{i} + 6y\hat{j} - 10z\hat{k}) \cdot d\overline{s}$ where s is
   the surface of sphere with radius 2 units.

S.E. ExTC sem III CBGS M-2014

Sub - CTL

QP Code : **NP-18764**

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

N.B. : 1. Attempt Q1 and any 3 from the remaining questions. In all 4 questions are to be attempted.
2. All sub-questions of the same question should be answered at one place only in their serial orders, and not scattered.
3. Assume suitable data with justification if missing.

1. (a) Determine the z-parameters of the network shown in Fig. 1(a) using y-z parameter relations only. 5

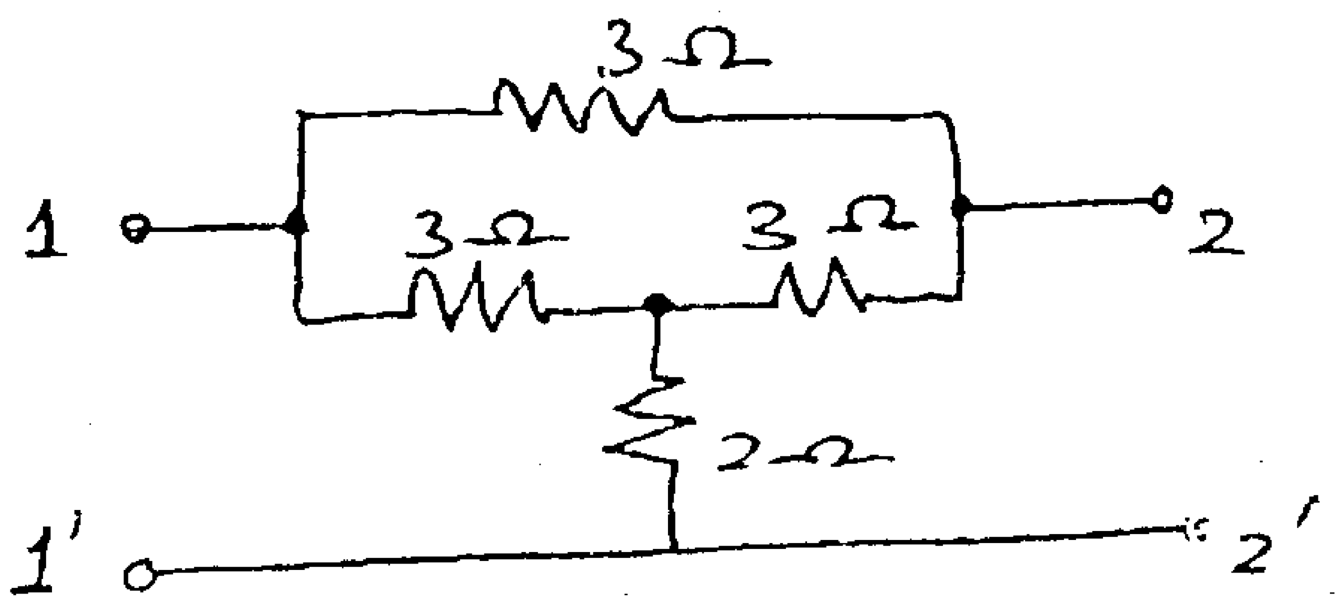

Fig. 1(a)

(b) Test if $F(s) = 2s^6 + 4s^5 + 6s^4 + 8s^3 + 6s^2 + 4s + 2$ is a Hurwitz polynomial. 5

(c) Both the coils connected in series have self inductance of 40 mH. The total inductance of the circuit is found to be 40 mH. Determine the (i) mutual inductance between the coils and (ii) the coefficient of coupling. 5

(d) Find Foster I and II, and Cauer I and II circuits for the driving point admittance $Y(s) = s + 1$. 5

2. (a) Find the Thevenin equivalent across the terminals XY for the circuit shown in Fig. 2(a) using mesh matrix method. What should be the value of μ so that the circuit becomes reciprocal? 10

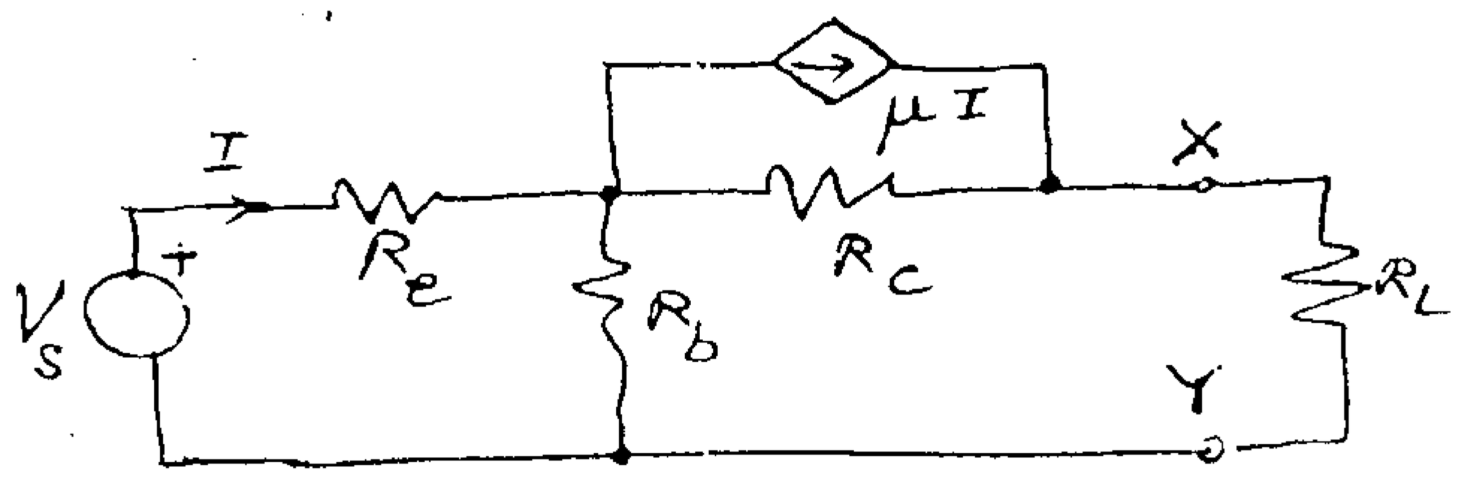

Fig. 2(a)

(b) Find the magnitude of the controlled source in the circuit shown in Fig. 2(b) by node analysis. **5**

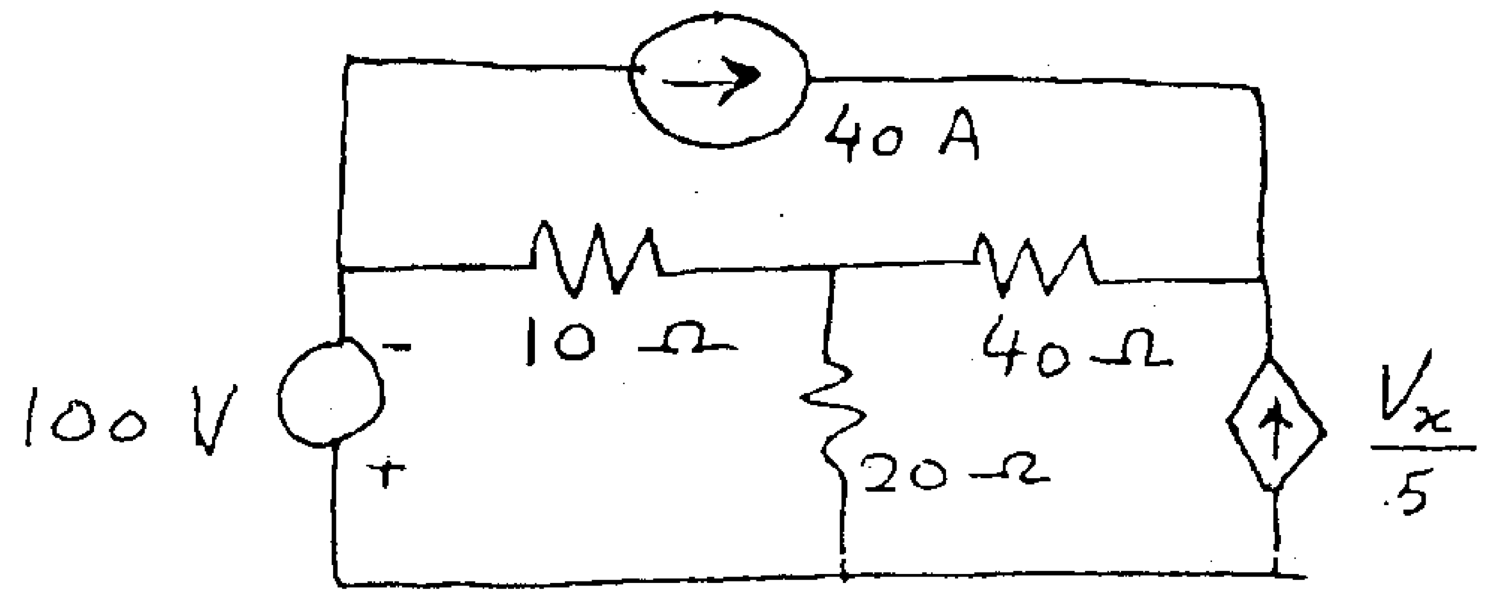

Fig. 2(b)

(c) Check if the following polynomials are Hurwitz polynomials. **5**

(i) $s + 8$ (ii) $(s + 8)^7$

3. (a) Synthesize the driving point function $F(s) = \frac{(s^2+4)(s^2+16)}{s(s^2+9)}$ when $F(s)$ is driving point (i) impedance (ii) admittance. Test if the circuits obtained are canonic. **10**

(b) Find the voltage transfer function of a loaded two port network N in terms of the y-parameters $(y_{11}, y_{12}, y_{21}, y_{22})$ of the network N and load admittance Y_L. **5**

(c) The parameters of a transmission line are: $G = 2.25$ mΩ/km, $R = 65$ Ω/km, $L = 1.6$ mH/km, $C = 0.1$ μF/km. Find characteristic impedance and the propagation constant of the line at a frequency of 1 GHz. **5**

4. (a) Determine the z-parameters of the network shown in Fig. 3(a). **10**

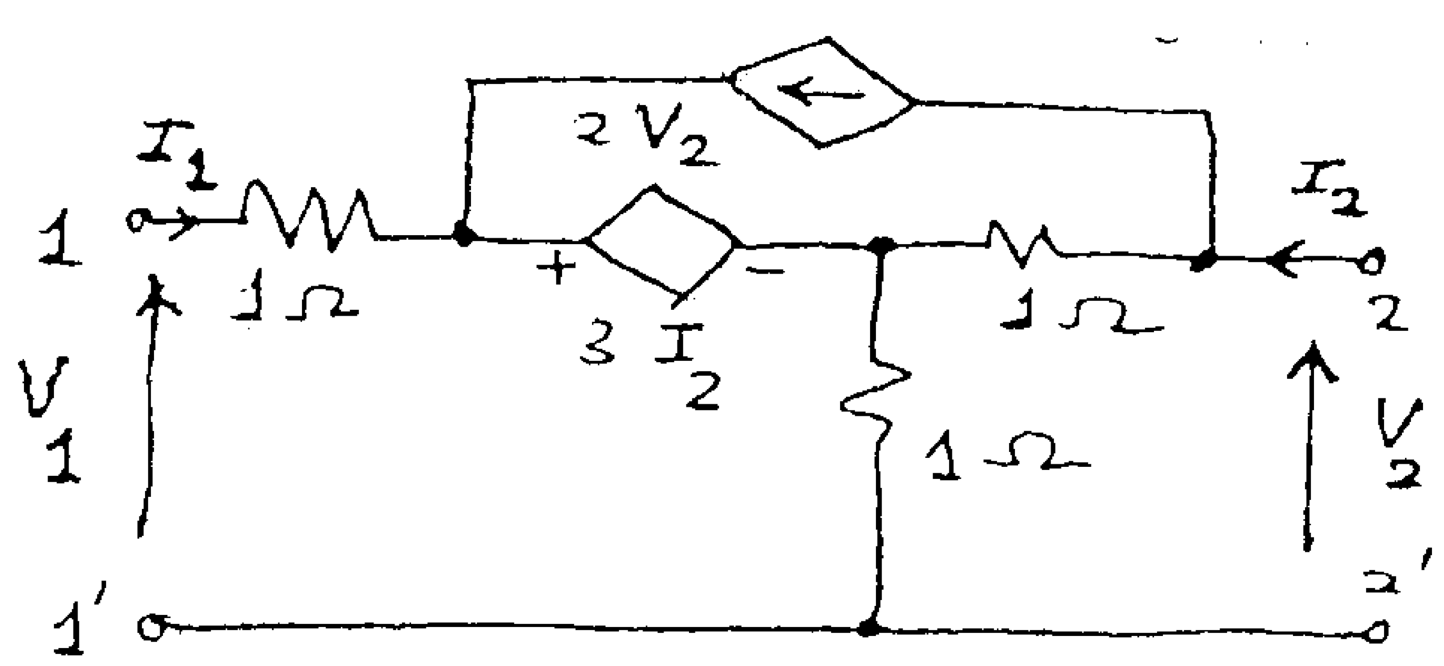

Fig. 3(a)

(b) Determine the voltage transfer function for the circuit shown in Fig. 4(b) under the condition $\omega^2 L_1 C_1 = \omega^2 L_2 C_2 = 1$. **5**

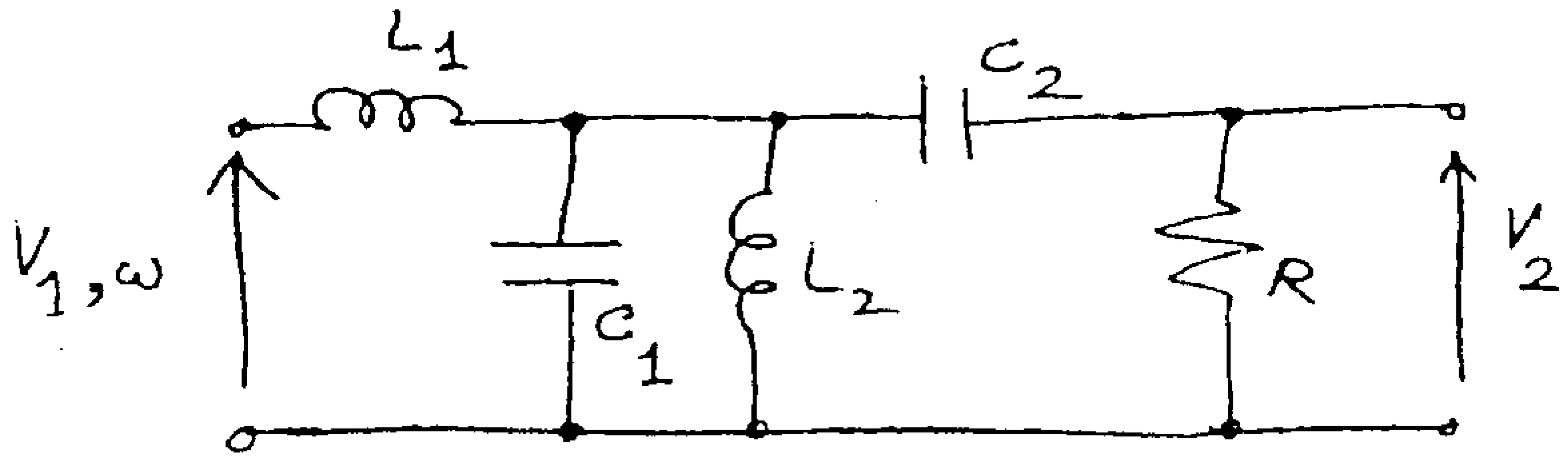

Fig. 4(b)

(c) Test if $F(s) = \dfrac{s^3 + 6s^2 + 7s + 7}{s^2 + 2s + 1}$ is a Positive Real Function. **5**

5. (a) The network shown in Fig. 5(a) attains steady-state with the switch K open. At $t = 0$ the switch is closed. Determine the current through the switch at $t = 0^+$. **10**

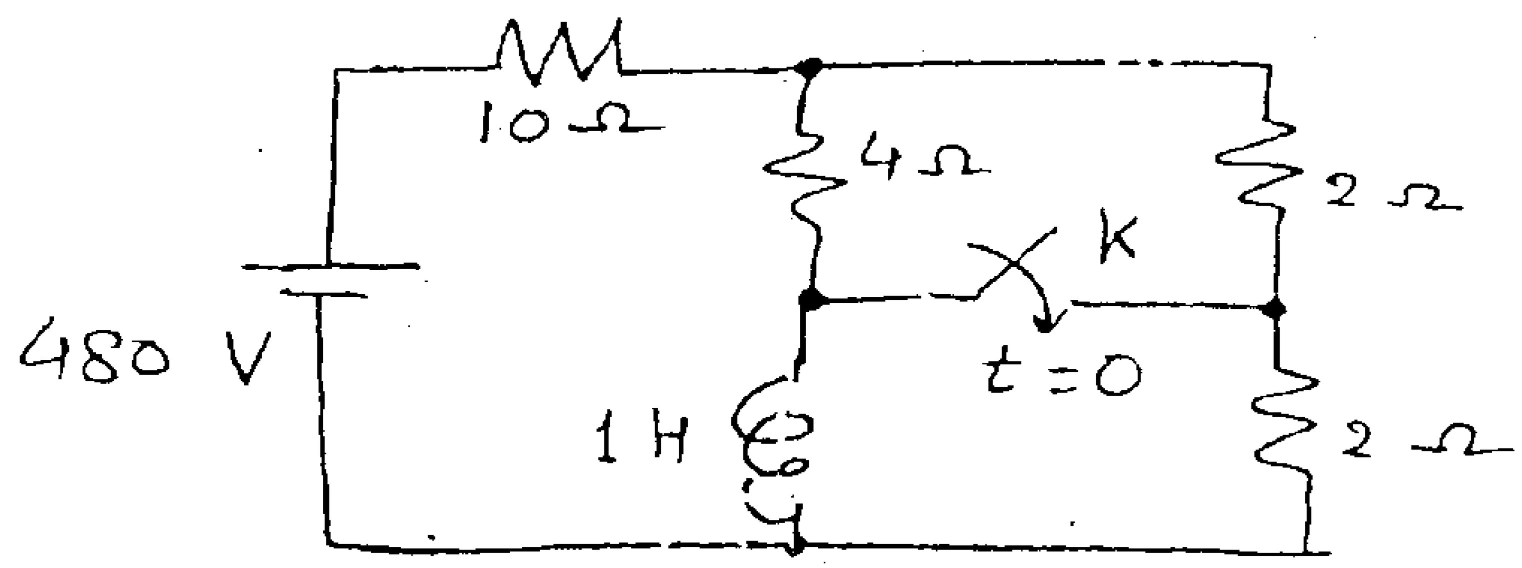

Fig. 5(a)

(b) In the circuit shown in Fig. 5(b) the two coupled coils have negligible resistances. Find the current I_2 when the input $v_i(t) = 100\sqrt{2}\sin 5000t$ V. **5**

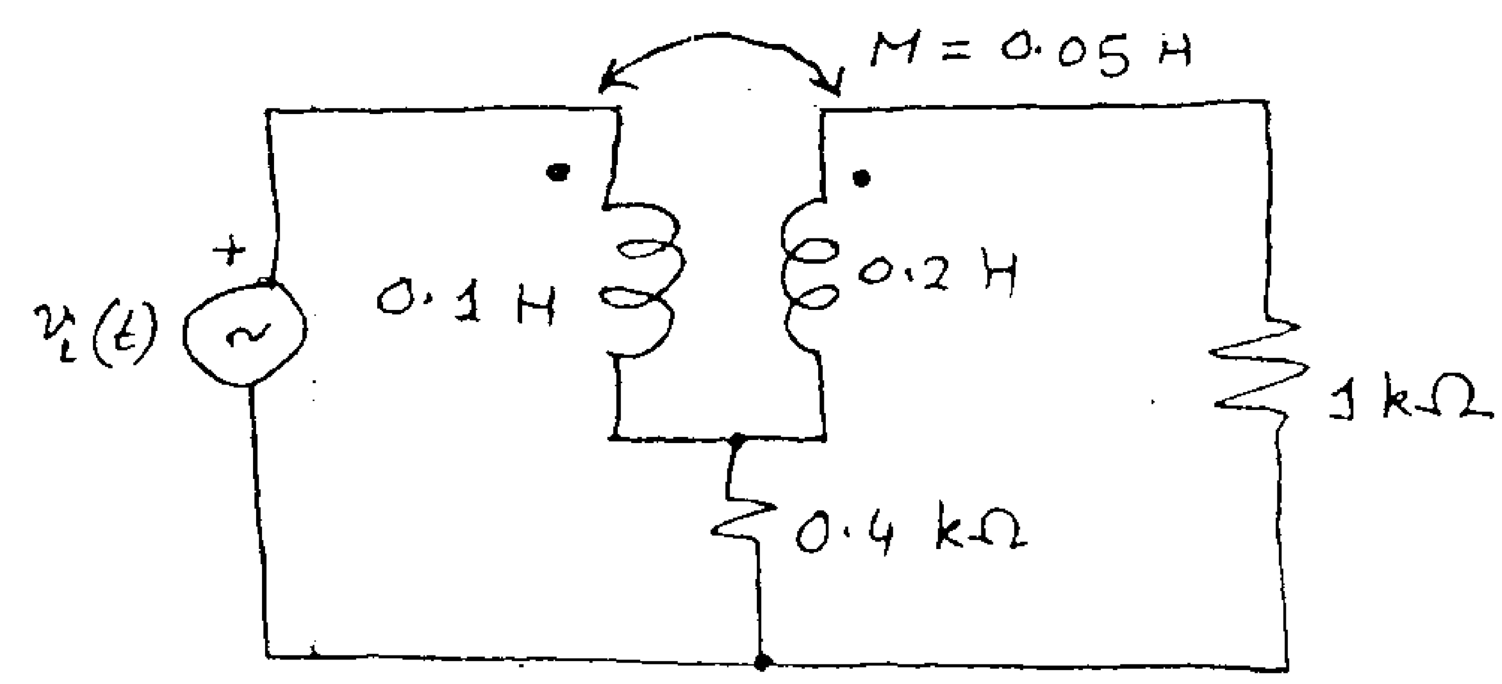

Fig. 5(b)

(c) A generator of 1 V, 1 kHz supplies power to a 1000 km open wire terminated in Z_0 having the following parameters. **5**

$R = 10.4\ \Omega/\text{km}$
$L = 3.07\ \text{mH/km}$
$G = 0.8\ \mu\Omega/\text{km}$
$C = 0.00835\ \mu\text{F/km}$

Calculate the power delivered at the receiving end.

6. (a) Find and expression for current $i(t)$ through R in the circuit shown in Fig. 6 (a) using Laplace transform. Assume that the circuit is overdamped. Why is the frequency domain method preferred to the classical time domain method? **10**

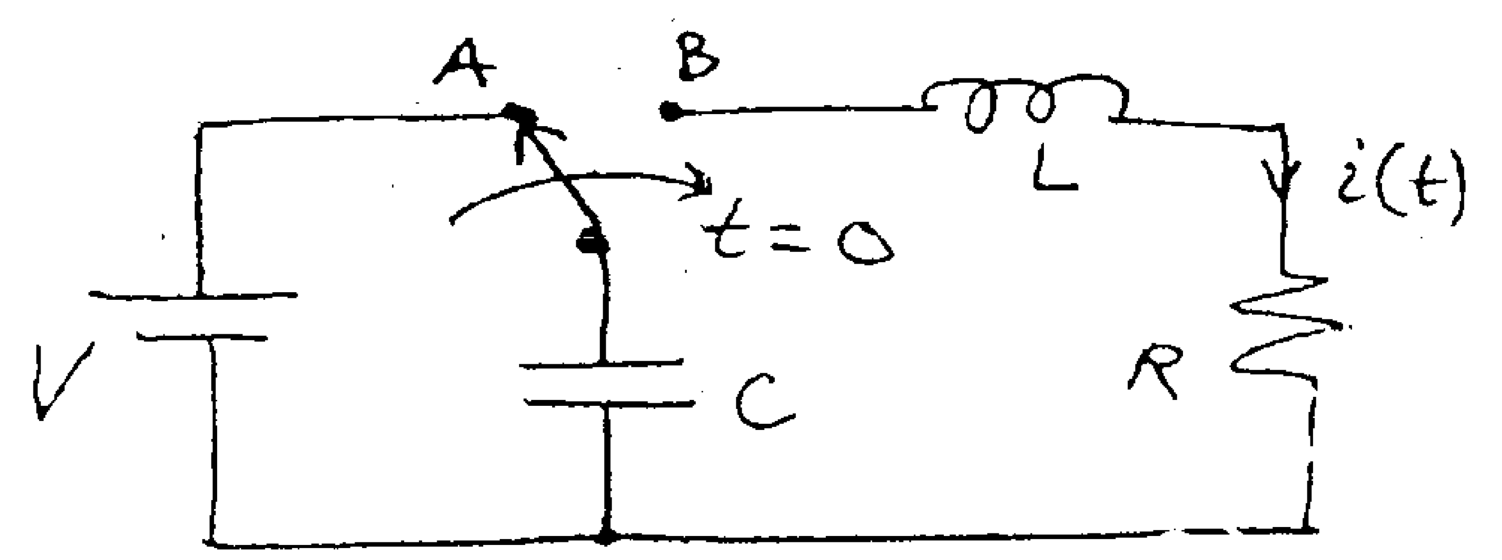

Fig. 6(a)

(b) Find the voltage transfer function for the circuit shown in Fig. 6(b). Assume $L = CR^2$. **5**

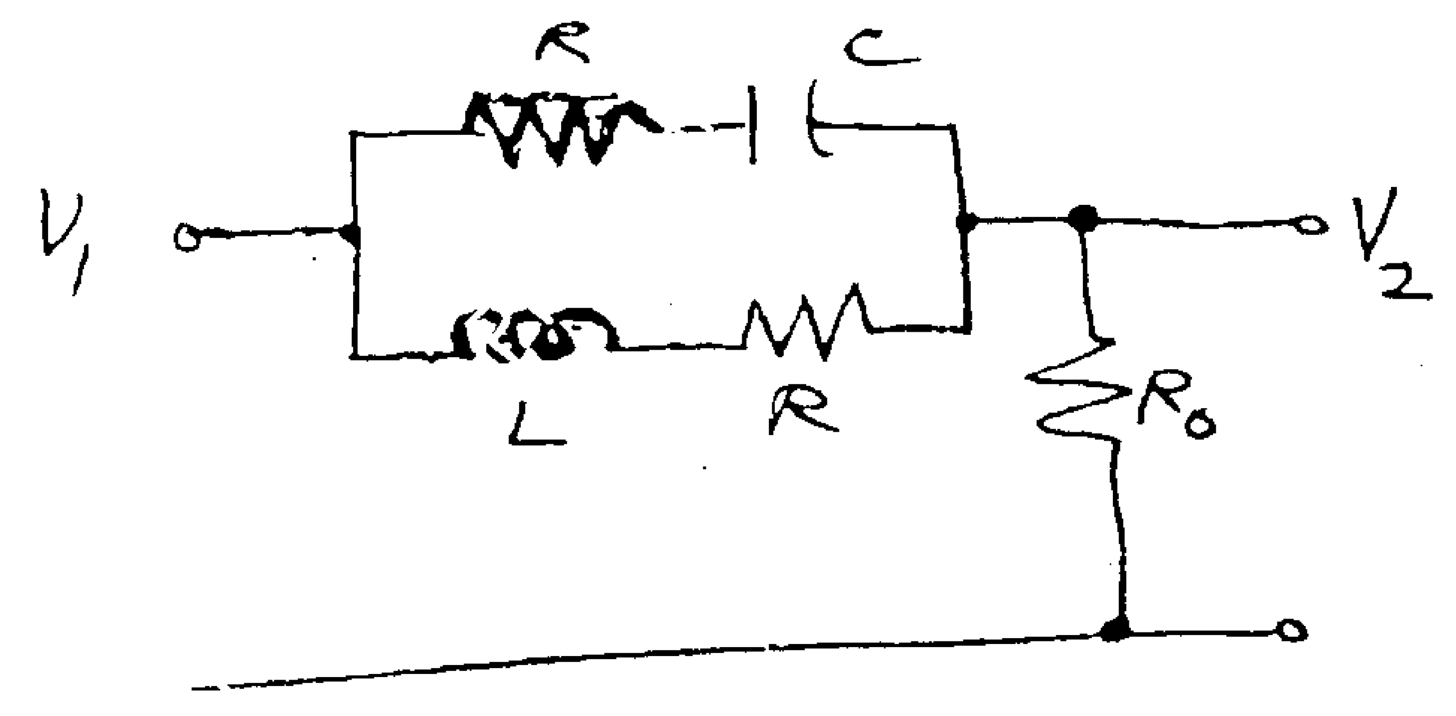

Fig. 6(b)

(c) Draw the following normalized quantities on the Smith chart. **5**

(i) (2 + j2) Ω,
(ii) (4 - j2) Ω,
(iii) (1.0) Ω,
(iv) (j1.0) Ω

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

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 $Ic = 2mA$

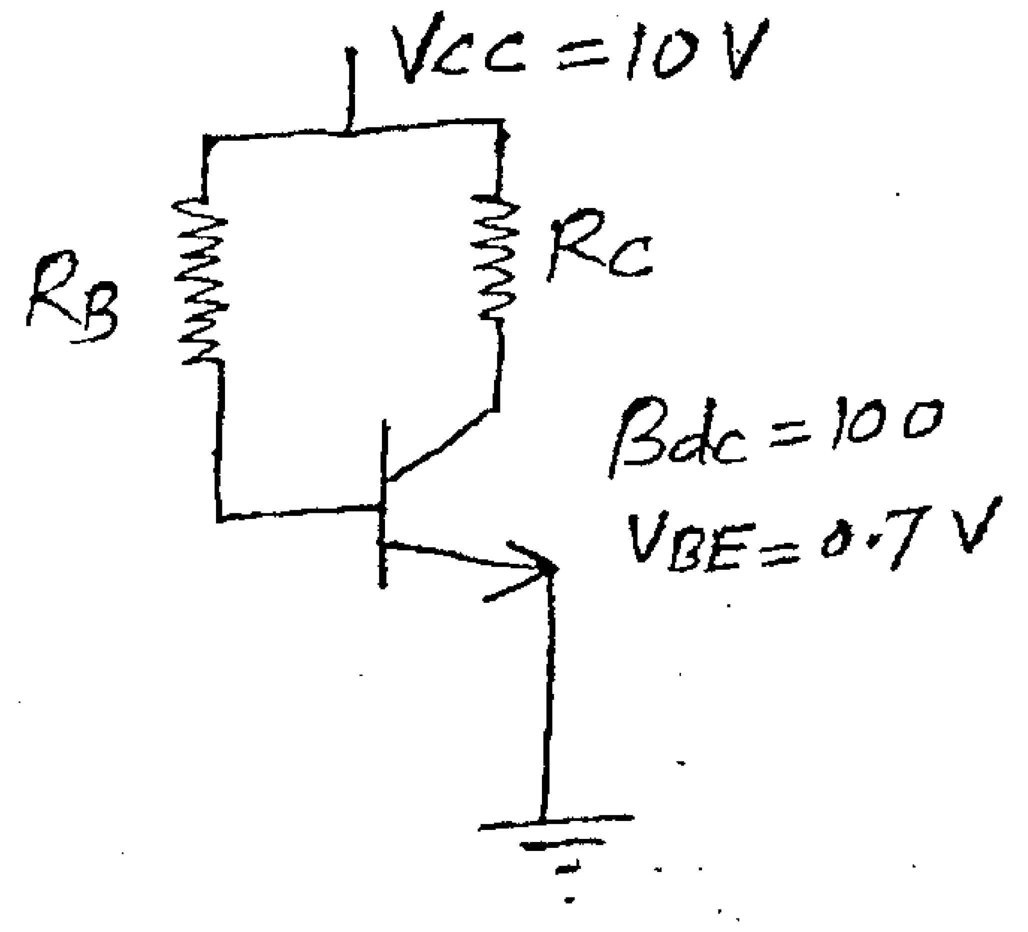

Fig. 1c

   (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**

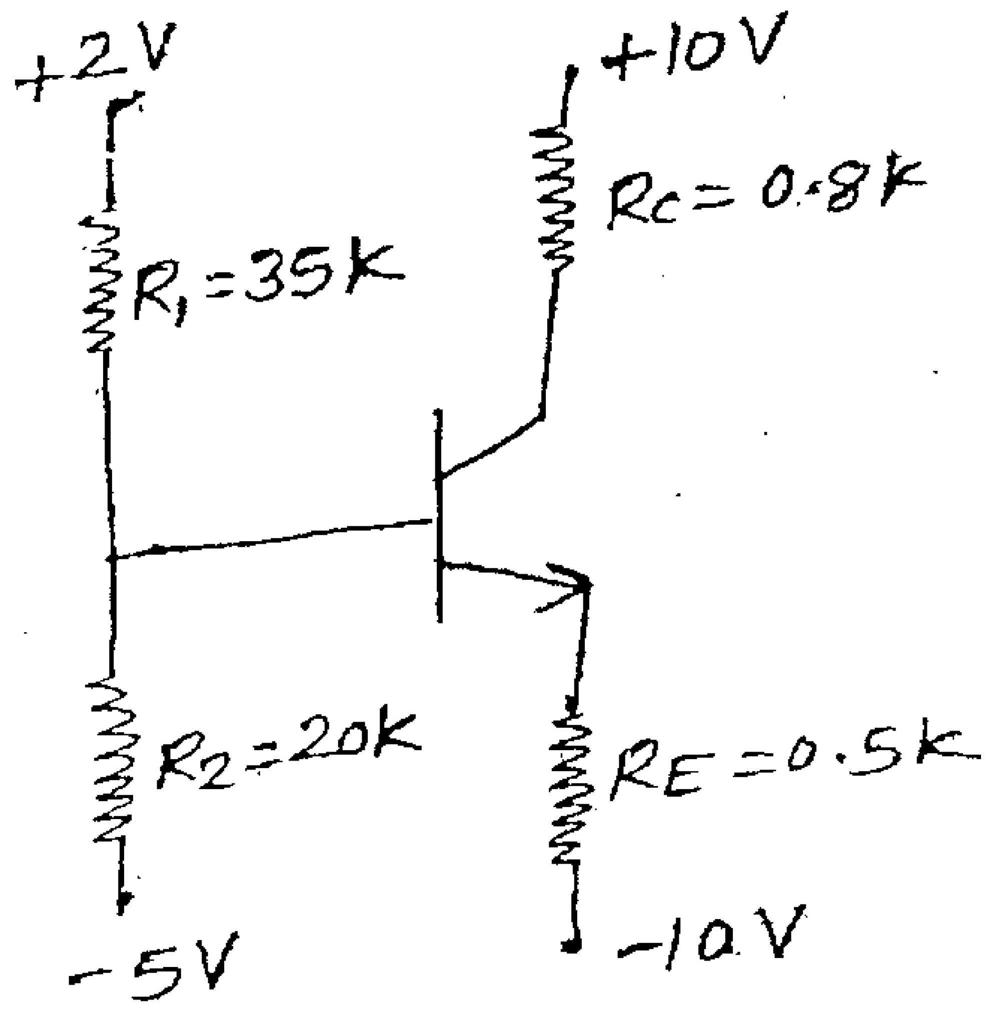

Fig 2a

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Con. 9839-14.

(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**

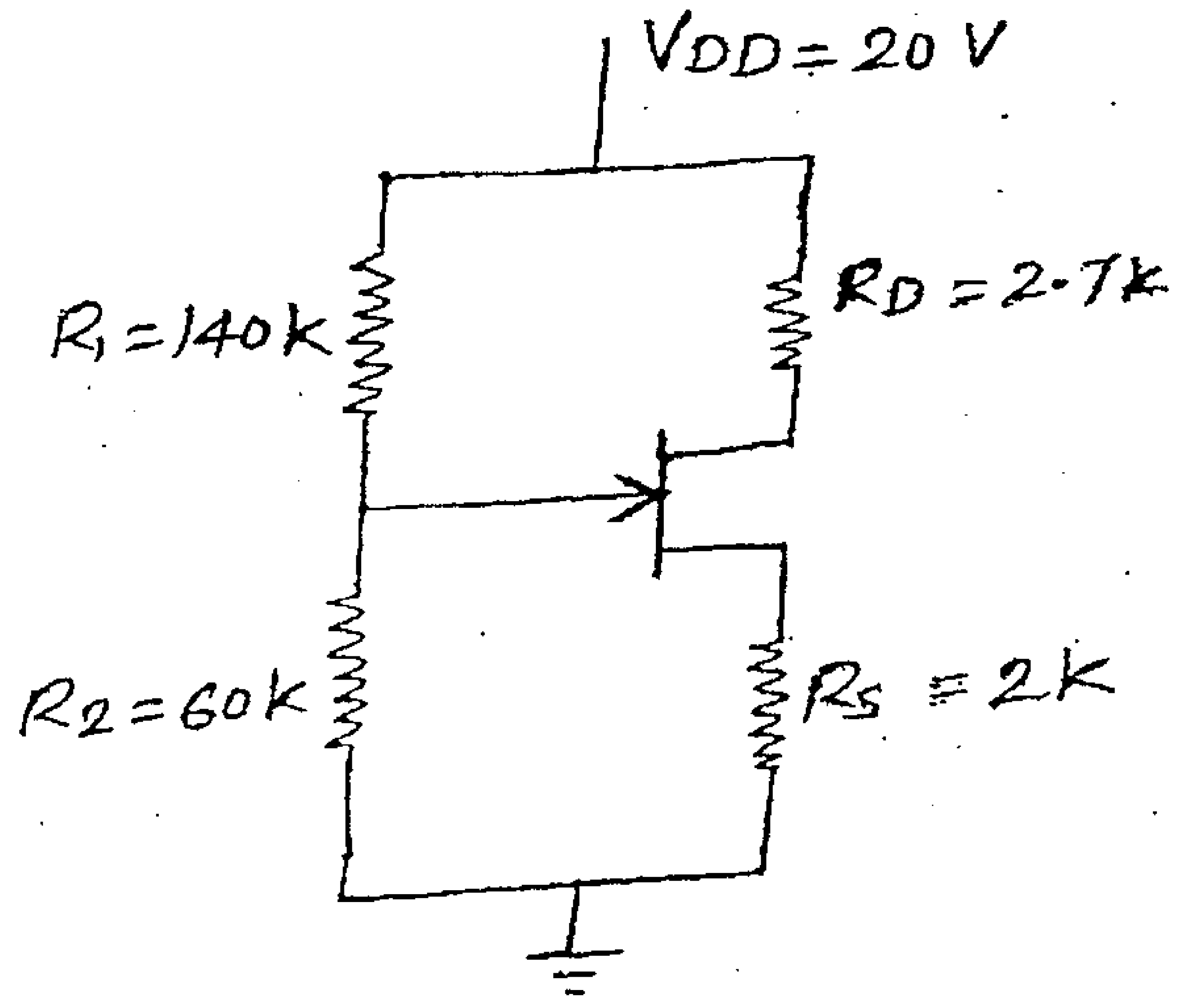

Fig 3b

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 λ = 0. **10**

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

(ii) Calculate gm and ro

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

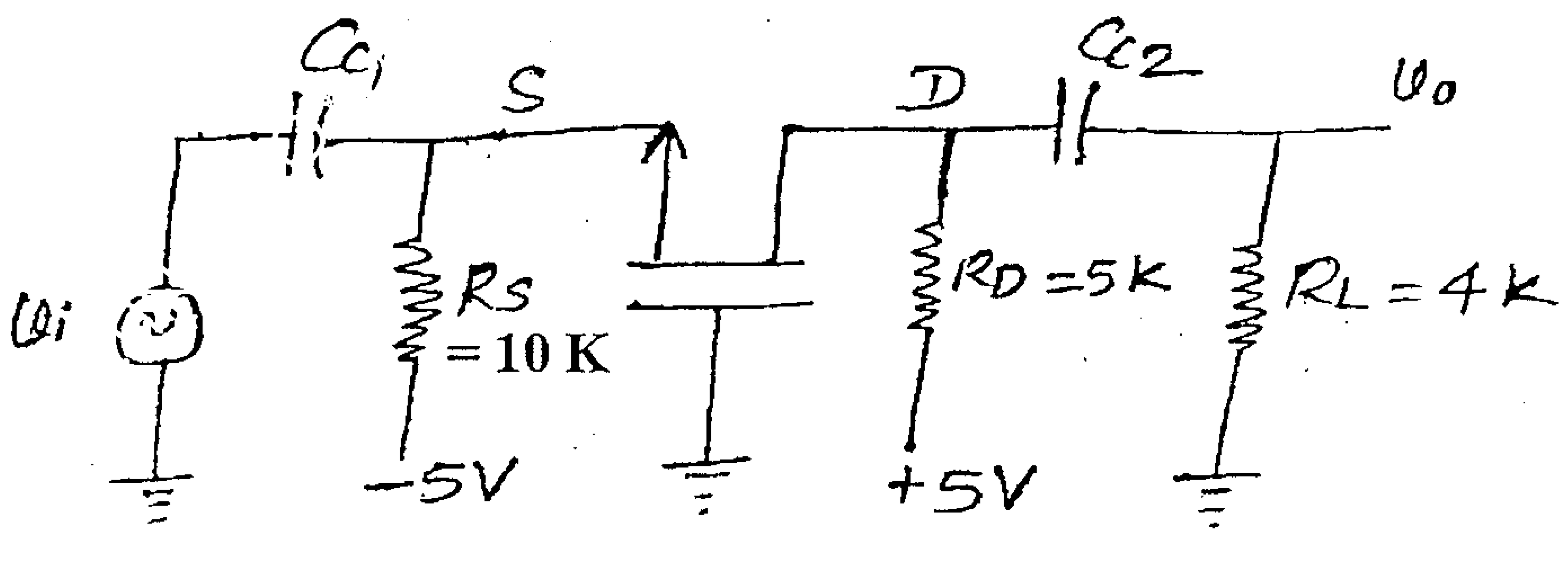

Fig 4a.

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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

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

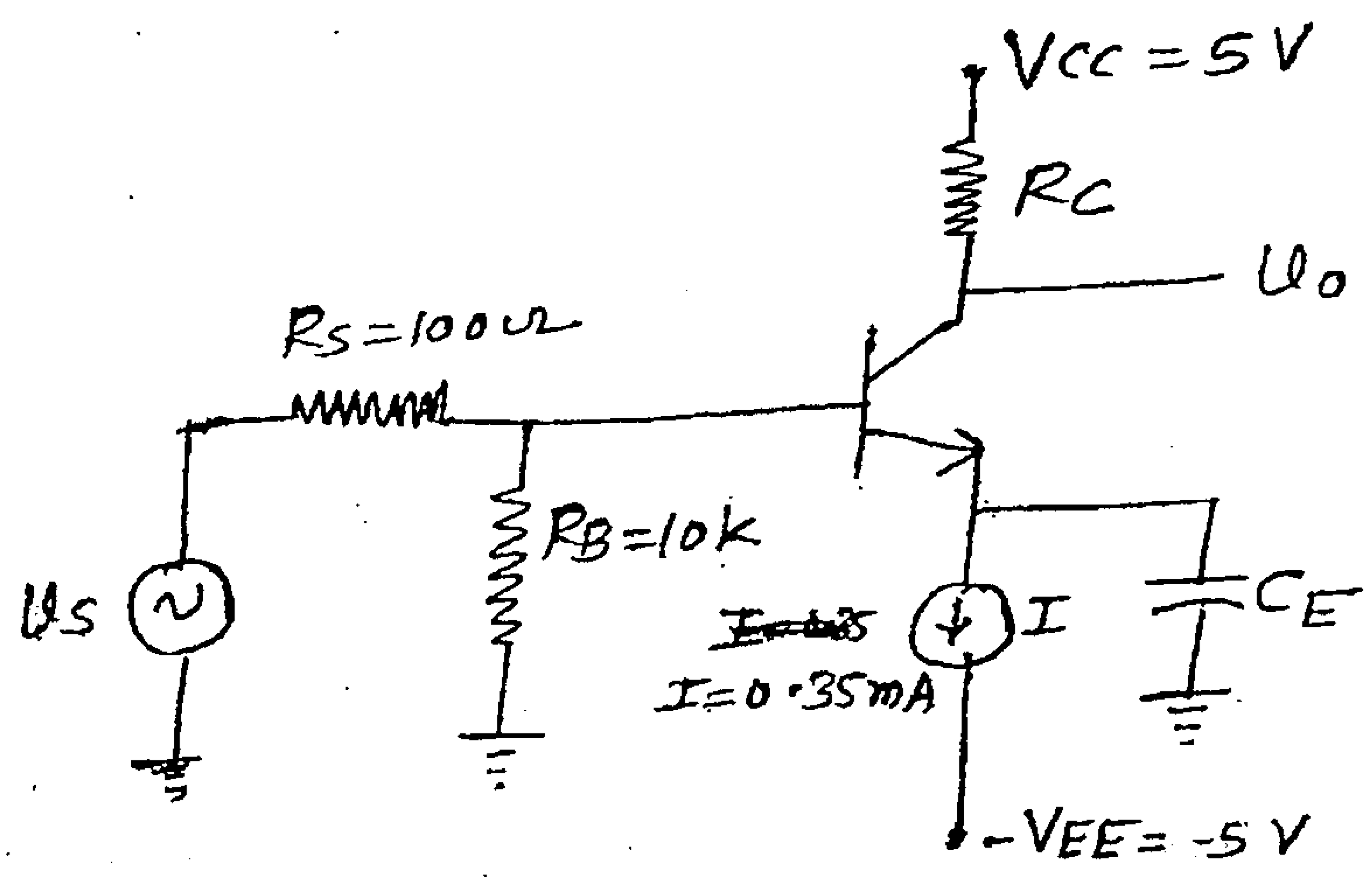

Fig 4b.

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**

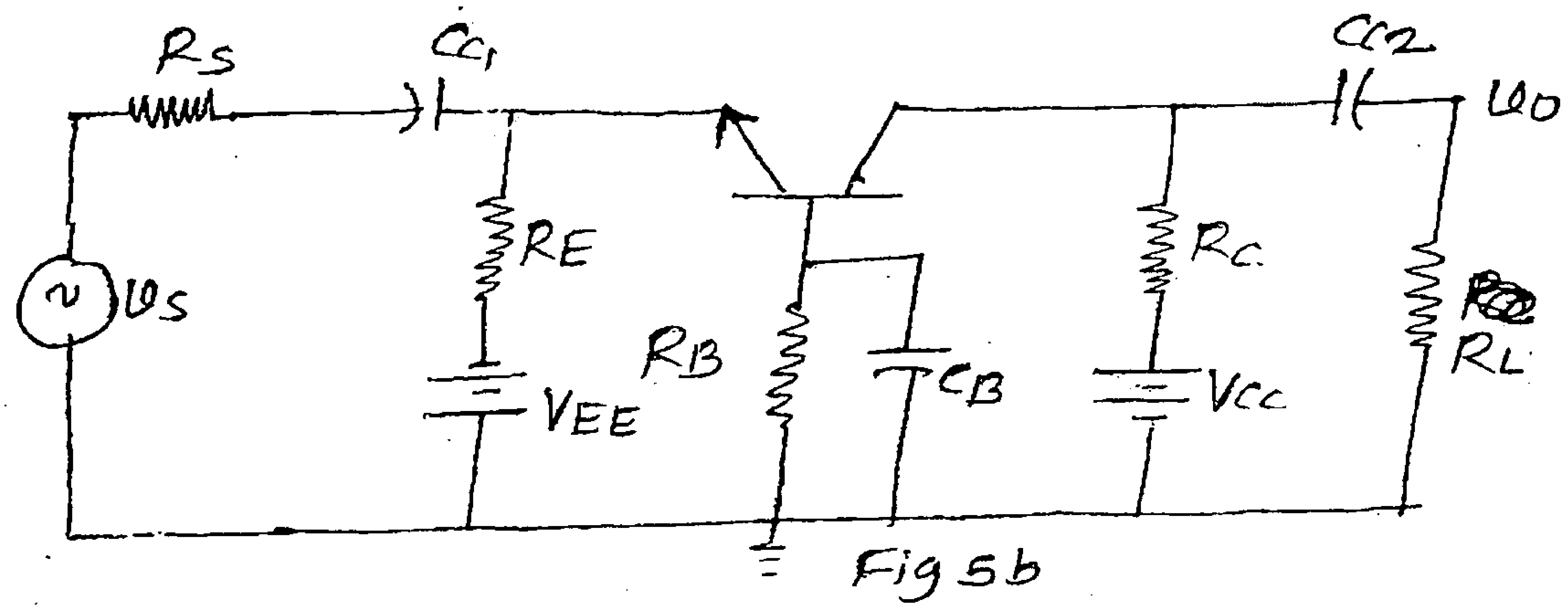

Fig 5b

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.

Con. 9839-14.