SE| ETRx|III (Rev.) 30|5|13
control System

28 : 1st half.13-AM(y)

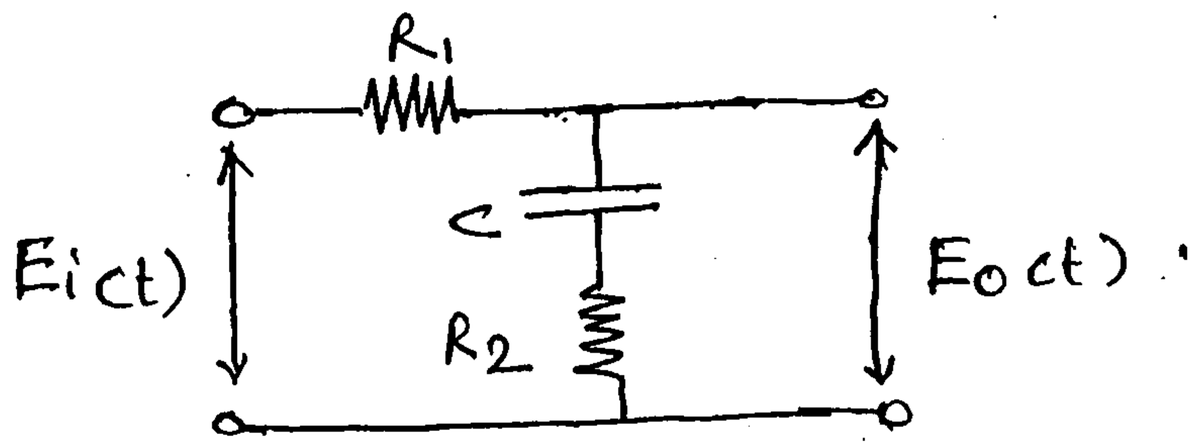
Con. 6566-13. **GS-6516**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six**.
(3) Assume suitable **data** wherever required and **justify** it.
(4) **Figures** to the **right** indicate **full** marks.

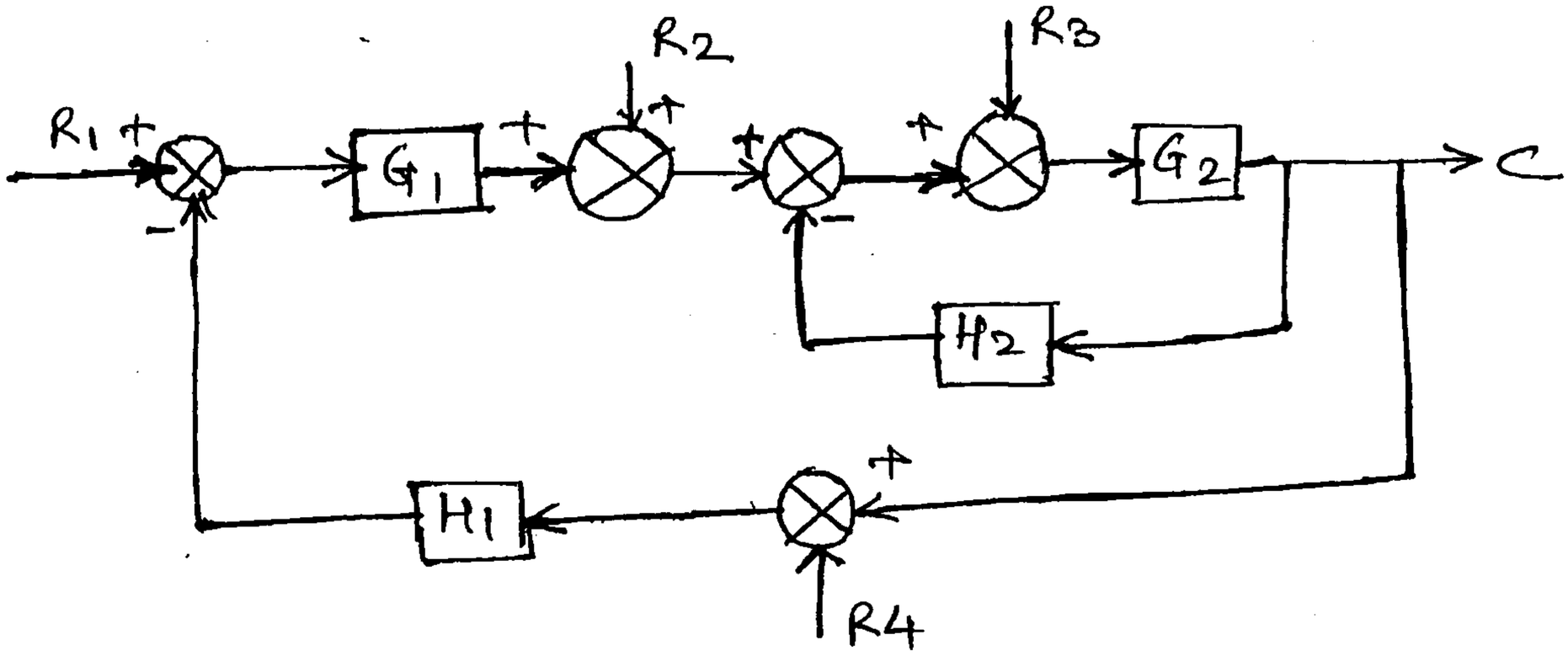
1. Solve the following :— **20**

(a) Obtain the transfer function of the lag network shown in **figure** below :



(b) Explain how to find gain margin and phase margin from polar plot.
(c) Compare the time response analysis with frequency response analysis.
(d) Explain various rules for block diagram reduction method to find out the transfer function.

2. (a) Find the total transfer function $\frac{C}{R}$ using block reduction technique for the **figure** below : **10**



[TURN OVER

(b) For a unity feedback control system the forward path transfer function is given by **10**

$$G(s) = \frac{20}{s(s+2)\left(s^2+2s+20\right)}$$

Determine the steady state error of the system, when the inputs are :—

(i) 5

(ii) 5t

(iii) $\frac{3t^2}{2}$

3. (a) The characteristic equations for certain feedback control system are given below. Determine the range of values of k for the system to be stable. **10**

(i) $s^4 + 20ks^3 + 5s^2 + 10s + 15 = 0$

(ii) $s^3 + 2ks^2 + (k + 2)\, s + 4 = 0$

(b) Sketch the complete root locus for the system having the openloop transfer function. **10**

$$G(s)H(s) = \frac{k}{s(s+3)\left(s^2+3s+4\cdot5\right)}$$

4. (a) A unity feedback system hos open-loop transfer function **10**

$$G(s) = \frac{192s(s+1)}{s^2+(s+4)(s+12)}$$

Draw the Bode plot and determine the gain margin and phase margin and state whether the system is stable or not ?

(b) Sketch the polar plot and discuss the stability of the system represented by **10**

$$G(s)H(s) = \frac{k}{s(s+1)(s+5)}$$

5. (a) Derive the value of kp, kv and ka for type 0, type 1, type 2, system. **5**

(b) Show the location of poles of a second order control system for various values of damping ratio. **5**

(c) A unity feedback system has openloop transfer function **10**

$$G(s) = \frac{3(2-s)}{(s+1)(s+5)}$$

Using Nyquist stability criterion, check whether the closed loop system is stable. If system is stable, find the gain margin and phase margin.

6. (a) Draw the circuit diagram of basic lag and lead networks and derive their respective transfer functions. **10**

   (b) Explain different composite contineous controllers. **10**

7. Write short notes on the following :— **20**

   (a) Masons gain formula and its applications

   (b) Stepper motor

   (c) Effect of adding zero to a second order control system

   (d) Synchro transmitter – receivers.

SE - SEM III (ETRX) (RW) May 2015
20/5/13
D. S. D. - I

133 : 1ST HALF-13 (p)-JP

Con. 6453–13. **GS–6306**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory.**
(2) Attempt any **four,** out of remaining **six** questions.

1. (a) Simplify $y = A + B\overline{C} + A\,B\,\overline{D} + A\,B\,C\,D$ using Boolean theorems and implement it using only NAND gates. **20**
   (b) Differentiate between Combinational and Sequential circuits.
   (c) Explain the term "Metastability", its causes and effects.
   (d) Draw the circuit diagram of 2 I/P CMOS NAND gate.

2. (a) Explain Gray Codes. Design 3-bit binary to gray code convertor using 74151 IC's. **20**
   (b) Obtain Hamming code for "1010" data using odd parity ? Why Hamming codes are called error correcting codes ? Justify.

3. (a) Simplify $F = \sum m\,(1, 2, 4, 7, 11, 13) + d\,(9, 15)$ using K-map. Implement the function using only NOR gates. **20**
   (b) Explain comparator IC 7485. Write its function table and design 12 bit comparator using three 7485 IC'S.

4. (a) Using Quine McCluskey Simplification Method : **20**
   Simplify $F = \sum m\,(1, 3, 8, 9, 13, 15) + \sum d\,(10, 11)$.
   (b) Briefly explain the classification of Logic families. Draw the diagram of 2 I/P TTL NAND gate and explain the advantages of Totem-pole output.

5. (a) Explain 4 bit Johnson counter using circuit diagram, state diagram and timing diagram. **20**
   (b) Draw circuit diagram of JKFF using NAND gates. Derive its characteristic equation and excitation table. What is a Race around condition in JKFF and give any two remidies to overcome it.

6. (a) Design Mod-11 synchrounous counter using TFF. **20**
   (b) A lawn sprinkling system is controlled automatically by certain combination of the following variables –
   season (S = 1 if summer, 0 otherwise)
   Temperature (T = 1 if high; O if low)
   Atmospheric humidity (H = 1, if high; O if low)
   Moisture content of the soil (M = 1, if high; O if low)
   The sprinkler is turned ON under any of the following circumstances :
   (i) The moisture content is low in winter
   (ii) The temperature is high and moisture content is low in summer
   (iii) The temperature is high and humidity is high in summer
   (iv) The temperature is low and moisture content is low in summer
   (v) The temperature is high and humidity is low.

7. Write short notes on :— **20**
   (a) Static and Dynamic Hazards
   (b) Switch Debouncing Logic Circuit
   (c) ECL Circuit for 2 I/P NOR Gate
   (d) Alphanumeric Codes.

SE | E+Rx | III (R)

BEC 1315 | 13

D : PH (April Exam) 198

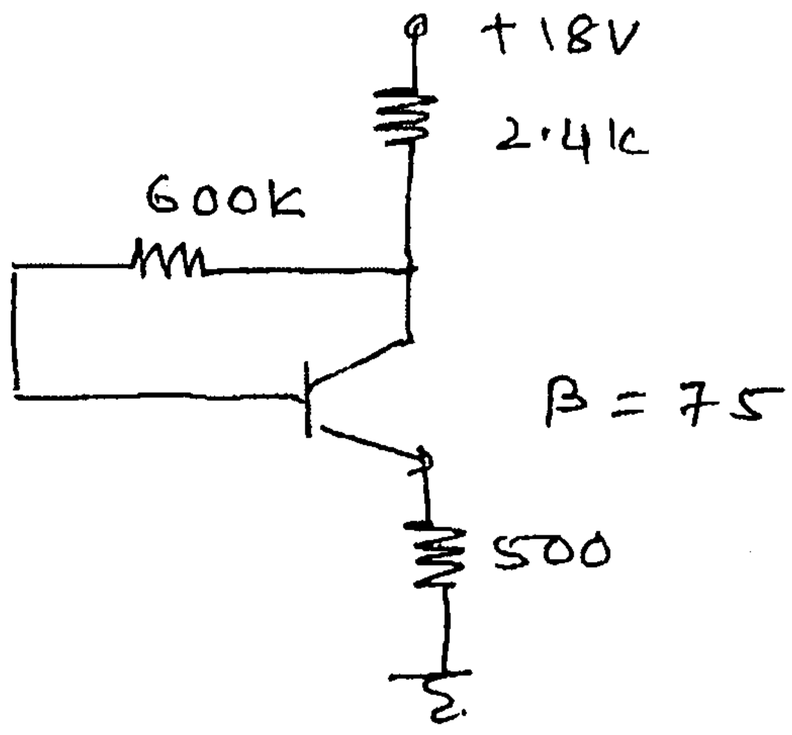
Con. 6398-13. **GS-6183**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **four** out of remaining **six** questions.
(3) Assume any suitable data wherever **required**.

1. (a) Draw and explain positive clamper circuit. **5**

(b) Calculate D.C. collector current IC and voltage V_{CE} for given circuit :– **5**



(c) Explain bias stabilization in BJT. **5**

(d) Derive the condition for zero temperature drift biasing of FET. **5**

2. (a) A Fullwave rectifier employing a bridge rectifier using four diodes rectifies 230 V/50 H_z, mains and supplies 200 V, 0-100 mA to a resistive load employing a filter to give ripple factor of 0·05. Calculate the specifications of the diodes and filter component if the filter used is L & LC filter. **10**

(b) Explain the operation of fullwave rectifier and draw the output waveform for v_{Ldc} and I_{Ldc}. **10**

3. (a) Design a single stage BJT CE amplifier for the following requirements : **15**
$A_v \geq 70$, $Z_i \geq 2{\cdot}7\ k\Omega$, $V_O(rms) = 4{\cdot}5\ V$
$S = +10$.

(b) Determine A_v, Z_i, Z_o for design circuit. **5**

[TURN OVER

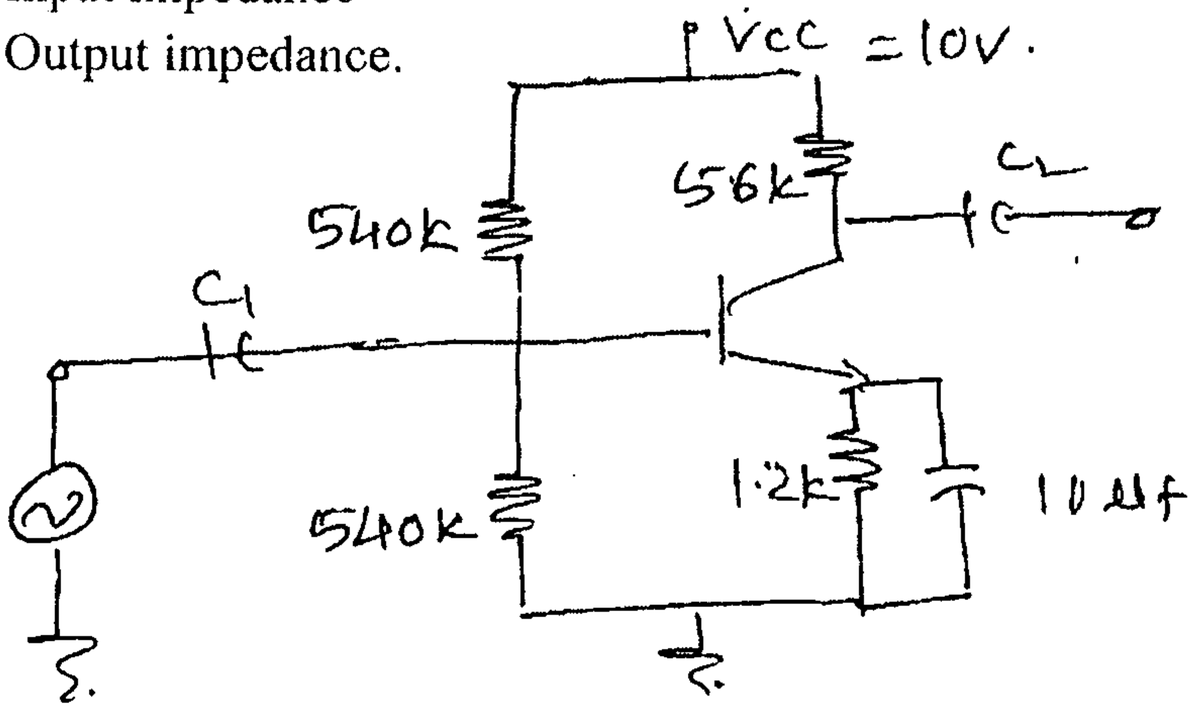
4. (a) For the circuit shown in **figure** determine, when RE bypass and unbypassed : **15**

(i) Voltage gain A_v

(ii) Current gain A_I

(iii) Input impedance

(iv) Output impedance.

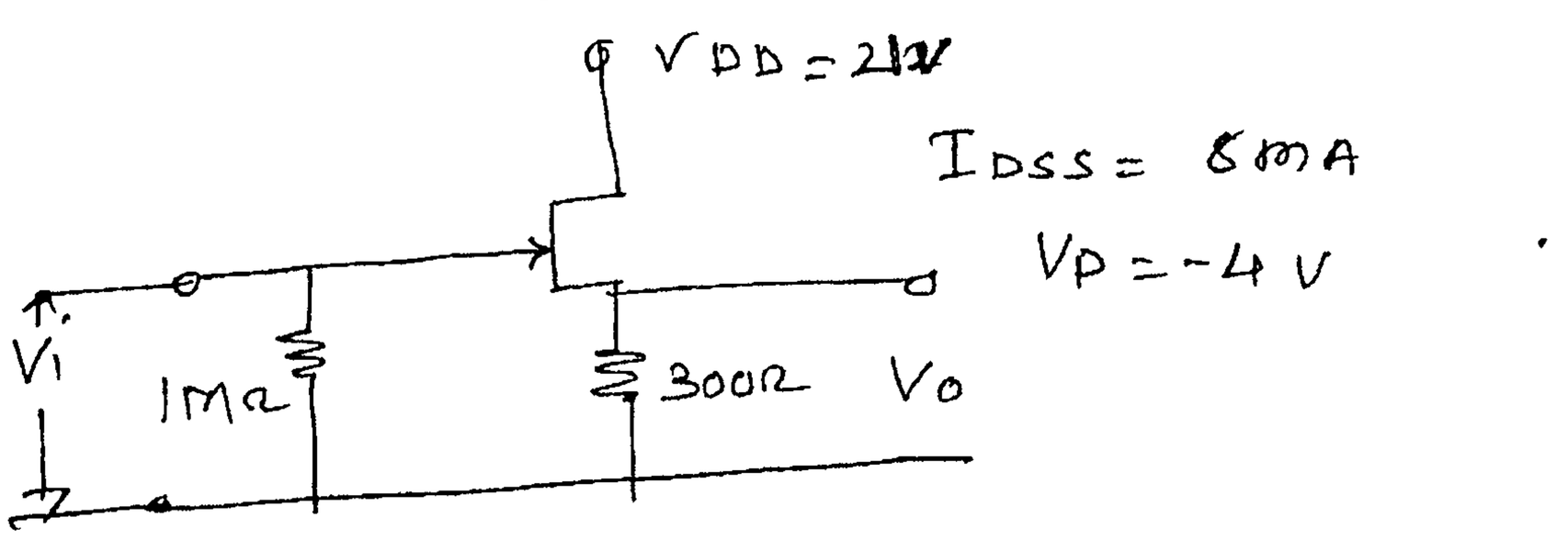


hie = 555k

hfe = 120

(b) Explain hybrid model of BJT **5**

5. (a) Determine A_v, R_i, and R_o for the circuit shown in **figure.** **10**



(b) Draw neat diagram of CS amplifier with voltage divider (Bypassed Rs) configuration. Derive the expression for Z_i, Z_o and A_v. **10**

SE | EXTC | Sem - III (Rev)
EDC - I 13/5/13

232 : Con. No.-JP

Con. 6416–13.

GS–6219

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1 and 2** are compulsory.
(2) Out of reinaining questions attempt any **three** questions.
(3) In all **five** questions to be attempted.
(4) Figures to the right indicate full marks.

1.a Design single stage R-C coupled CE audio frequency amplifier employing BC147B BJT to satisfy the following requirements. **[15]**
$|Av| \geq 100$, $S_{ICO} \leq 10$, Load resistor R_L = 10KΩ and Output voltage Vo=3volts.

1.b For the designed amplifier in part (a) determine; expected voltage gain, input impedance, output impedance and current supplied by source voltage V_{CC} **[5]**

2. a Design single stage R-C coupled CS audio frequency amplifier employing JFET BFW-11 to satisfy the following requirements. **[10]**
$|Av| \geq 10$, $I_{DQ} = 0.5\ I_{DSS}$, RL = 120 KΩ, V_{DD} = 20 volts and Output peak voltage Vo = 4.5volts.

2. b For the above designed circuit with source resistor 'RS' unbypassed, determine voltage gain, input impedance, output impedance and output voltage for input voltage of 20Vpp. **[10]**

3. a With the help of neat circuit diagram explain the operation of BJT series voltage regulator and derive for its line regulation and load regulation. **[10]**

3. b **Answer the following**

i. Why do we need **filters** in a dc power supply? **[3]**
ii. Under what condition we shall prefer a **capacitor filter?** **[3]**
iii. What is function of a **bleeder resistor** in rectifiers using LC filter? **[4]**

4. a **Multiple Choice Question** **[5x2]**

i. A voltage of **200cos100t** is applied to a half-wave rectifier with a load resistor of **5kΩ.** The rectifier is represnted by an ideal diode in series with a resistor of **1kΩ.** The maximum value of current, d.c. component of current and r.m.s.

[TURN OVER

value of current will be respectively,
a) 33.33 mA 10.61mA,& 16.67mA b) 22.22 mA 8.61mA,& 13.38mA
c) 28.33 mA 14.61mA,& 13.33mA d) 40 mA 20mA, & 25mA

ii. The percentage voltage regulation of voltage supply providing **100V** unloaded and **95V** at a full load is
a) 5.3% b) 5.0%
c) 0.53% d) None of the above

iii. The value of total collector current in a **CB** circuit is
a) $I_C = \alpha I_E$ b) $I_C = \alpha I_E + I_{CO}$
c) $I_C = \alpha I_E - I_{CO}$ d) $I_C = \beta I_E$

iv. The configuration that behaves as a **constant current source** is
a) Common Emitter b) Common Base
c) Common Collector d) Emitter Follower

v. The output resistance of a **source follower** is
a) Low b) Moderate
c) High d) None of the above

4. b Explain the following (Any two) **[2x5]**
i. Graphical determination of h-parameters
ii. UJT characteristics
iii. E-MOSFET
iv. Voltage Regulators
v. Features of IGBT

5. a **[5x2]**

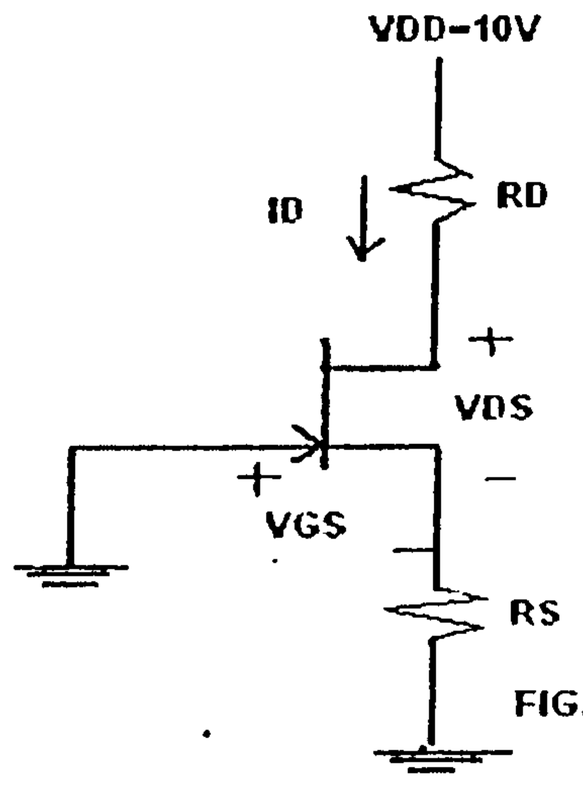


FIG.5a

For the circuit in Figure 5a the JFET parameters are $I_{DSS} = 5$ **mA**, $V_P = -4V$. Determine the following with $I_D = 2$ **mA and** $V_{DS} = 6V$
i. R_D

ii. R_S
iii. V_D (voltage between drain terminal and ground)
iv. VS (voltage between source terminal and ground)
v. V_{RD} (voltage across R_D)

5. b Explain with the help of neat diagram the structure of a N-channel FET, and its volt-ampere characteristics. In what ways it is different from a BJT? [4+4+2]

6. a A CE BJT amplifier is as shown in figure 6a with $V_{CE} = 12V$, $I_C = 2$ mA, Stability factor ≤ 5.1, $V_{CC} = 24V$, $V_{BE} = 0.7V$, $\beta = 50$ and $R_C = 4.7k\Omega$. Determine the value of resistors R_E, R_1 and R_2 (hint: $R2 = 0.1\ \beta R_E$) [10]

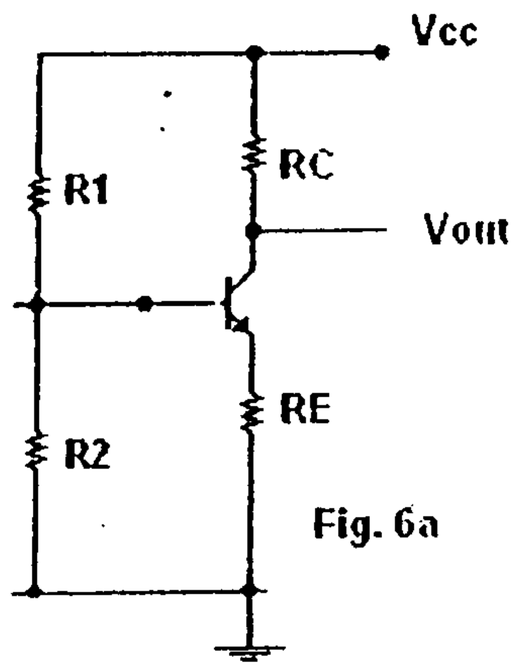


Fig. 6a

6. b [2x5]

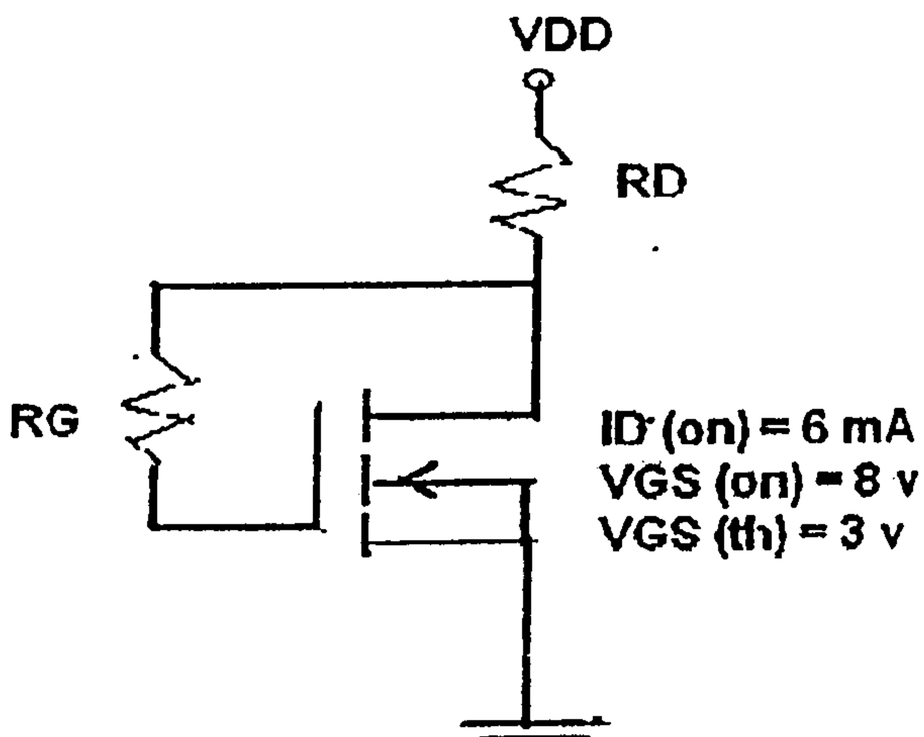


Fig.6b

For the network of figure 6b with RD=2KΩ, RG=10MΩ, and VDD=12volts. Determine the following.
i. IDQ
ii. VDSQ

7. Explain in brief [4x5]

i. How would you provide temperature compensation for the variation of V_{BE} and stabilisation of the operating point?

ii. How do you set a Q-point in a self-biased JFET?

iii. How triggering of an SCR can be controlled by the gate signal applied?

iv. How do we bias JFET against device variation

08/05/13 SEM III
E7RX Maths (III)
Engg. Mathematics

P3–upq–Feb.–13KL–31 A4 D

Con. 6381–13. **GS–6096**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of the remaining **six** questions.
(3) Figures to the **right** indicate **full** marks.

1. (a) Show that $f(z) = \frac{z}{|\bar{z}|^2}, |z| \neq 0$ is analytic function. Hence find f' (z). **5**

(b) Find Fourier series expansion for f (x) = sin x in $(-\pi, \pi)$ **5**

(c) Find Laplace transform of $t \cdot \sqrt{1 + \sin t}$ **5**

(d) Find z transformation of $\{\alpha^k \sin \alpha k\}, k \geq 0$. where α is constant. **5**

2. (a) Using Laplace transform evaluate $\int_0^\infty e^{-t} \frac{\sin 3t}{t} dt$. **6**

(b) Find the Fourier series expansion for f(x) = cos px where p is non-integer in $(0, 2\pi)$ **7**

(c) Find the matrix A, if adj $A = \begin{bmatrix} -2 & 1 & 3 \\ -2 & -3 & 11 \\ 2 & 1 & -5 \end{bmatrix}$. **7**

3. (a) Find inverse Laplace transform of — **6**

(i) $\log\left(\frac{s-2}{s-3}\right)$ (ii) $\frac{s+1}{(s^2-4)}$

(b) Find non-Singular maarices P and Q such that PAQ is in normal form. Also find rank of a matrix A where **7**

$$A = \begin{bmatrix} 2 & -4 & 3 & 1 & 0 \\ 1 & -2 & 1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$$

(c) Verify Green's theorem in the plane for $\oint_c (xy + y^2)dx + x^2 dy$ where c is the closed curve of the region bounded by $y = x$ and $y^2 = x$. **7**

4. (a) Obtain complex form of Fourier Series for the function $f(x) = e^{-ax}$ in $(-2, 2)$ where a is not an integer. **6**

[TURN OVER

(b) If $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 5 & 7 \\ 2 & 1 & -1 \end{bmatrix}$ compute A^{-1} and hence, Solve the system of equations 7

$x+ y+z = 9,\ 2x + 5y + 7z = 52,\ 2x + y - z = 0.$

(c) Find Laplace transform of — 7

$$f(t) = 1, \quad 0 \le t \le a$$
$$= -1, \quad a < t \le 2a$$
$$\& \ f(t + 2a) = f(t)$$

5. (a) Find the analytic function $f(z) = u + iv$ if $u = \left(r + \frac{a^2}{r}\right)\cos\theta$. 6

(b) Show that the equations. 7

$$ax + by + cz = 0$$
$$bx + cy + az = 0$$
$$cx + ay + bz = 0$$

has a non-trivial solution if a+b+c = 0 or if a=b=c. Find the non-trivial solution when the condition is satisfied.

(c) Find Fourier integral representing 7

$$f(x) = \begin{cases} 1-x^2 & , \ |x| \le 1 \\ 0 & , \ |x| > 1 \end{cases}$$

6. (a) Find the half range cosine series for $f(x) = 2x - x^2$ in (0, 2). 6

(b) Find the bilinear transformation which maps the points 2, i, –2 onto the points 1, i, –1. 7

(c) Using Laplace transform solve the differential equation 7

$$\frac{d^2y}{dt^2} - 2\frac{dy}{dt} - 8y = 4,\ y(0) = 0 \ \& \ y'(0) = 1$$

7. (a) Find inverse z-transform of $F(z) = \frac{1}{(z-2)(z-3)}$ if ROC is $2 < |z| < 3$. 6

(b) Verify stoke's theorem for $\overline{F} = x^2\hat{i} + xy\hat{j}$ & C is the boundary of the rectangle 7

$x = 0,\ y = 0,\ x = 2,\ y = 3.$

(c) Using Divergence theorem evaluate $\iint_S \overline{F} \cdot \hat{n}\, ds$, where $\overline{F} = 4x\hat{i} + 3y\hat{j} - 4z^2\hat{k}$ and 7

S is closed surface bounded by the planes $x = 0,\ y = 0,\ z = 0$ and $2x + 2y + z = 4$.

08/05/13 SEM III CMPN Maths (III) Applied Maths III

P3-upq-Feb.-13KL-42 A4 D

Con. 6384–13. **GS–6105**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** from remaining **six** questions.
(3) Figures to the **right** indicate **full** marks.
(4) Assume the **suitable** data if needed with **justification**.

1. (a) Find $L\{t\,e^{3t}\sin t\}$. **5**

(b) Show that every square matrix can be uniquely expressed as the sum of a Hermitian and skew- Hermitian matrix. **5**

(c) Find Z-transform and region of convergence of $f(k) = 3k,\ k \geq 0$. **5**

(d) Find the Fourier expansion of $f(x) = x^2$ where $-\pi \leq x \leq \pi$. **5**

2. (a) Prove that following matrix is orthogonal and hence find its inverse. **6**

$$A = \frac{1}{9}\begin{bmatrix} -8 & 4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{bmatrix}.$$

(b) Find $L^{-1}\left\{\frac{s+2}{(s^2+4s+5)^2}\right\}$ **6**

(c) Obtain the Fourier expansion of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the internal and $0 \leq x \leq 2\pi$ **8**

and $f(x + 2\pi) = f(x)$. Also deduce that,

(i) $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \ldots\ldots$

(ii) $\frac{\pi^4}{90} = \frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} + \ldots..$

3. (a) Investigate for what values of λ and μ the equations, **6**

$$x + y + z = 6$$
$$x + 2y + 3z = 10$$
$$x + 2y + \lambda z = \mu \text{ have,}$$

(i) No Solution
(ii) a unique solution
(iii) Infinite no. of solutions.

(b) Obtain complex form of Fourier series for $f(x) = e^{ax}$ $(-\pi, \pi)$ where a is not an integer. **6**

(c) Solve $\left(D^2 - D - 2\right) y = 20 \sin 2t$ with $y(0) = 1$, $y'(0) = 2$. **8**

4. (a) Find Laplace transform of **6**

$$f(t) = a \sin pt \quad 0 < t \leq \pi / p$$

$$f(t) = 0 \quad \frac{\pi}{p} < t \leq \frac{2\pi}{p}$$

$$\text{and } f(t) = f\left(t + \frac{2\pi}{p}\right).$$

(b) Find the inverse Z-transform for **6**

$$f(z) = \frac{1}{(z-3)(z-2)}$$

for $2 < |z| < 3$.

(c) Find inverse Laplace transform of **8**

(i) $\dfrac{e^{4-3s}}{(s+4)^{5/2}}$ (ii) $\tan^{-1}\left(\dfrac{2}{s}\right)$

5. (a) Examine whether the following vectors are linearly independent or dependent **6**
[2, 1, 1], [1, 3, 1], [1, 2, –1].

(b) Using Convolution theorem prove that **6**

$$\ell^{-1}\left[\frac{1}{s}\ell n\left(\frac{s+1}{s+2}\right)\right] = \int_0^t \left(\frac{e^{-2u} - e^{-u}}{u}\right) du$$

(c) Using Fourier cosine Integral prove that **8**

$$e^{-x}\cos x = \frac{1}{\pi}\int_0^\infty \frac{w^2+2}{w^4+4}\cos wx\, dw$$

6. (a) Find the Fourier Transform $0 + f(x) = e^{-|x|}$ **6**

(b) Find $z\{f(k)\}$ where $f(k) = \cos\left(\frac{k\pi}{u} + a\right)$ where $k \geq 0$. **6**

(c) Find Fourier expansion of $f(x) = 2x - x^2$ where $0 \leq x \leq 3$ and period is 3. **8**

7. (a) Reduce the following matrix to normal form and find its rank. **6**

$$A = \begin{bmatrix} 1 & -1 & 3 & 6 \\ 1 & 3 & -3 & -4 \\ 5 & 3 & 3 & 11 \end{bmatrix}$$

(b) Evaluate $\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\, dt$. **6**

(c) Show that the set of functions, **8**

$$\sin\left(\frac{\pi x}{2L}\right), \sin\left(\frac{3\pi x}{2L}\right), \sin\left(\frac{5\pi x}{2L}\right), \ldots\ldots$$

is orthogonal over (0, L)
Hence construct corresponding orthonormal set.

4/6/13 S.E. Sem III (Rev) Electronics
Electrical Network Analysis and Synthesis

P3–upq–Feb.–13KL–309 A4 E

Con. 6623–13. **GS–6606**

(3 Hours) **[Total Marks : 100**

N.B. :(1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data wherever **necessary**.
(4) Figures to the **right** indicate **full** marks.

1. (a) Explain Y-parameters interms of Z-parameters. **5**
(b) Draw the dual of the network shown in **figure (a)**. **5**

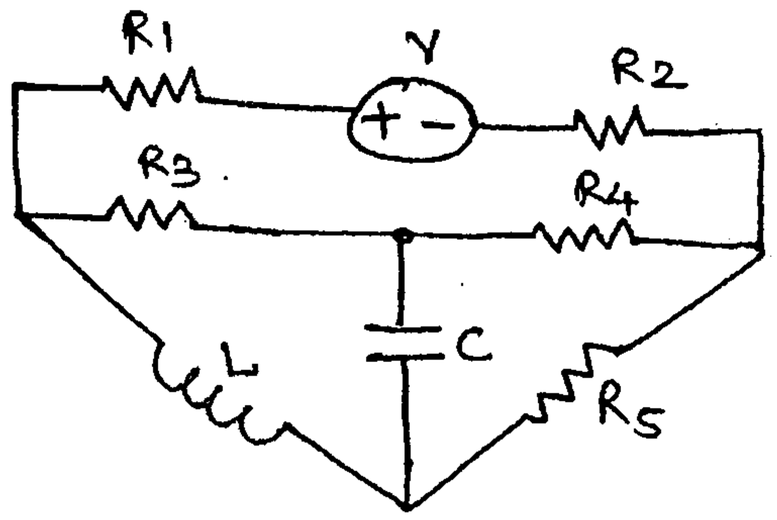


figure (a)

(c) Find the poles and zeros of impedence of the network shown in **figure (b)**. **5**

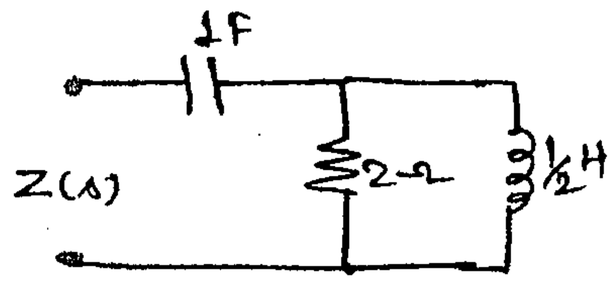


figure (b)

(d) State the properties of prf. **5**

2. (a) Find the Thevin equivalent network of **figure (c)**. **10**

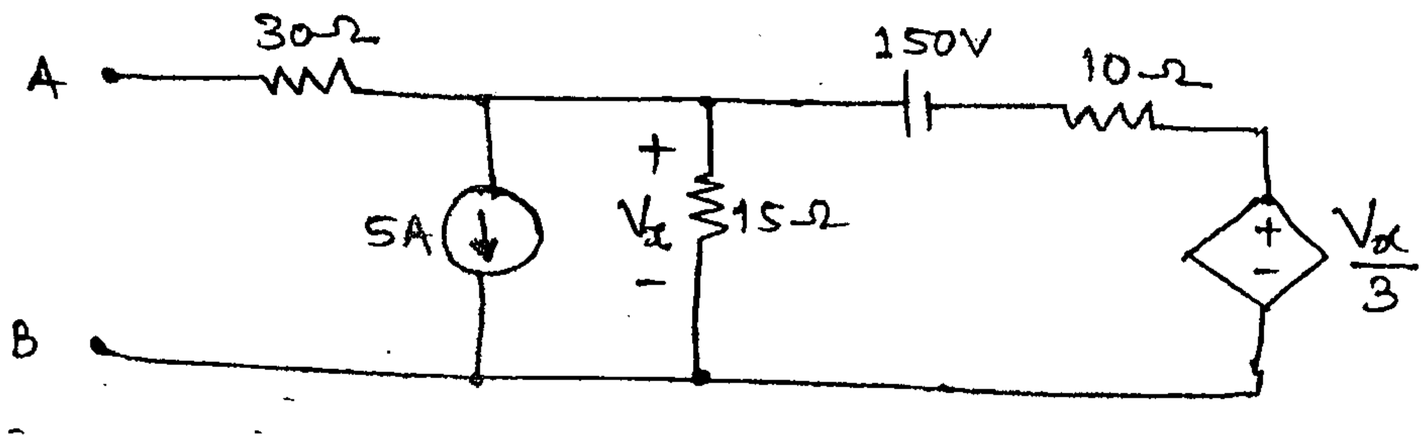


figure (c)

[TURN OVER

(b) Find the current I_2 using mesh analysis of **figure (d).** **10**

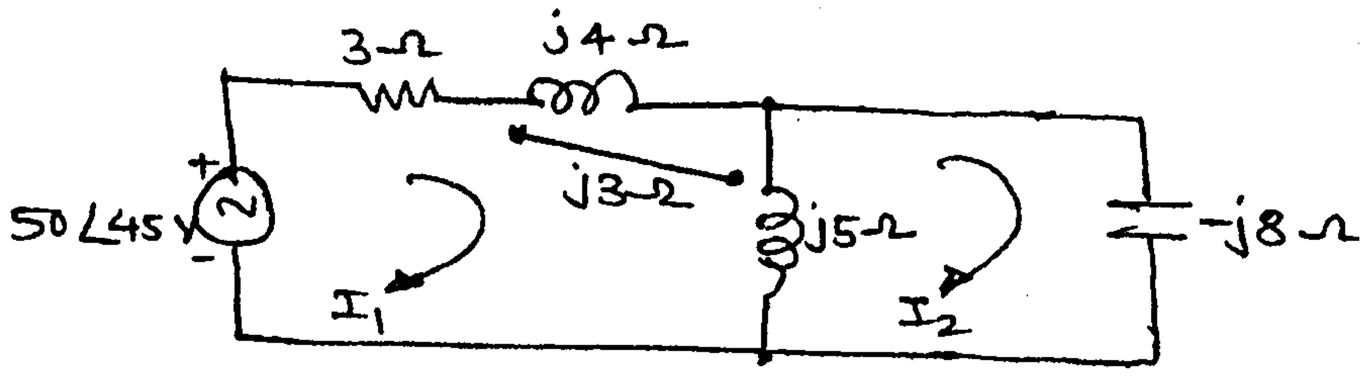


figure (d)

3. (a) The switch is closed at t = 0, find values of I, $\frac{dI}{dt}$, $\frac{d^2I}{dt^2}$ at $t = o^+$. Assume all initial current of inductor to be zero for circuit (e). **10**

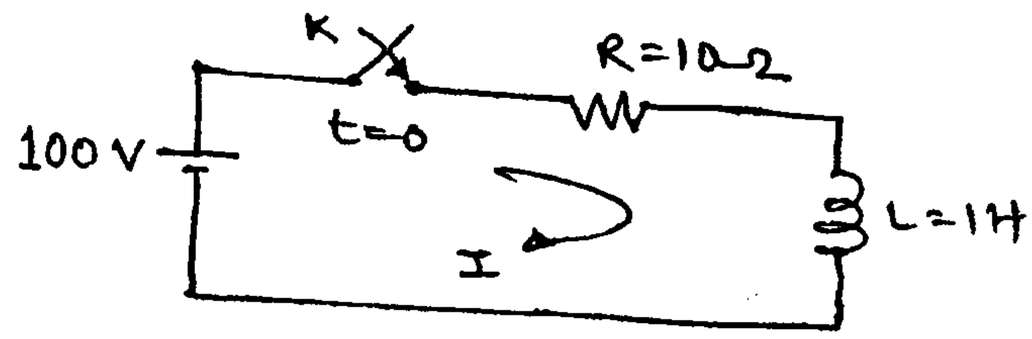


figure (e)

(b) Calculate the twig voltages using KVL equations for network shown in **figure (f).** **10**

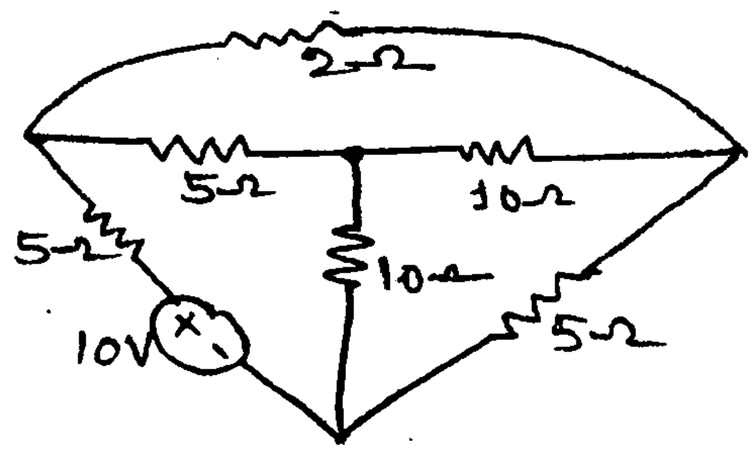


figure (f)

4. (a) Determine Y-parameters for network **an figure** (g). **10**

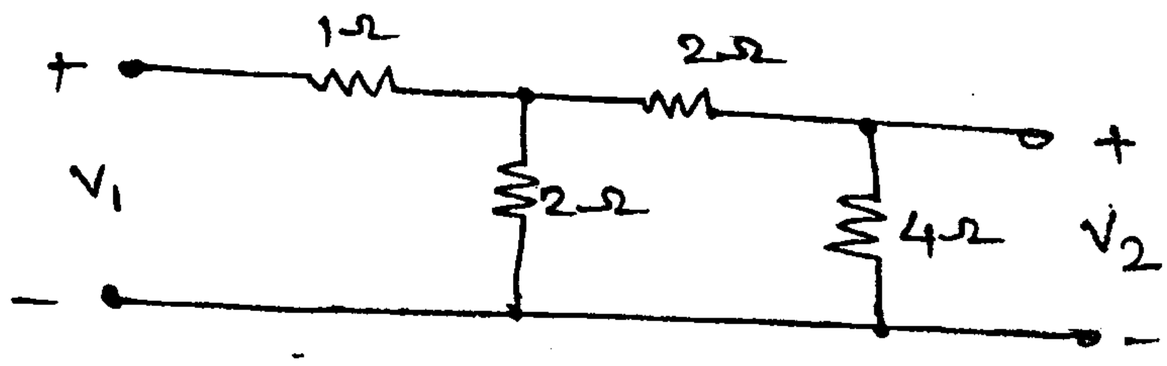


figure (g)

(b) In the network **figure (h)**. Determine the currents i_1 (t) and i_2 (t) when the switch 'k' is closed at t = 0. **10**

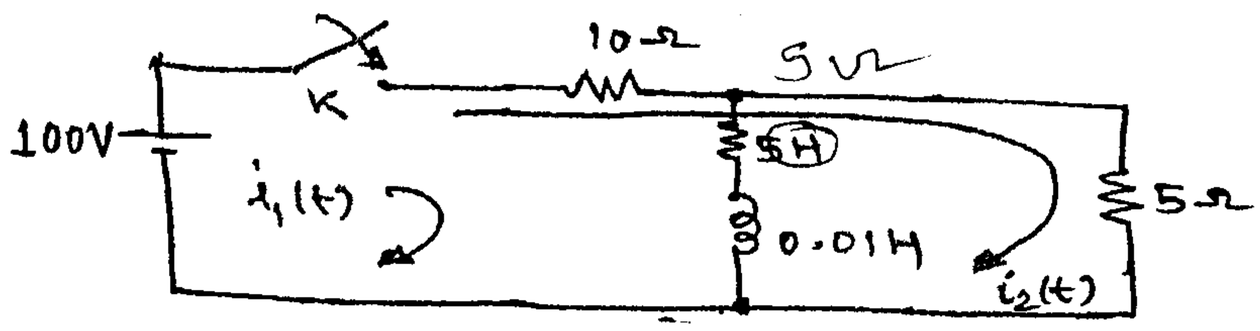


figure (h)

5. (a) The pole-zero diagram of driving point impedance function of network **figure (i)**. At d.c. the input impedance is resistive and equal to 2Ω. Determine the values of R–L and C. **10**

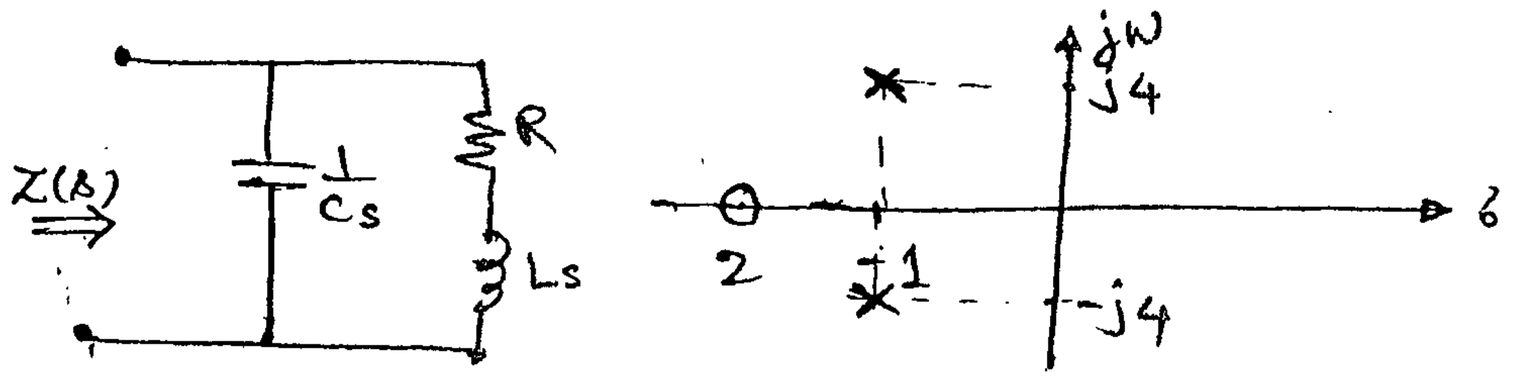


figure (i)

(b) Test whether the following polynamials are Hurwitz. Use continuous fraction expansion method :— **10**

(i) $s^4 + 2s^2 + 2$

(ii) $s^7 + 2s^6 + 2s^5 + s^4 + 4s^3 + 8s^2 + 8s + 4$

6. (a) Determine the node voltages at 1 and 2 of the network shown in **figure (f)**. Use nodal analysis. **10**

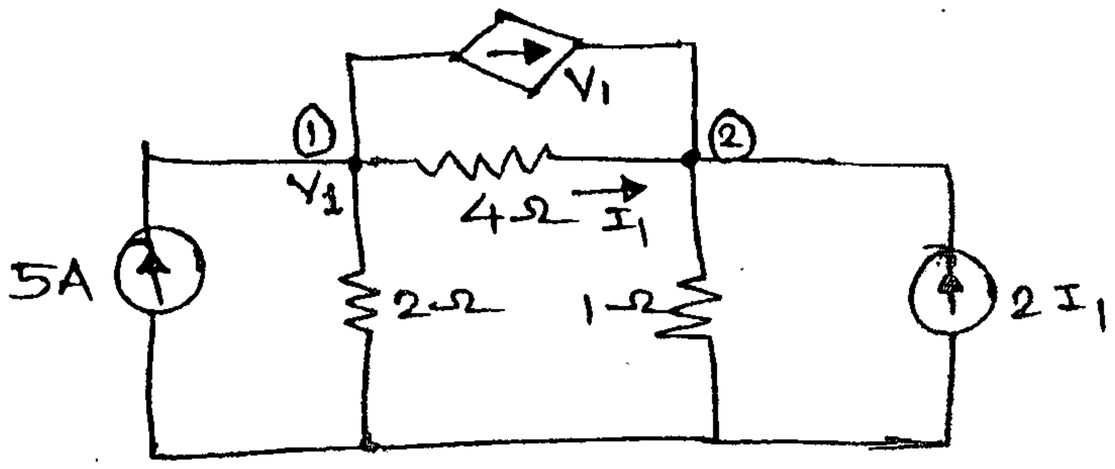


figure (j)

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(b) Find the response of V_0 (t) for network shown in **figure (k)**. **10**

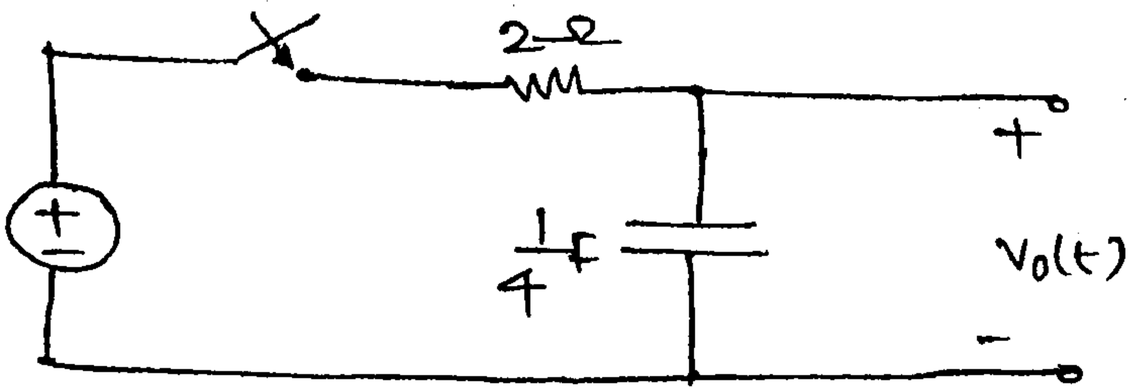

figure (k)

7. Realize the given expression in Foster I, Foster II, Cauer – I and Cauer – II form. **20**

$$z(s) = \frac{s(s+4)(s+8)}{\left(s^2+7s+6\right)}$$
