SE | EXTC | III (Rev.)
APP. Maths- III
24/11/12

D : scan Oct.12 294
Con. 7340-12.

KR-3098

(3 Hours) [Total Marks : 100

N.B. (1) Question No. 1 is compulsory.
(2) Attempt any four out of the remaining six questions.
(3) Non-programmable calculator are allowed.

1. (a) $A = \frac{1}{7}\begin{bmatrix} 2 & 6 & 3 \\ 6 & -3 & 2 \\ 3 & 2 & -6 \end{bmatrix}$ 5

Show that –
(i) $|A| = 1$
(ii) adj $A = A'$

(b) Show that the Fourier cosine transform of– 5

$f(x) = \frac{1}{\sqrt{x}}$ is $\frac{1}{\sqrt{s}}$

(c) Show that $L^{-1} \tan^{-1}\left(\frac{a}{s}\right) = \frac{\sin(at)}{t}$ 5

(d) Show that $\int_0^\infty e^{-t} \sin\left(\frac{1}{2}\right), \sin h\left(\frac{\sqrt{3}t}{2}\right) dt \ \frac{\sqrt{3}}{2}$ 5

2. (a) If z is any non zero complex number show that– 6

$A = \frac{1}{\sqrt{2}|z|}\begin{bmatrix} z & -\bar{z} \\ z & \bar{z} \end{bmatrix}$ is a unitary matrix.

(b) Find the Fourier series expansion of $f(x) = x^2$ in $[0, 2\pi]$ 6

(c) Show that $\int_0^\infty \frac{\sin 2t + \sin 3t}{te^t} dt = \frac{3\pi}{4}$. 8

3. (a) Find the half range sine series for $f(x) = \pi x - x^2$ in $[0, \pi]$, hence find $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^6}$. 6

(b) Show that $L(\cos at \cos h at) = \frac{s^3}{s^4 + 4a^4}$. 6

(c) If a, b, c are distinct real numbers such that $a + b + c \neq 0$. Show that the vectors (a, b, c), (b, c, a) and (c, a, b) are linearly independent. 8

[TURN OVER

4. (a) Find the Fourier series expansion of – 6

$$f(x) = \begin{cases} x, & -\pi \leq x < 0 \\ 0, & 0 < x < \frac{\pi}{2} \\ x - \frac{\pi}{2}, & \frac{\pi}{2} < x, < \pi \end{cases}$$

(b) Find all the possible ranks of the matrix 6

$$A = \begin{bmatrix} k & -3 & -3 \\ -3 & k & -3 \\ -3 & -3 & k \end{bmatrix}$$ where k is any real number.

(c) Find – (i) $L^{-1} \frac{se^{-\pi s}}{s^2+3s+2}$; (ii) $L\,[\, t.H(t-4) + t^2\,\delta(t-4)\,]$ 8

5. (a) Solve the system of equation using the Gauss-Seidel method : 6

$$3x + 4y + 6z = 6$$
$$2x + 5y + 4z = 11$$
$$2x + y + z = 5$$

(b) Find $L^{-1} \frac{s}{(s^2+2)^2}$ using the convolution theorem. 6

(c) Show that $z\,[\cos(\alpha k)] = \frac{z^2 - z\cos\alpha}{z^2 - 2(\cos\alpha)z + 1}$. 8

6. (a) Find L f(t) where $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \sin t, & t \geq \pi \end{cases}$ 6
using the Heaviside unit step function.

(b) Find $z^{-1} \frac{1}{(z-2)(z-3)}$ for $2 < |z| < 3$ using residues. 6

(c) Express the matrix $A = \begin{bmatrix} \cos\alpha & 0 & \sin\alpha \\ (\sin\alpha)(\sin\beta) & \cos\beta & -(\sin\beta)(\cos\alpha) \\ -(\cos\beta)(\sin\alpha) & \sin\beta & (\cos\alpha)(\cos\beta) \end{bmatrix}$ as a product of two 8
orthogonal matrices.

7. (a) Solve the DE $y + \int_0^t y\,dt = 1 - e^{-t}$ using laplace transforms. 6

(b) If $0 \leq x \leq \pi$ show that– 6

$$x^2 = \frac{2}{\pi}\left[\left(\frac{\pi^2}{1} - \frac{4}{1^3}\right)\sin x - \left(\frac{\pi^2}{2}\right)\sin 2x + \left(\frac{\pi^2}{3} - \frac{4}{3^3}\right)\sin 3x + \ldots.\right].$$

(c) Show that $\{\cos nx\}_{n \geq 1}$ is an orthogonal family of functions in $[-\pi, \pi]$. Also find the corresponding orthonormal set. 8

S.E.-SEM III (EXTC) Nov-Dec 2012

Sub:- EDC-I

Con. 9605–12. KR–3203

(3 Hours) [Total Marks : 100

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

1. a Design for Supply voltage V_{CC}. Collector resistor RC, Emitter resistor RE, voltage divider biasing resistor R1 & R2 of a single stage RC coupled CE audio amplifier for peak output voltage of 3V at 5kΩ load, Av ≥ 100 and $S_{ICO} \leq 10$. [10]

1. b. Answer the following question related to design of single stage CE audio frequency voltage amplifier
   i. Upper limit and lower limit on choice of power supply voltage VCC [2]
   ii. Upper limit on the choice of collector resistor RC [2]
   iii. Lower limit on selection of emitter resistor RE [2]
   iv. Experimentally how will you determine input impedance and output impedance of CE without measuring input and output current [4]

2. a. Design single stage RC coupled common source (CS) audio amplifier employing JFET type BFW11 typical to provide a voltage gain of Av ≥ 10 at peak output voltage of Vo = 4.5V, load resistor of 120kΩ , supply voltage of 20 V with biasing circuit to provide IDQ = 3 mA . [10]

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. Design a full wave rectifier dc supply using center tapped transformer with two diodes to give dc output voltage at 150 volts to a variable resistive load. The load current expected is 50 ± 10 mA with ripple factor not to exceed 0.07. Use LC filter [10]

3. b.

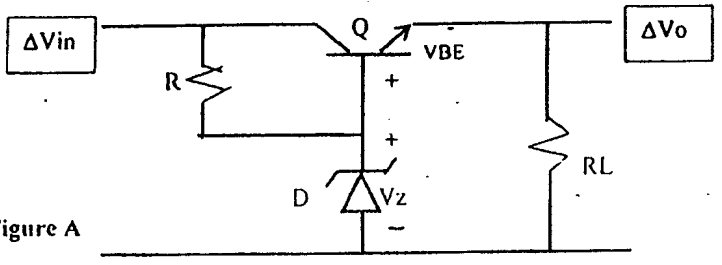

Figure A

Explain operation of the circuit shown in Figure A with detailed function of resistor 'R', Zener diode 'D', and BJT 'Q' in above circuit [10]

[TURN OVER

4. a. Multiple Choice Question

i. The best location for setting a Q-point on d.c. load line of an FET amplifier is at [2]
   a) Saturation point b) Cut-off point
   c) Mid-point d) None of these

ii. When transistors are used in digital circuits they usually operate in the: [2]
   a) Active region b) Break down region
   c) Saturation region d) Saturation & cut-off region

iii. When an input delta of 2 V produces a transconductance of 1.5 ms, what is the drain current delta? [2]
   a) 666 mA b) 3 mA
   c) 0.75 mA d) 0.5 mA

iv. Introducing a resistor in the emitter of a common emitter amplifier stabilizes the dc operating point against variations in: [2]
   a) Only the temperature b) Only the β of the transistor
   c) Both temperature and β d) None of the above

v. A voltage regulator has a no-load output of 18 V and a full-load output of 17.3 V. The percent load regulation is [2]
   a) 0.25 % b) 96.1 %
   c) 4.05 % d) 1.04 %

4. b. Explain the following (Any two): [5x2]
   i. Graphical determination of FET parameters
   ii. Features of IGBT
   iii. BJT as a switch
   iv. Power MOSFET

5. a. Discuss, using the concept of a load line superimposed on the transistor characteristics. how a simple common emitter circuit can amplify a time varying signal [10]

5. b. The following parameters are obtained from certain JFET data sheet: $V_{GSoff} = -8$ V and $I_{DSS} = 5$ mA. Determine the values of I_D, for each value of V_{GS} ranging from 0 V to – 8 Vin 1 V steps. Plot the transfer characteristic curve for the same data [10]

6. a. For the network shown in Figure B, determine the following with $|VBE\ on| = 0.7\ V$ and $\beta = 100$ [2x5]
   i. I_{CQ} and I_{EQ}
   ii. Input& Output impedance
   iii. Voltage gain
   iv. Current gain
   v. List disadvantages of circuit shown

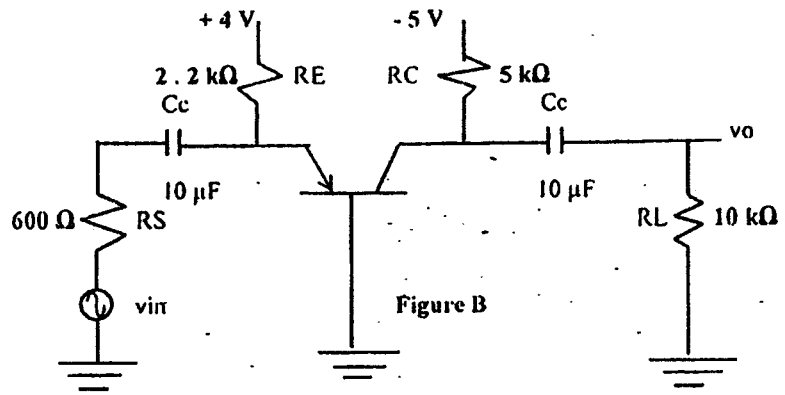

Figure B

6. b. Determine the small signal voltage gain of a MOSFET circuit with VGSQ = 2.12 V, VDD = 5 V, Rd = 2.5 kΩ, V_{TN} = 1 V, Kn = 0.8 mA/V^2 and λ = 0.02 V^{-1} (body effect coefficient). Assume transistor (Figure C) is biased in the saturation region. [10]

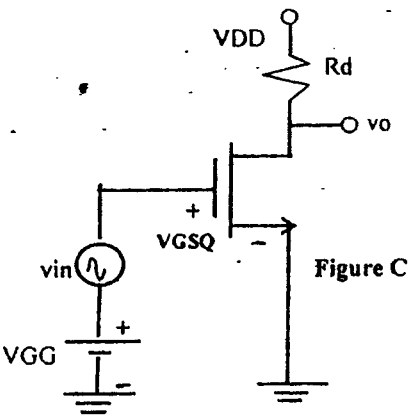

Figure C

7. Explain in brief and sketch experimental setup to determine – [4x5]
   i. Output characteristic of CE BJT voltage amplifier
   ii. Line regulation of BJT shunt regulator
   iii. Forward characteristic of SCR
   iv. Transfer characteristic of JFET
   v. UJT characteristic

DBEC DATA SHEET

Transistor type	Pdmax @ 25°C Watts	Idmax @ 25°C Amps	V_{GS} (off) volts d.c.	V_{DSO} volts d.c.	V_{DGO} (Sus) volts d.c.	V_{DSX} (Sus) volts d.c.	V_{GSX} volts d.c.	V_{BDO} volts d.c.	T_j max °C	D.C. current gain min	typ.	max.	Small Signal min.	typ.	h_{fe} max.	V_{DS} max.	θ_{j-c} °C/W	Derate above 25°C W/°C
2N3055	115·5	15·0	3·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	0·7
ECN055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	0·4
ECN149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	0·3
ECN100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	—
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N525(PNP)	0·225	0·5	0·25	35	30	—	—	—	100	35	—	65	—	45	—	—	—	—
BC147B	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9	—	—

Transistor type	hie	hoe	hre	αfe
BC 147A	2·7 KΩ	18μ ℧	1·5 × 10⁻⁴	0·4°C/mw
2N 525 (PNP)	1·4 KΩ	25μ ℧	3·2 × 10⁻⁴	—
BC 147B	4·5 KΩ	30μ ℧	2 × 10⁻⁴	0·4°C/mw

BFW 11—JFET MUTUAL CHARACTERISTICS

-Vgs volts	0·0	0·2	0·4	0·6	0·8	1·0	1·2	1·6	2·0	2·4	2·5	3·0	3·5	4·0
Ios max. mA	10	9·0	8·3	7·6	6·8	6·1	5·4	4·2	3·1	2·2	2·0	1·1	0·5	0·0
Ios typ. mA	7·0	6·0	5·4	4·6	4·0	3·3	2·7	1·7	0·8	0·2	0·0	0·0	0·0	0·0
Ios min. mA	4·0	3·0	2·2	1·6	1·0	0·5	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0

N-Channel JFET

Type	V_{gs} max. Volts	V_{gd} max. Volts.	V_{gl} max. Volts	P_d max. @25°C	T_j max.	I_{dss}	g_{fs}	$-V_p$ Volts	r_d	Derate above 25°C	θ_{j-c}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μΩ	6	50 KΩ	2 mW/°C	0·59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5000 μΩ	2·5	50 KΩ	—	0·59° C/mW

UJT type	P_d max. @25°C	I_E max. @25°C	I_P peak pulse current max.	V_{BB} Volts max.	V_{BB1} Volts	T_j max	η min.	η max.	R_{BB}KΩ min.	R_{BB}KΩ typ.	Max.	I_v max. μA	I_v min. mA	I_{EO} μA
2N2645	300mW	50mA	2Amp.	30	35	125°C	0·56	0·75	4·7	7·0	9·1	5·0	4·0	−2·0

S.E. Sem III Rev NID-2012 EXTC

Sub — DLD

Con. 10038–12.

KR–3335

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Out of remaining **six** questions solve any **four**.
(3) **Each** question carries **20** marks. **Equal** marks for the **sub-questions**.
(4) Assume **suitable** data if **required**.

1. (a) Perform the following operations :
   (i) 1010·1 x 101·1
   (ii) $(AA)_H \times (55)_H$
   (iii) Convert $(77)_8$ into Decimal number system
   (iv) Find $(22\text{-}31)_{10}$ using 2's complement number system
   (v) Convert $(1110101100000111)_2$ into Hexa-decimal number system
   (b) Draw state diagram of sequence detector to detect a non-overlapping sequence 10001. Write its state table. Find the equivalent states if they are present.

Que (2) (A) Design lockout free Mod 13 up synchronous counter using JKMS flip flops.
(B) Do the following conversions of flip flops;
(I) JKMS to T (II) D to T.

Que (3) (A) Draw CMOS inverter circuit, discuss its operation and draw its transfer characteristic.
(B) For the following function implement the SOP and POS circuit.
$F(A,B,C,D) = \sum m(2,3,5,7) + \sum d(6,13,14,15)$

Que (4) (A) For the following function find the reduced Boolean equation using Quine McClusky method;
$F(A,B,C,D) = \sum m(1,3,4,6,9,11,12) + \sum d(5,8,15)$
(B) Draw JKMS flip flop and explain its operation.

Que (5) (A) Design full adder using decoder with active high output.
(B) Explain following characteristics of logic families;
(I) Propagation delay (II) Noise margin (III) Current parameters
(IV) Temperature range (V) Fan out.

Que (6) (A) Design a PROM which will convert BCD numbers into Gray code.
(B) Use 5 Input, 3 Product, 4 Output PAL to realize following 3 functions.
$F1(A,B,C,D) = \sum m(2,3,4,8,9,13,14)$
$F2(A,B,C,D) = \sum m(2,3,5,8,9,14,15)$
$F3(A,B,C,D) = \sum m(2,3,4,8,9,14,15)$.

Que (7) Write short notes on any four of the following;

(I) FPGA, (II) Asynchronous counters , (III) ECL logic family

(IV) Weighted and non-weighted codes, (V) ROM.

S.E. EXTC Sem III (Rev) 11/Dec - 2012

Sub - EI.

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Con. 10287-12.

KR-3437

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **four** questions from the remaining questions.
(3) Assume **suitable** data.

1. Solve any **four** questions :– **20**
   (a) Classify transducer.
   (b) Explain the significance of rise time and bandwidth of CRO.
   (c) True RMS meters is always specified by crest factor. Justify.
   (d) Compare different types of ADCs.
   (e) On what principle does a digital frequency meter operate ?
   (f) State advantages and disadvantages of land line telemetry.

2. (a) Compare following temperature transducers with respect to their characteristics, measurement range applications RTD, thermocouple and thermistors. **10**
   (b) What is the basic principle of wave analyser ? Explain hetrodyne wave analyser with application. **10**

3. (a) What is the role of a time base generator ? What are the time base requirements. **10**
   (b) Explain the principle of operation of dual slope DVM. **10**

4. (a) Explain the significance of $3\frac{1}{2}$ and $4\frac{1}{2}$ digit displays. **10**
   (b) Explain modulation methods used for R. F. telemetry system. **10**

5. (a) Explain the modes of operation of DSO. **10**
   (b) Write a note on applications of Q meter. **10**

6. (a) How is the displacement measured ? State different transducers used for displacement measurement. **10**
   (b) Explain the performance characteristics of D/A converters. **10**

7. (a) Explain pulse code modulation technique. **10**
   (b) Explain different types of measurement errors with frequency counters. **10**

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S.E. ~~EFRX~~ EXTC sem III (Rev) Dec - 2012

Sub. - EN

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Con. 11036-12.

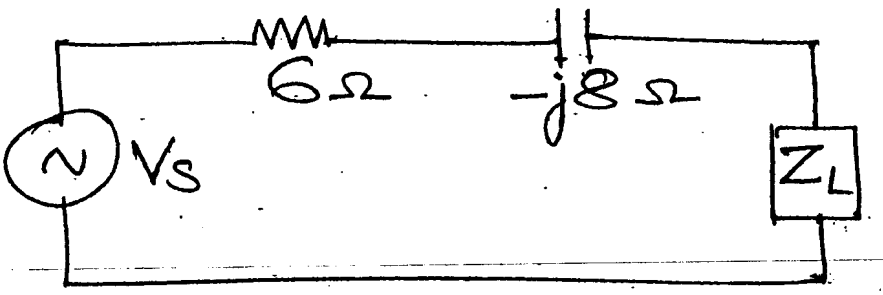
KR-3659

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

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from the remaining **six** questions.
(3) **All** questions carry **equal** marks.

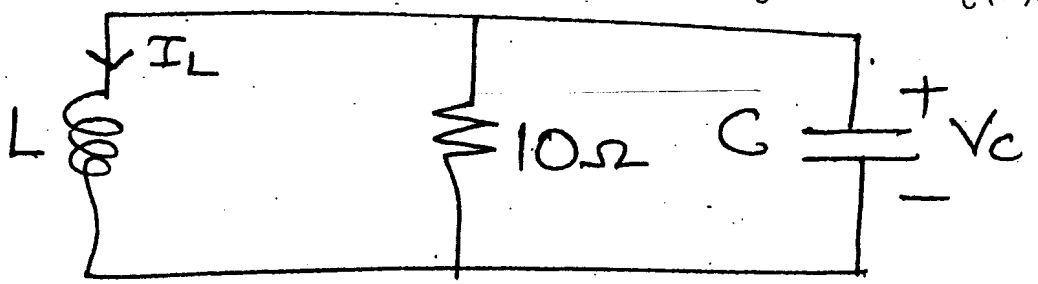
1. Attempt any **four** :– **20**

(a) For maximum power transfer find the value of Z_L if
(i) Z_L is impedance
(ii) Z_L is pure resistance.



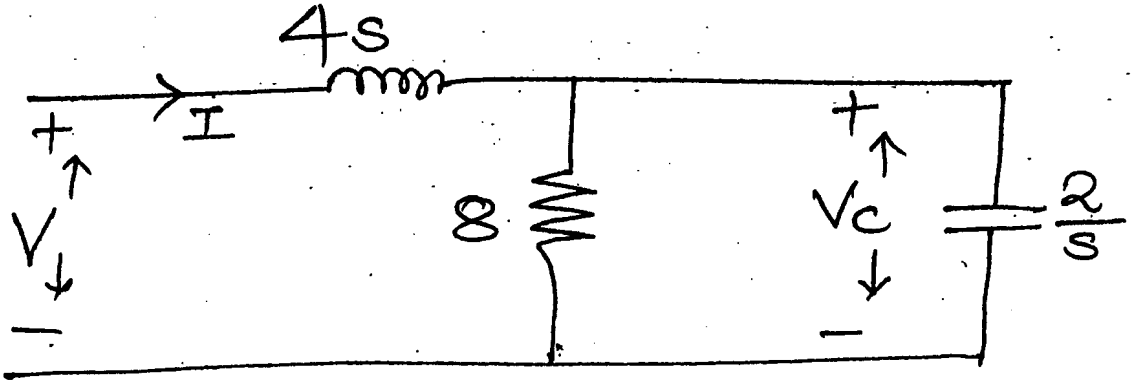
(b) Find initial value of,
$f(t) = 20 - 10t - e^{-25t}$
verify using initial value theorem.

(c) In network given below, initial value of $I_L = 4A$ and $V_C = 100V$. Find $I_C(0^+)$.



(d) Currents I_1 and I_2 entering at Port 1 and Port 2 respectively of two port network are given by following equation.
$I_1 = 0{\cdot}5\, V_1 - 0{\cdot}2\, V_2$
$I_2 = -0{\cdot}2\, V_1 + V_2$
Obtain T and π(pi) representation.

(e) For network shown, find $\frac{V_C}{V}$ and draw pole-zero plot.



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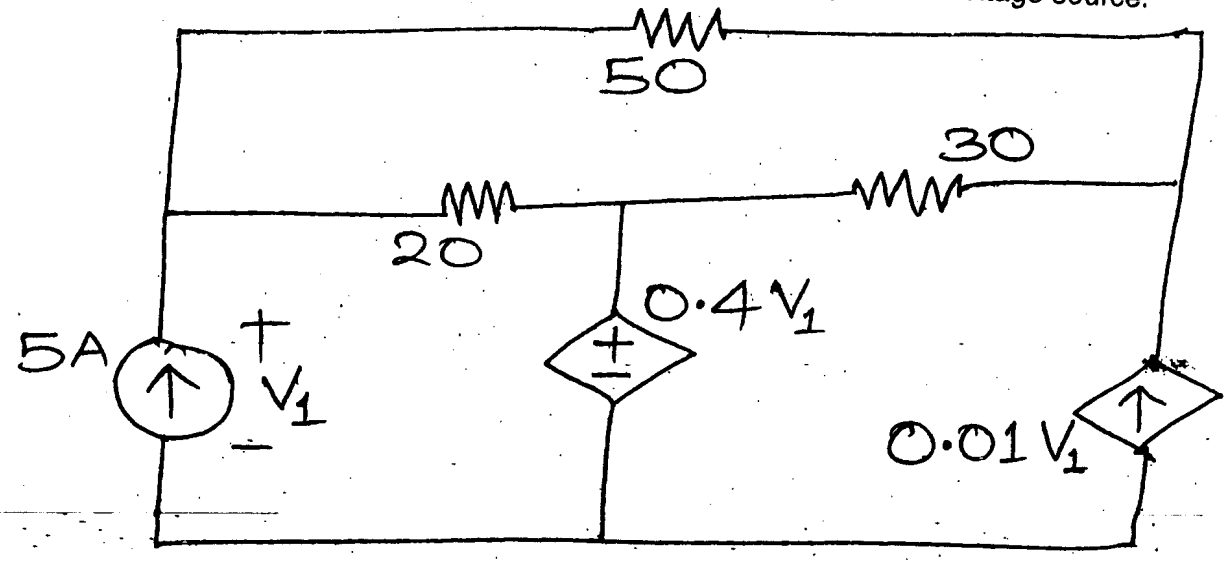
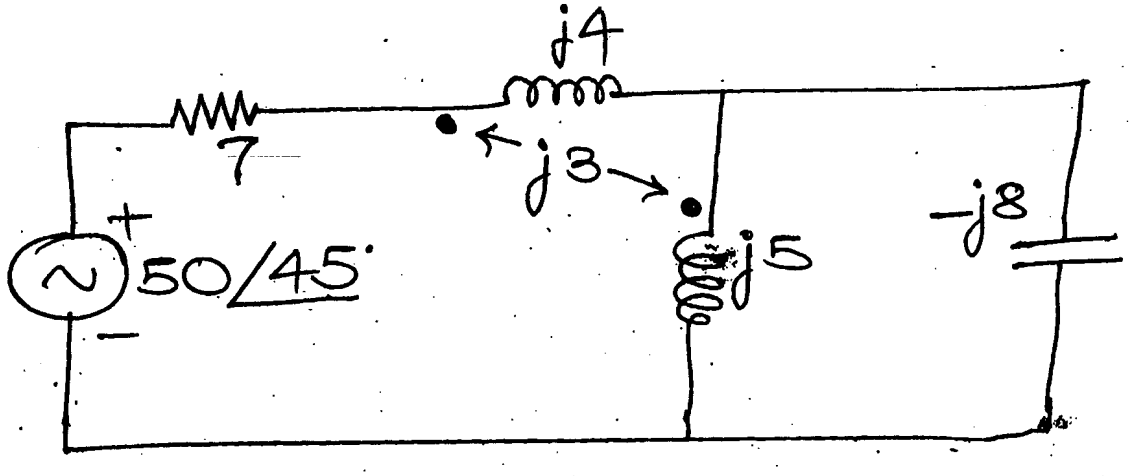
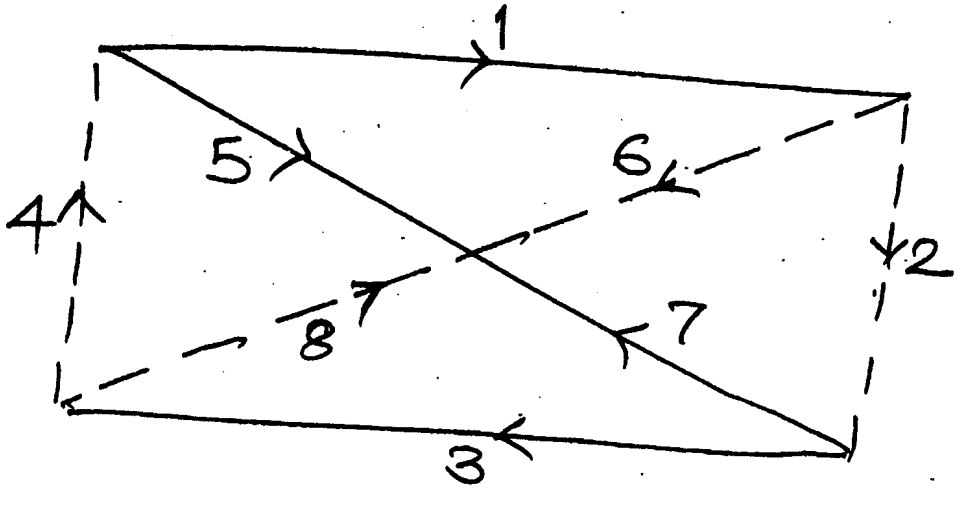
2. (a) Using mesh analysis find the power supplied by dependent voltage source. **10**



(b) Find current supplied by source. **10**



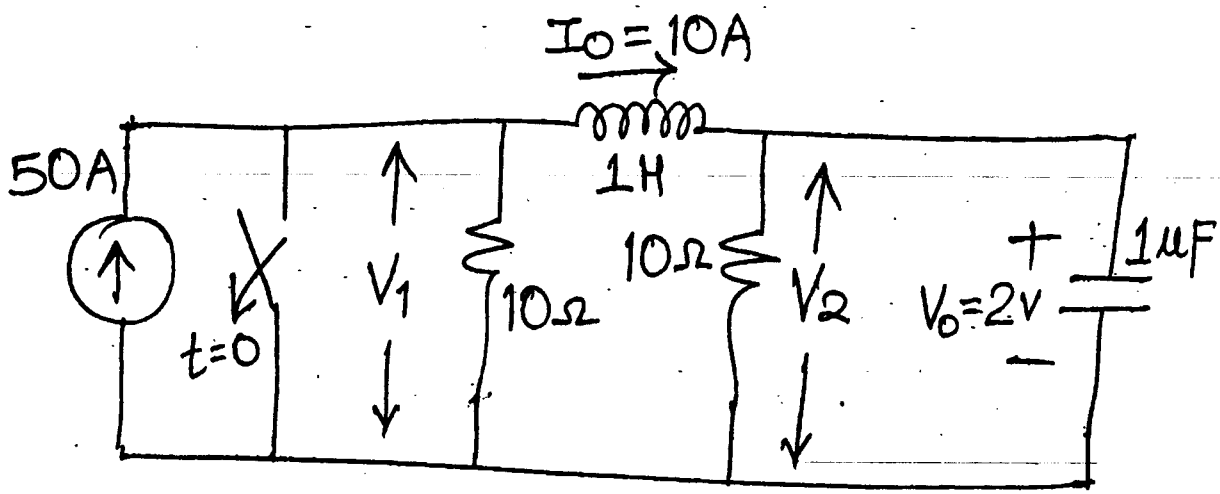
3. (a) Write B and Q matrix for the Graph shown. **10**



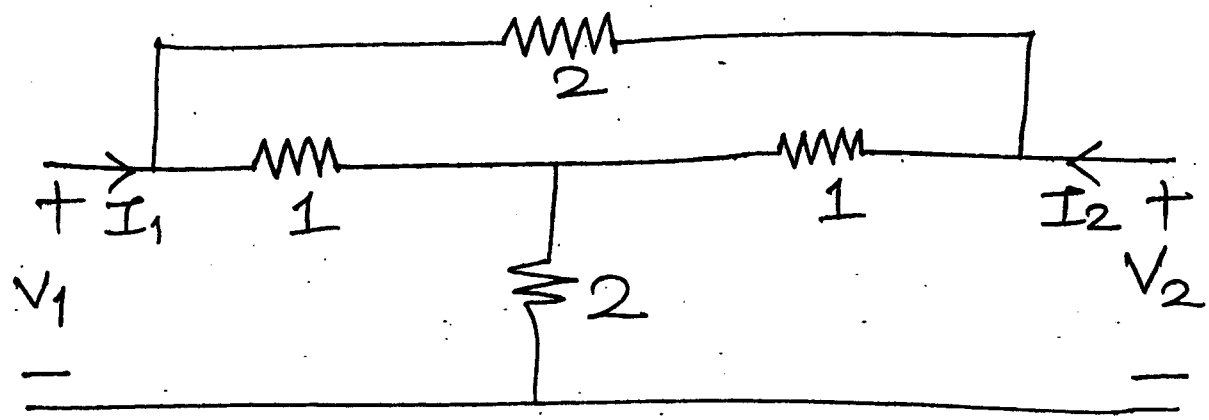
(b) Draw Bode Plot for the function G(s). Find gain margin, phase margin and comment on stability. **10**

$$G(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

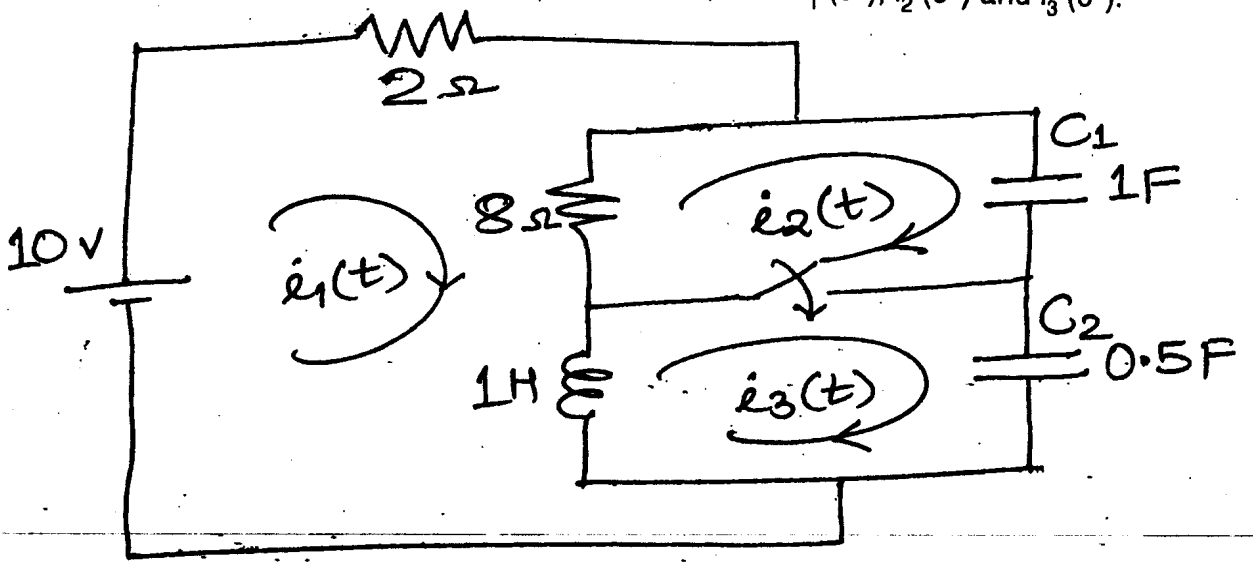
4. (a) For the network below, switch is opened at t = 0 with initial conditions shown. Find $v_1, \frac{dv_1}{dt}, \frac{dv_2}{dt}$ at time 0^+ **10**



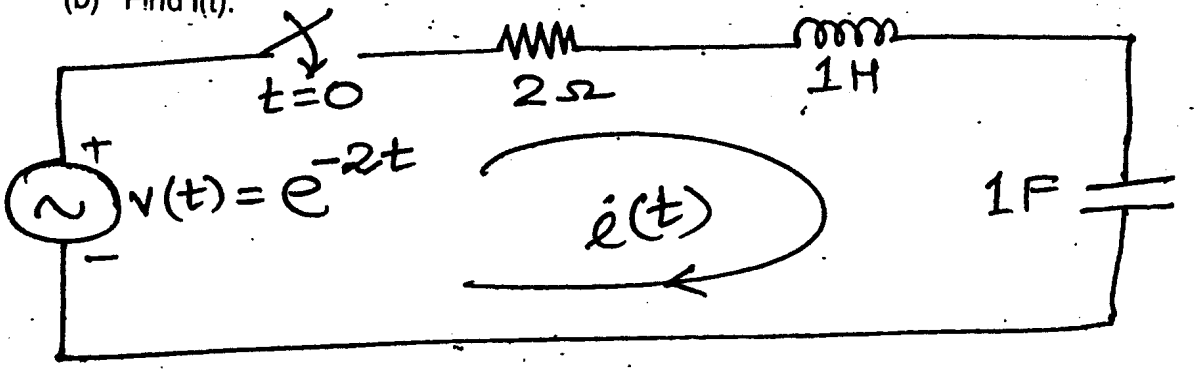
(b) Find Y parameter using interconnection. **10**



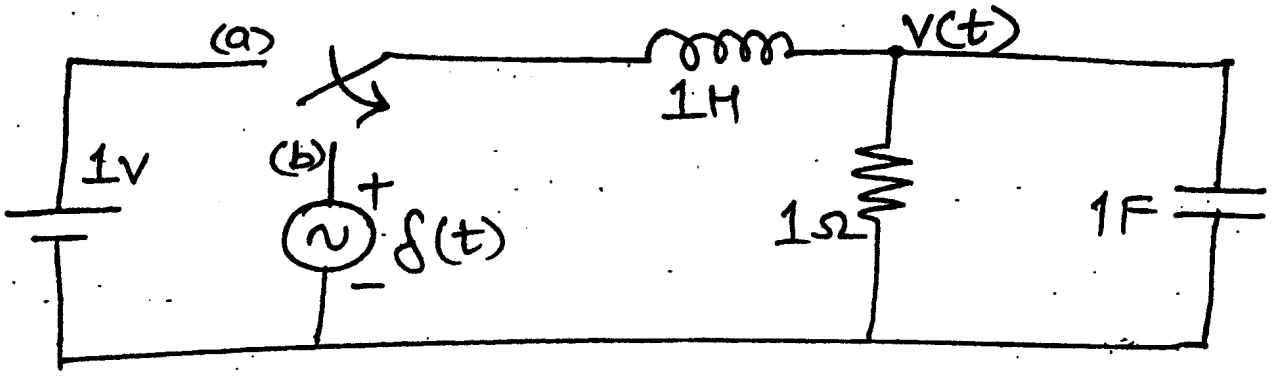
5. (a) In the network below, key is closed at t = 0, Find $i_1(0^+)$, $i_2(0^+)$ and $i_3(0^+)$. 10



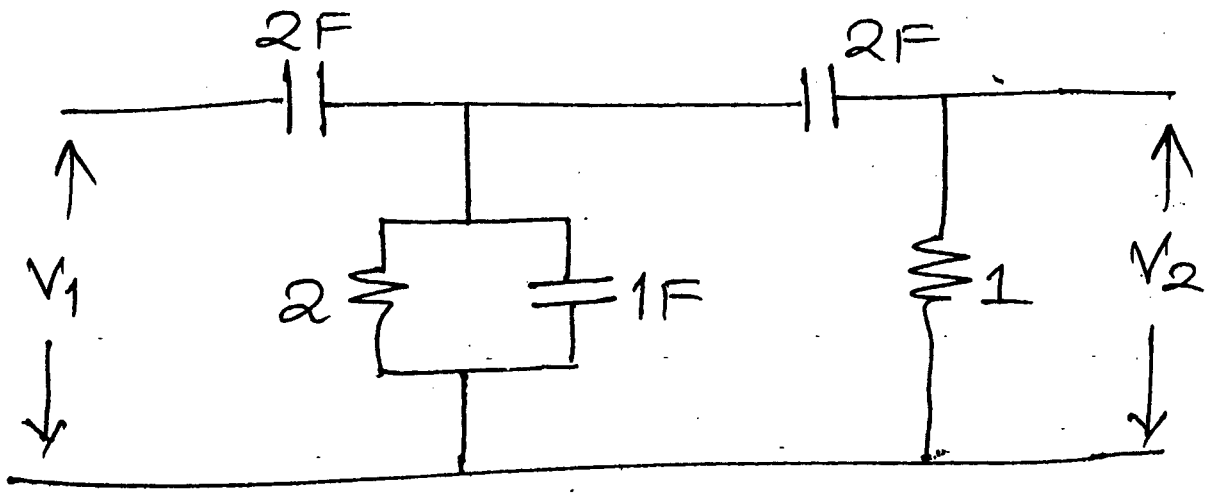
(b) Find i(t). 10



6. (a) The circuit attains steady state with switch at position (a) and is moved to position (b) at t = 0. Find v(t) for t ≥ 0. 10



(b) Find Z_{11}, Z_{21} and G_{21} **10**



7. (a) Realize following function in Foster II form **10**

$$Z(s) = \frac{(s^2+1)(s^2+3)}{s(s^2+2)(s^2+4)}$$

(b) Check following polynomials for Hurtwitz :— **10**

(i) $p(s) = s^4 + 4s^2 + 8$

(ii) $p(s) = s^4 + s^3 + 5s^2 + 3s + 4$.
