SE (EXTC) Sem - III
Electronic Devices & Circuits-I

P4–Exam.–May–11–107

Con. 3052–11.

RK–1290

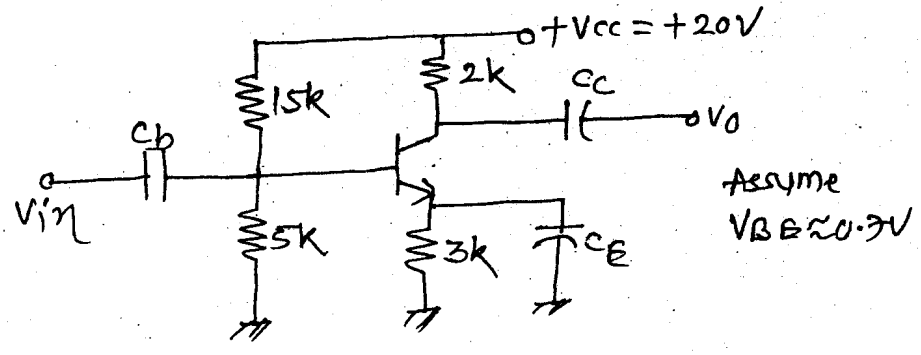
(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. 1 and 2 **is Compulsory.**
(2) Attempt **any three** questions from the remaining Five questions.
(3) Figures to the right indicate full marks.
(4) Assume **suitable data** whenever necessary but **justify** the same.

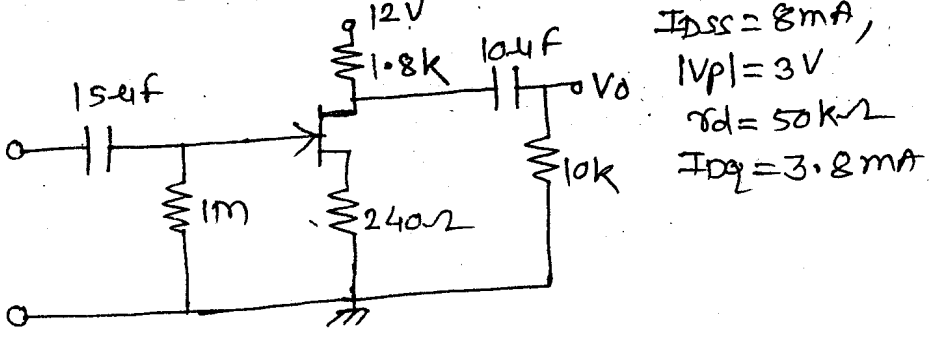
1. A full wave rectifier using a centre tapped transformer with two diodes gives output voltage of 250 V to a resistive load, the current being 75±25mA. If the ripple factor is 0.001, calculate the specification of the devices and components required if the filter used are – 20
   i) L section (LC) filter, ii) π- Filter and iii) C filter. Draw complete circuit diagrams each case.

2. a) Design a Single stage RC coupled amplifier using FET BFW-11 biased to provide 3.5 mA to achieve voltage gain of 10, lower cutoff frequency of 20 Hz and to provide Vo=2.5 V. 15
   b) For the designed amplifier find Av, Ri, Ro. 05

3. a) Determine the values of the biasing components for a CE configuration if Vcc=12V, V_{CE}=6 V, R_C = 1K, V_{BE}=0.6 V, h_{FE}=180 for the following circuits- 10
   (i) Fixed bias without R_E.
   (ii) Voltage divider biasing with V_{RE}=1 V.
   b) Determine Q Point and draw the dc load line for the following circuit. 10



4. a) For the following circuit, determine Av, Ri, Ro. 10



   b) For a CE amplifier derive the expressions for Av, AI, Zi and Zo. 10

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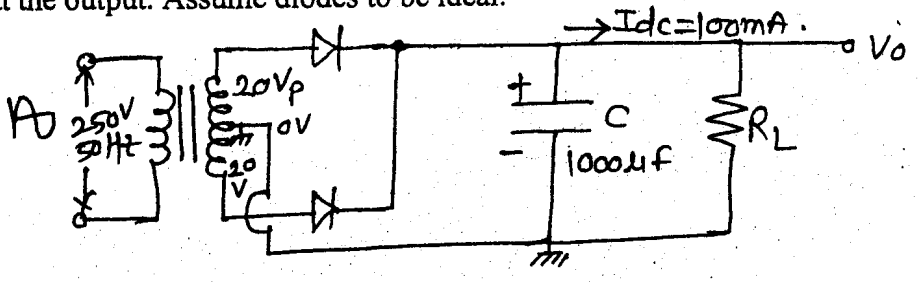
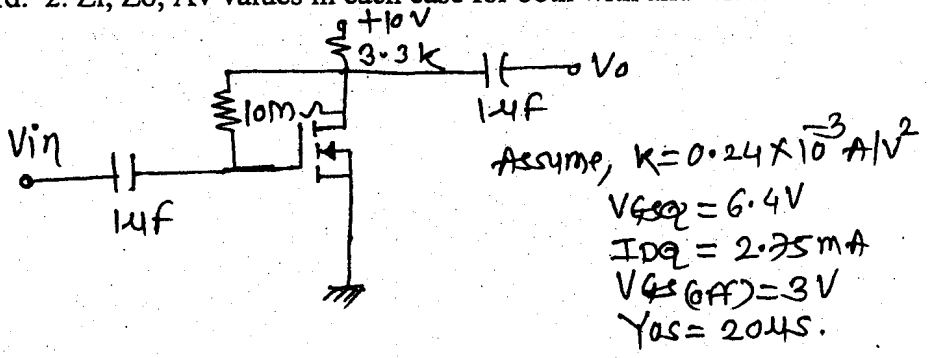
5. a) For the following circuit determine d.c. output voltage, ripple factor and ripple at the output. Assume diodes to be ideal. 10

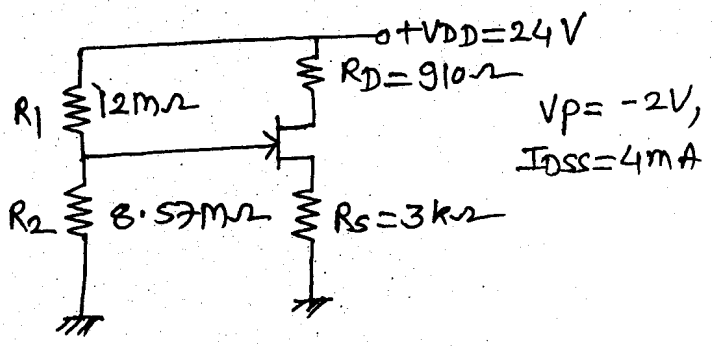


b) What are the causes of instability of operating point of a BJT amplifier? Derive the expression for stability factor S_{ICO} for voltage divider bias circuit. 10

6. a) For the amplifier shown in following figure, determine- 10
1. Gm, rd. 2. Zi, Zo, Av values in each case for both with and without rd.



b) For the following circuit, determine I_{DQ} and verify if the FET will operate in pinch-off region. 10



7. Write short notes on any <u>three</u> of the followings- 20
   i) Power Mosfet- Characteristics, ratings and application.
   ii) Schottkey diode- Characteristics, ratings and application.
   iii) UJT- Characteristics, ratings and application.
   iv) IGBT- Characteristics, ratings and application.

DATA SHEET

Transistor type	Pdmax @ 25°C Watts	Icmax @ 25°C Amps	$V_{CE}^{(sat)}$ volts d.c.	V_{CBO} volts d.c.	V_{CEO} (Sus) volts d.c.	V_{CEX} (Sus) volts d.c.	V_{CEX} volts d.c.	V_{EBO} volts d.c.	T_j max °C	D.C. current gain min.	typ.	max.	Small Signal min.	typ.	h_{fe} max.	V_{BE} max.	θ_{j-} °C/W	Derate above 25°C W/°C
2N 3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	0·7
ECN 055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	0·4
ECN 149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	0·3
ECN 100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	0·05
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N 525(PNP)	0·225	0·5	0·25	85	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	θja
BC 147A	2·7 K Ω	18μ ℧	1·5 × 10^{-4}	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	3·2 × 10^{-4}	—
BC 147B	4·5 K Ω	30μ ℧	2 × 10^{-4}	0·4°C/mw
ECN 100	50 Ω	—	—	—
ECN 149	15 Ω	—	—	—
ECN 055	12 Ω	—	—	—
2N 3055	6 Ω	—	—	—

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_{DS} max. Volts	V_{OG} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{fs} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ ℧	6	50 KΩ	2 mW/°C	0·59°C/m
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ ℧	2·5	50 KΩ	—	0·59° C/m

S.E (EXTC) sem. III (R)
APP. Maths III

Con. 3540-11. (REVISED COURSE) RK-1296

(3 Hours) [Total Marks : 100

N.B. (i) Question **No.1** is compulsory
(ii) Answer any **four** out of the remaining six questions
(iii) Figures to the right indicate full marks

1 (A) State the First Shifting theorem of Laplace Transforms. Find the Laplace Transform of $t^2 \sin at$. [5]

(B) Find the Fourier series of $f(x)=\frac{\pi^2}{12}-\frac{x^2}{4}$, $x \in (-\pi, \pi)$. [5]

(C) Obtain the inverse Z-transform of $\frac{8z^2}{(2z-1)(4z-1)}$ [5]

(D) Solve by the Gauss-Jordan method:

$$\begin{aligned} 5x+2y+z &= 29 \\ x+4y+2z &= 4 \\ 2x-y+10z &= 44 \end{aligned}$$ [5]

2 (A) Obtain the Fourier series of $f(x)=\frac{\pi-x}{2}$, $x \in (0, 2\pi)$. Deduce that

$$\frac{\pi}{4}=1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots$$ [7]

(B) Find the inverse Laplace Transforms of (i) $\frac{2s^2-1}{(s^2+1)(s^2+4)}$ (ii) $\left(\frac{1-\sqrt{s}}{s^2}\right)^2$ [7]

(C) Define a unitary matrix. Is $A=\frac{1}{2}\begin{bmatrix} 1+i & -1+i \\ 1+i & 1-i \end{bmatrix}$ unitary? [6]

3 (A) State the convolution theorem for Z-transforms. Use the theorem to find $Z(h(k))$ where $h(k)$ is the convolution of $f_1(k) = 3^k$, $k \geq 0$ and $f_2(k) = 4^k$, $k \geq 0$ [7]

(B) Given the Laplace Transform of $f(t)$, write the formula for $L(f^n(t))$ where $f^n(t)$ is the nth order derivative of $f(t)$. If $L\{t \sin \omega t\} = \dfrac{2\omega s}{(s^2+\omega^2)^2}$, evaluate

$L\{\omega t \cos \omega t + \sin \omega t\}$ [7]

(C) Express the function $f(x) = \begin{cases} 1, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$ as a Fourier integral. Hence evaluate

$$\int_0^\infty \frac{\sin \lambda \cos \lambda x}{\lambda} \, d\lambda.$$ [6]

4 (A) State the Second Shifting theorem of Laplace transforms. Find the Laplace transform of (i) $(t-1)^2 u(t-1)$ (ii) $e^{-3t}u(t-2)$ where

$u(t-a) = \begin{cases} 0, & t < a \\ 1, & t \geq a \end{cases}$ is the Unit Step function. [7]

(B) Show that every square matrix can be expressed as a sum of a Hermitian matrix and a skew- Hermitian matrix. Express $A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & 0 & 5 \\ -3 & 3 & 4 \end{bmatrix}$ as a sum of a Hermitian matrix and a skew- Hermitian matrix. [7]

(C) Obtain the complex form of the Fourier series of $f(x) = \cos ax$ in $(-\pi, \pi)$ where a is not an integer. [6]

5 (A) (i) Find λ and μ such that the system of equations

$$\begin{aligned} x+2y+\lambda z &= 1 \\ x+2\lambda y+z &= \mu \\ \lambda x+2y+z &= 1 \end{aligned}$$

has (i) no solution (ii) unique solution (iii) infinite number of solutions

(ii) Find non-singular matrices P and Q such that

$$A=\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & -1 \end{bmatrix}$$ is in normal form [7]

(B) Find the half-range sine series of $f(x)=lx-x^2$ in $(0,l)$. Hence deduce that

$$\frac{\pi^3}{32}=1-\frac{1}{3^3}+\frac{1}{5^3}-\frac{1}{7^3}+\ldots$$ [7]

(C) Solve using Laplace transform:

$$\frac{d^2x}{dt^2}+2\frac{dx}{dt}+5x=e^{-t}\sin t,\ x(0)=0,\ x^1(0)=1$$ [6]

6 (A) Obtain the Fourier series of

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

Hence find $\sum_{n=1}^{\infty}\frac{1}{(2n-1)^4}$ [7]

(B) Find the Fourier sine transform of $e^{-|x|}$. Hence evaluate $\int_0^{\infty}\frac{x\sin mx}{1+x^2}\,dx$ [7]

(C) State the convolution theorem for inverse Laplace transforms. Apply the theorem to evaluate $L^{-1}(\frac{s}{(s^2+a^2)^2})$ [6]

7 (A) Solve the following system of equations by the Gauss-Seidel method (correct to 3 decimal places). Start with the initial values: $x=y=z=1$.

$$\begin{aligned} x+2y+z &= 0 \\ 3x+y-z &= 0 \\ x-y+4z &= 3 \end{aligned}$$ [7]

(B) Find the Z transforms of (i) $4^n\delta(n-1)$ and (ii) $u(n-1)$ where

$$\delta(n)=\begin{cases} 1, & n=0 \\ 0 & \text{otherwise} \end{cases} \quad \text{and} \quad u(n)=\begin{cases} 1, & n\geq 0 \\ 0 & \text{otherwise} \end{cases}$$ [7]

(C) Show that the set of functions $\left\{\sin\frac{\pi x}{l},\sin\frac{3\pi x}{l},\sin\frac{5\pi x}{l},\ldots\right\}$ is orthogonal in the interval $[0,l]$. Construct the corresponding orthonormal set. [6]

SE EXTC III (Rev)
Digital logic Design.

Con. 3351–11. RK–1302

(3 Hours) [Total Marks : 100

Note:- (1) Question No 1 is **compulsory.**
(2) Out of remaining Six, solve any **Four** questions.
(3) Each Question carries **20** marks and each sub-Question (a,b)carries **10** marks.
(4) assume suitable data if required.

Que (1) (a) Perform the following operations:
(I) $1011 \cdot 11 \times 101 \cdot 1$
(II) $(5A)_H \times (5B)_H$
(III) Convert $(43)_8$ in to Hexa-decimal number system.
(IV) Find $(18 - 34)_{10}$ using 2's complement number system.
(V) Convert $(9CD)_H$ in to decimal number system.
(b) Draw Standard TTL inverter, discuss its operation and draw its transfer characteristic.

Que (2) (a) (i) Explain weighted and non-weighted codes with examples.
(ii) Using NOR gates draw Inverter, AND, OR gates.
(b) For the following function find the reduced Boolean equation using Quine McClusky method;
$F(A,B,C,D) = \sum m(3,4,9,13,14,15) + \sum d(5,7)$

Que (3) (a) For the following function implement the logic circuit using (i) only NAND gates, (ii) only NOR gates;
$F(A,B,C,D) = \sum m(1,3,4,6,9.11,12,14) + \sum d(2,5,8,15)$
(b) Explain following characteristics of logic families with examples;
(i) Figure of merit (ii) Fan out (iii) Voltage parameters
(iv)speed (v) Noise margin.

Que (4) (a) Draw JKMS flip flop using gates and explain its operation.
(b) Do the following conversion of flip flops;
(i) JKMS to D (ii) SR to T

Que (5) (a) Implement 16:1 multiplexer using 4:1 multiplexers only and explain its operation.
(b) Design 1:4 de-multiplexer with active high outputs and explain its operation.

Que (6) (a) Design Mod 6 up synchronous counter using JKMS flip flops.
(b) Draw a state diagram of sequence detector to detect a non overlapping sequence ----1101---- and write its state table. Find the equivalent states if they are present.

Que (7) Write short notes on any 2
(i) FPGA (ii) PLA (iii) Full Subtractor.

SE EXTC III (Rev)
Electronic Instrumentation

VT-April.-11- 207

Con. 3626–11.

RK–1293

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

N.B. : (1) Question No. **1** is **compulsory.**
(2) Attempt any **four** questions from remaining **six** questions.

1. Attempt any **four** questions :– **20**
   (a) Explain important characteristics to a Transducers.
   (b) Define term Telemetry. Explain any Telemetry system using suitable diagram.
   (c) What is Z-axis intensity control ?
   (d) What are the advantages of computer based DAS ?
   (e) State advantages of Electronic Voltmeters over conventional type Analog Voltmeter.
   (f) State important specifications of Spectrum Analyzer.

2. (a) With the help of neat diagram explain principle of dual slope integration DVM and its operation. Also state its advantages and disadvantages. **10**
   (b) Digital frequency counter used for ratio measurement for frequencies such as f_1 = 1 MHz and f_2 = 200 kHz. Calculate % error in measurement. Suggest suitable solution for improving accuracy of measurement by 10 times. **10**

3. (a) With the help of diagram explain construction and operation of LVDT. What are diffrent performance characteristics of LVDT ? **10**
   (b) Draw the block diagram of a general purpose CRO. Explain the functions of various blocks. **10**

4. (a) Explain Flash ADC. State its advantages and disadvantages. **10**
   (b) Estimate the Bandwidth of CRO if a signal of 12 MS rise time is observed as the signal with 15 MS rise time. **10**

5. (a) Explain Universal Counter with neat block diagram. Explain the applications of Universal Counter. **10**
   (b) A platinum resistance thermometer has a resistance of 150 Ω at 0 °C. What is the resistance when temperature is 200 °C ? When the thermometer has a resistance of 400 Ω, what is the value of temperature ? The resistance temperature coefficient of platinum is 0·0039/°C. **10**

6. (a) Explain the Digital Storage Oscilloscope. Also explain various modes of operations of DSO. **10**
   (b) Explain Pulse Amplitude Modulation in detail. **10**

7. Write short notes on (any **three**) :– **20**
   (a) Significance of 3½ and 4½ digit in DVM.
   (b) Capacitive Transducers
   (c) True RMS Meter
   (d) Network Analyzer.

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SE (EXTC) Sem-III (CR)
Electrical Network.

124 : 1st half.11-PH(I)

Con. 3669-11. **RK-1299**

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

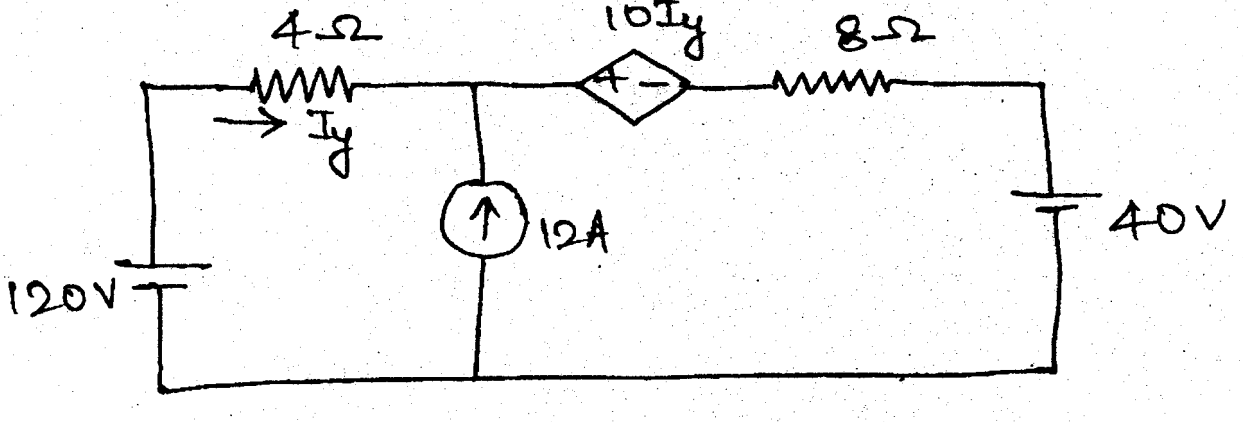
N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) Assume suitable **data** if **necessary** and state it **clearly.**

1. (a) Write the V-I relationship and their ρ-domain equivalent for resistor, inductor and capacitor. **5**
   (b) The reduced incident matrix of an oriented graph is– **5**

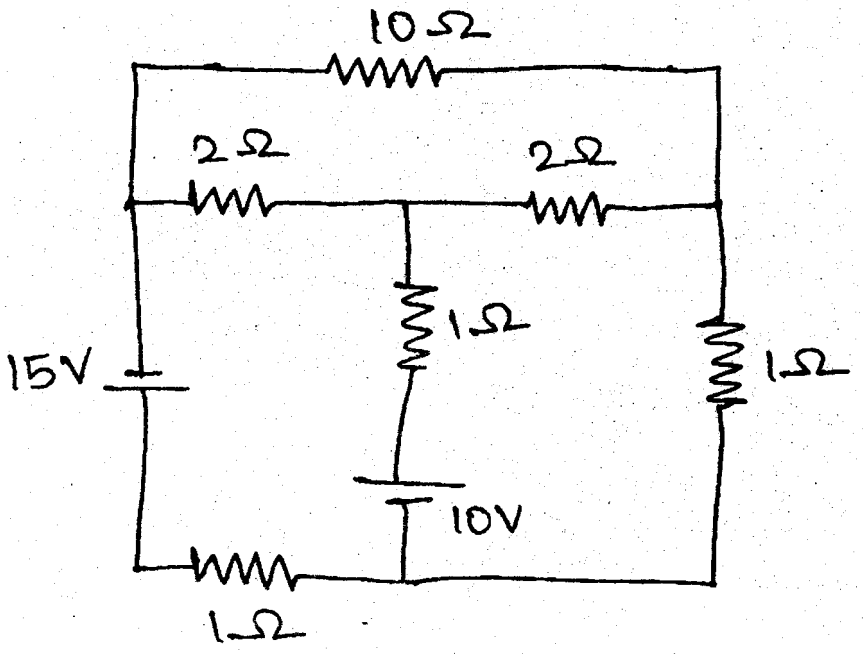
$$A=\begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

   Draw the graph. How many tress are possible for this graph ? Write the tie-set and cut-set matrix.
   (c) State and explain properties of Hurwitz polynomial. **5**
   (d) Write short note on interconnection on 2-port N/w. **5**

2. (a) Using super-position theorem, find the current I_y. **10**



   (b) Find the current through 10 Ω resistor. **10**



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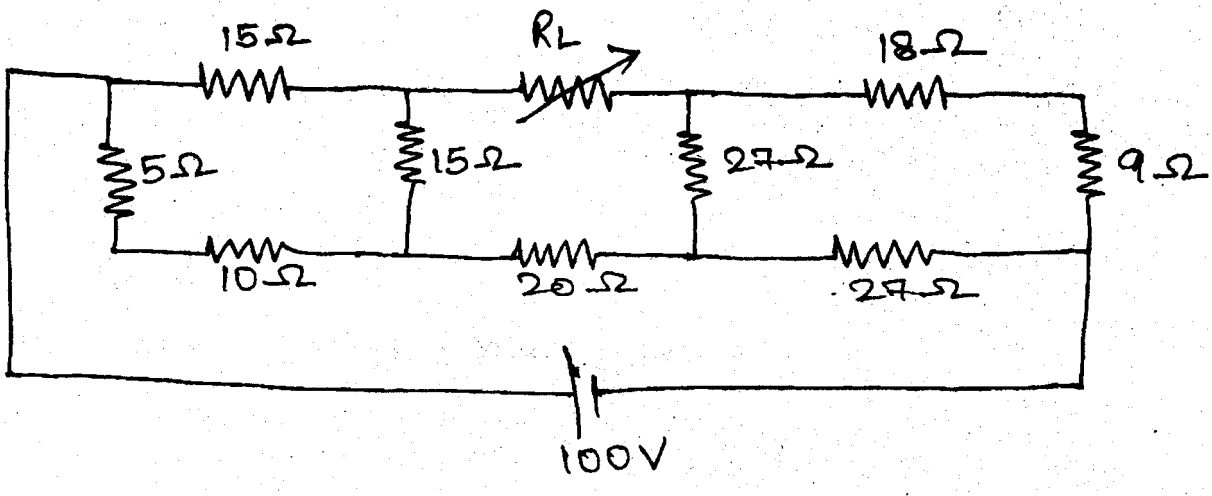
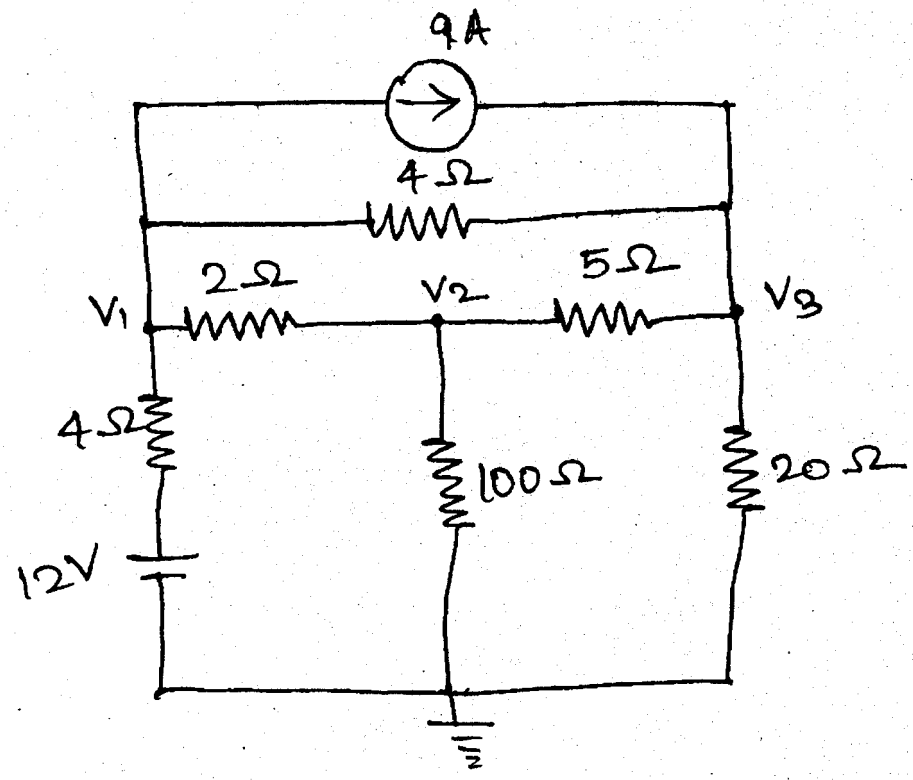
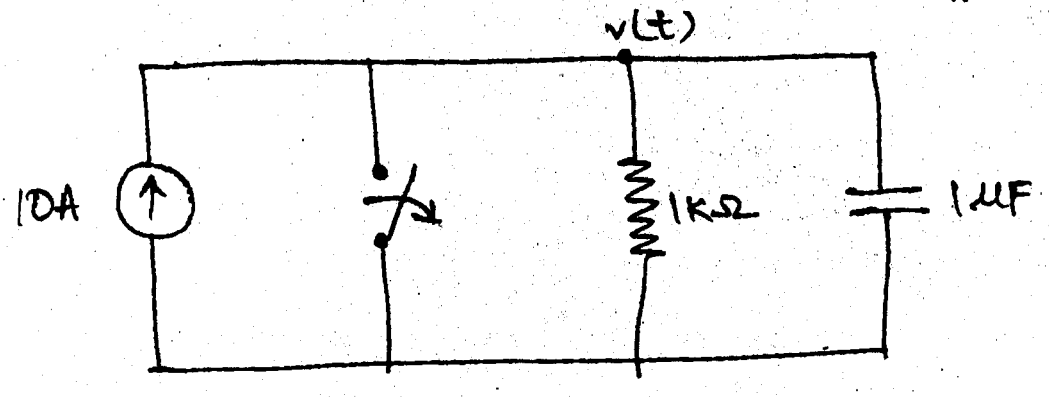
3. (a) For the circuit shown, find the value of resistance R_L for maximum power and calculate the maximum power. **10**



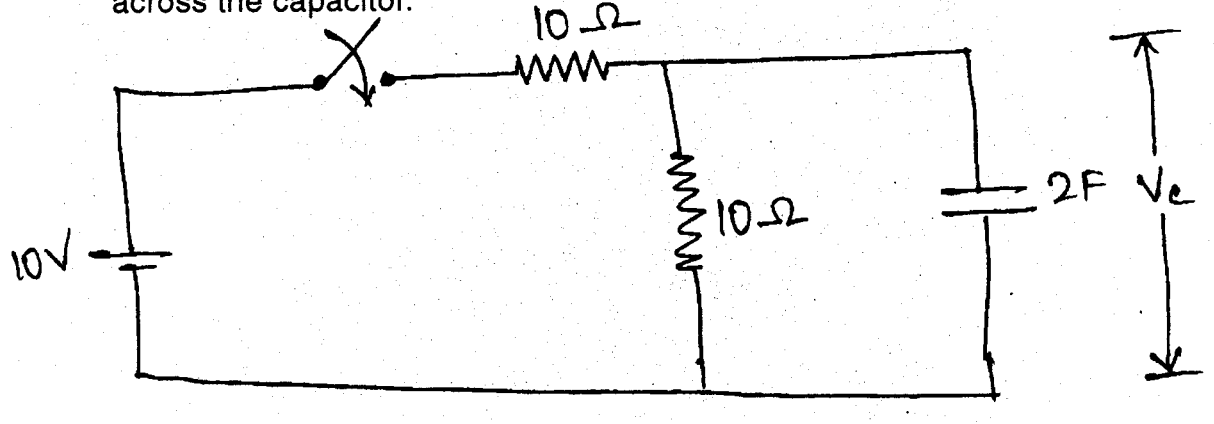
(b) Find the voltage across the 5- Ω resistor using Nodal analysis. **10**



4. (a) In the given network, the switch is open at t = 0, solve for v, $\frac{dv}{dt}$, $\frac{d^2v}{vt^2}$ at t = O$^+$. 10



(b) The switch in the network shown below is closed at t = 0. Determine the vtg across the capacitor. 10



5. (a) Test whether– 10

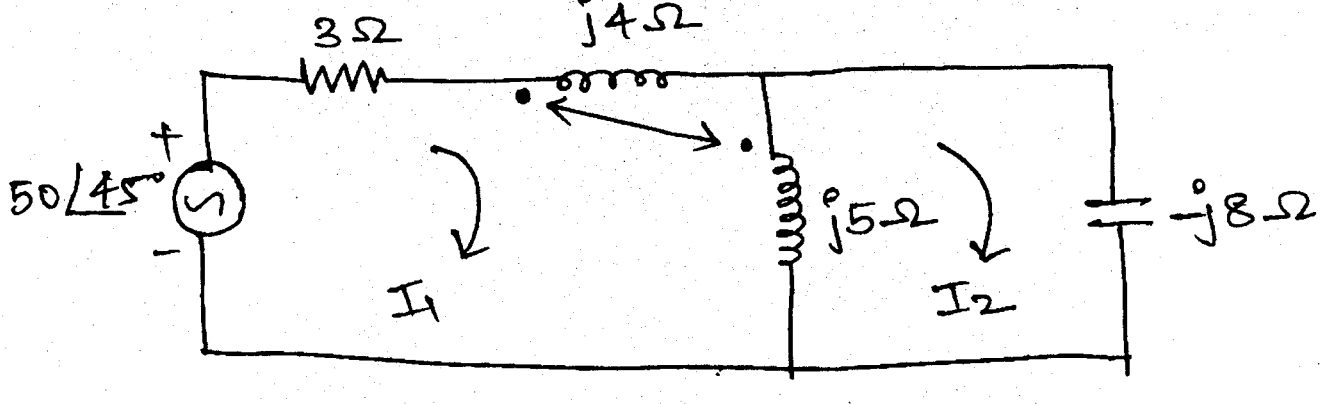
$$F(s) = \frac{2s^3 + 2s^2\,3s + 2}{s^2 + 1}.$$

Is positive real function ?

(b) Realize Foster forms of L.C impedence circuit. 10

$$z(s) = \frac{(s^2 + 1)\ (s^2 + 3)}{s(s^2 + 2)}.$$

6. (a) Find the current I_2 using Mesh analysis. 10



(b) Test whether the following polynomial are Hurwitz :—
(i) $s^5 + 2s^4 + 4s^3 + 6s^2 + 2s + 5$ 5
(ii) $2s^6 + s^5 + 13s^4 + 6s^3 + 56s^2 + 25s + 25$. 5

7. (a) Write short notes on (any **two**) :– 10
(i) Positive Real Functions.
(ii) Time domain response of R-L-C series ckt.
(iii) Time domain analysis using laplace transform.

(b) Find the open-ckt impedence parameters for the n/w shown :— 10