AIKTC/KRRC/SoET/ACKN/QUES/2017-18/ **Date:** _____

School: SoET-CBCS **Branch:** ELECT. ENGG. **SEM:** IV

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Applied Mathematics- IV	EEC401		✓	
2	Power System - I	EEC402		✓	
3	Electrical Machines – II	EEC403		✓	
4	Electromagnetic Field and wave Theory	EEC404		✓	
5	Analog and Digital Integrated Circuits	EEC405		✓	
6	Electrical Network	EEC406		✓	

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

AIKTC/KRRC/SoET/ACKN/QUES/2017-18/ **Date:** _____

School: SoET-CBCS **Branch:** CIVIL ENGG. **SEM:** V

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Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Structural Analysis – II	CE-C501			
2	Geotechnical Engg. - I	CE-C502			
3	Applied Hydrolics-I	CE-C503			
4	Environmental Engineering - I	CE-C504			
5	Transportation Engg. – I	CE-C505			
6	Department Level I–Optional Course	CE-C506			
7	Business and Communication Ethics				

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

SF-sem-IV – Choice Based – Electrical – AM-IV

11/5/1

Q.P. Code: 37579

Duration – 3 Hours **Total Marks : 80**

(1) N.B.:-Question no 1 is compulsory.
(2) Attempt any THREE questions out of remaining FIVE questions.

Q.1) a) Find the extremal of the functional $\int_0^{\pi/2}(y'^2 - y^2 + 2xy)\,dx$ with y(0)=0 and $y\left(\frac{\pi}{2}\right)$=0. (5)

b) A continuous random variable has probability density function $f(x) = kxe^{-\frac{x}{3}},\ x > 0$.Find 'k' and the mean. (5)

c) Find the minimal polynomial of A=$\begin{bmatrix}2 & -3 & 3\\ 0 & 3 & -1\\ 0 & -1 & 3\end{bmatrix}$ and check whether it is derogatory. (5)

d) Evaluate $\int_c \frac{z^2-2z+4}{z^2-1}dz$ where $c: |z-1| = 1$. (5)

Q.2 a) If $A=\begin{bmatrix}-1 & 4\\ 2 & 1\end{bmatrix}$, then prove that $3\tan A = A\tan 3$. (6)

b) Evaluate $\int_C \frac{\sin \pi z + \cos \pi z}{z^2+z}\,dz$; C is $|z|=4$. (6)

c) Let V={(x,y) / x, y∈ R, y>0}. Let (a,b), (c,d) ∈ V and α ∈ R. Define (a,b)+(c,d) = (a+c, b . d) and α (a, b)=(α a, b^{α}). Examine whether V is a Vector space. (8)

Q.3 a) Calculate the Karl Pearson's coefficient of correlation for the following bivariate series. (6)

X	28	45	40	38	35	33	40	32	36	33
Y	23	34	33	34	30	26	28	31	36	35

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b) Find the curve y=f(x) for which $\int_{x_1}^{x_2} y\sqrt{1+y'^2}\,dx$ is minimum subject to the constraint $\int_{x_1}^{x_2} \sqrt{1+y'^2}\,dx = l$. (6)

c) Evaluate the integral $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+1)(x^2+4)}\,dx$ using Residue theorem. (8)

Q. 4 a) Let R^3 have the Euclidean inner product. Use Gram-Schmidt Process to transform the basis $\{u_1, u_2, u_3\}$ into orthonormal bases where $u_1=(1,1,1)$, $u_2=(0,1,1)$, $u_3=(0,0,1)$. (6)

b) Find the lines of regression for the following data (6)

x	65	66	67	67	68	69	70	72
y	67	68	65	66	72	72	69	71

c) A skilled typist,on routine work, kept a record of mistakes made per day during 300 working days. (8)

Mistakes per day	0	1	2	3	4	5	6
No of days	143	90	42	12	9	3	1

Fit a Poisson distribution to the above data and hence calculate the theoretical frequencies.

Q. 5 a) A random variable X has the following probability distribution (6)

X	0	1	2	3
P(X=x)	1/6	1/3	1/3	1/6

Compute i) Moment generating function about the origin, ii) first two raw moments and hence the variance.

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b) Find eigen values and eigen vectors of A^3-2A+I if $A=\begin{bmatrix}2&2&1\\1&3&1\\1&2&2\end{bmatrix}$. (6)

c) Obtain the Laurent and Taylor's series for $\frac{z-1}{z^2-2z-3}$ indicating region of convergence. (8)

Q. 6 a) Using Rayleigh-Ritz method, solve the boundary value problem $I=\int_0^1(xy+\frac{1}{2}y'^2)dx; 0\le x\le 1$ Given y(0)=0 and also y(1)=0. (6)

b) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find mean and standard deviation of the distribution. (6)

c) If $A=\begin{bmatrix}1&0&0\\1&0&1\\0&1&0\end{bmatrix}$. Show that for every integer n ≥ 3, (8)

$A^n=A^{n-2}+A^2-I$. Hence find A^{50}.

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SE-sem-IV - choice Based - Electrical - PS-I

17/5/1

Q.P. Code: 38443

[Time: Three Hours] [Marks:80]

Note:
1. **Question No. 1 is compulsory.**
2. **Attempt any 3 questions from the remaining five questions.**
3. **Figures to the right indicate full marks.**
4. **Make suitable assumptions wherever necessary.**

I) Answer any Four. **(20)**

a) What are bundled conductors? For Extra high voltage (EHV) transmission bundled conductors are used. Justify.

b) Derive the expression for voltage regulation of a short transmission line from its phasor diagram.

c) Pin type insulators are used for low voltage lines while suspension type insulators are used for high voltage lines. Explain.

d) What is per unit system? How base values are selected?

e) What are the capacitances in 3-Φ , 3 core cables. How they can be measured?

II) **(10)**

a) Fig.1 below shows a power system. The ratings of generators and transformers are as follows:

Generator G_1 : 25 MVA, 6.6 kV, j 0.2 p.u
Generator G_2 : 15 MVA, 6.6 kV, j 0.15 p.u
Generator G_3 : 30 MVA, 13.2 kV, j 0.15 p.u
Transformer T_1 : 30 MVA, 6.6 kVΔ / 115 kV Y, j0.1 p.u
Transformer T_2 : 15 MVA, 6.6 kVΔ / 115 kV Y, j0.1 p.u
Transformer T_3 : single phase units each rated 10 MVA, 69/6.9 kV, j0.1 p.u

Draw the reactance diagram with all values in p.u. on a base of 30 MVA, 6.6 kV in the circuit of Generator G_1

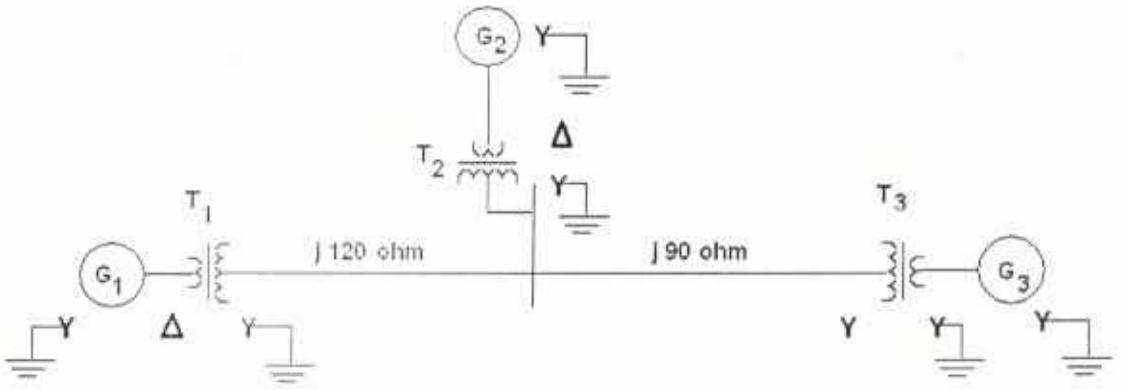

Fig. 1

b) With neat single line diagram explain the general AC power transmission scheme. **(10)**

III)

a) Draw the circuit representation and phasor diagram of a medium transmission line in Nominal Π method and also derive the expressions for its A,B,C,D constants. **(10)**

b) A 3-Φ, 66 kV, 50 Hz line has a resistance of 9.6 Ω, inductance of 0.097 H and capacitance of 0.765 μF per phase resp.. It delivers 24 MVA at 66 kV at 0.8 pf lagging. Find voltage regulation and transmission efficiency. Use Nominal T circuit. **(10)**

IV)

a) Assuming the shape of an overhead line to be a parabola, derive the expression for calculating sag and conductor length. How can the effect of wind and Ice loadings be taken into account? **(10)**

b) A string insulator has 3 units. The capacitance from each joint to the tower is 12.5 % of the capacitance of each unit. It is desired that the voltage across any unit should not exceed 11 kV. Find the maximum voltage across the string for which it can be used. **(10)**

V)

(a) Derive the expression for inductance per phase of a 3-ø double circuit line with flat vertical spacing. Assume the line is transposed. **(10)**

(b) A 3-Φ, single circuit bundled conductor line with three sub-conductors per phase has horizontal spacing with 6.1 m between the centre lines of adjacent phases. The distance between the sub conductors of each phase is 30.5 cm and each sub-conductor has a diameter of 2.54 cm. Find the inductance and capacitance per phase per km. **(10)**

VI) Answer any two **(20)**

(a) What do you understand by Grading of Cables ? Explain any one method in detail.

(b) What are the different methods of Neutral Grounding? Explain the features of solidly (Effectively) grounded system and Resonant (Arc suppression coil) grounding.

(c) Define earth electrode, earth current , resistance of earth electrode, Tolerable step and touch potential.

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72 SE-sem-IV- Electrical — Choice Based- EM-II 23/05/18

Q.P.Code: 50056

(3 Hours) [Total Marks:80]

Q.1 is compulsory.

Solve ANY THREE questions out of remaining.

ASSUME SUITABLE DATA wherever necessary.

Q.1 Answer **ANY FOUR**. (20Marks)

a) Mention types of winding used in transformer and explain any one in detail.

b) Define:**i)** Rated Burden **ii)** Accuracy Class in relation with current transformer (CT).

c) List out the conditions to be satisfied for successful parallel operation of three phase transformers.

d) Explain any one connection of phasor group number 4 in case of three phase transformer.

e) Write down the desirable properties of magnetic materials used in electric machine design.

Q.2 (20Marks)

a) Derive an expression for saving in copper in case of auto-transformer as compared to conventional transformer.

b) Explain 'Sumpner Test'in detail with diagram.

Q.3 (20Marks)

a) Write a short note on 'Scott Connection'.

b) Two 3 phase transformers having same turns ratio are connected in parallel to supply a load of 800 kW at 0.8 power factor lagging. Transformer 'A' is rated at 400 KVA with per unit resistance of 0.02 and per unit reactance of 0.04, transformer 'B' is rated at 600 KVA with per unit resistance of 0.01 and per unit reactance of 0.05. Determine power output and power factor of each transformer.

Q.4 (20Marks)

a) Explain the assumptions made in leakage reactance calculation of three phase core type transformer.

b) Write a short note on 'mechanical forces' in transformer.

Q.5 (20Marks)

a) A single phase, 50 KVA, 2400/120 V transformer gave following results:

Open Circuit test	120 V	9.65 A	396 W on LV side
Short Circuit test	92 V	20.8 A	810 W on HV side

Determine the equivalent circuit parameters, and voltage regulation at full load, 0.8 power factor lagging.

b) Write a short note on 'Oscillating neutral'.

TURN OVER

Q.6 (20Marks)

a) Derive output equation for a 3 phase transformer. Also mention meaning of terms used in it.

b) Calculate approximate overall dimensions for a 200 KVA, 6600/440 V, 50 Hz, 3 phase core type transformer.
Assume following data: EMF per turn 10 V, maximum flux density $1.3Wb/m^2$, Current density $2.5A/mm^2$, Window space factor 0.3, overall height =overall width, stacking factor 0.9, $a = 0.9\ d$ and $A_i = 0.6d^2$, where d is diameter of circumscribing circle.

72 SE-sem-IV- chvile-Based- Electrical- EFW 29/5/18

Q.P.Code: 38368

Duration: 3Hrs **Marks: 80**

N.B. 1. **Q.No.1 is compulsory**
2. Solve **any three** out of remaining questions.
3. Assume suitable data wherever necessary and justify the same.

Q.1 Solve **any four**:- **20**

a) An electric field at a point P ,expressed in cylindrical coordinate system is given by $\overline{E} = 6r^2 \sin\phi \overline{a_r} + 2r^2 \cos\phi \overline{a_\phi}$
Find the value of divergence of field if the location of point P is given by (5, 5, 5) in cartesian coordinate system.

b) State Gauss' law in point and integral form and give two examples.

c) Explain magnetic forces acting on conductor carrying current I and electric charge Q moving with fixed velocity $\overline{U}$.

d) Derive the expression for conduction and displacement current density.

e) What are the parameters of electromagnetic waves and give their role?

Q.2 a) Derive an electric field intensity due to a finite volume, having density $\rho_v(C/m^3)$. **10**

b) The electric flux density is given as $\overline{D} = \frac{r}{4}\overline{a_r}$ nC/m^2 in free space. Calculate (a) the electric field intensity at r=0.25m,(b)the total charge within a sphere of r=0.25m,and(c)the total flux leaving the sphere r=0.35m. **10**

Q.3 a) Obtain $\overline{H}$ due to finite circular closed current carrying conductor and an infinitely long straight filament of current I. **10**

b) Potential is given by $V = 2(x+1)^2(y+2)^2(z+3)^2$ V in free space. At a point P(2,-1,4)calculate (i)the potential at point P,(ii)electric field intensity $\overline{E}$ at point P (iii)flux density $\overline{D}$ at point P,(iv)volume charge distribution ρ_v at point P, and (v)unit vector in the potential gradient direction at P. **10**

Q.4 a) A boundary exists at z=0 between two dielectrics $\varepsilon_{r1} = 2.5$ region z<0,and $\varepsilon_{r2} = 4$ region z>0.The field in the region 1 is $\overline{E_1} = -30\overline{a_x} + 50\overline{a_y} + 70\overline{a_z}$ V/m. Find (a)normal component of $\overline{D_2}$ (b)tangential component of $\overline{D_2}$ (c)polarization in the second medium,(d)angle between $\overline{E_2}$ and normal to the surface. **10**

b) A straight conductor of 0.2m lies on the x axis with one end at origin. The conductor is subjected to a magnetic flux density $\overline{B} = 0.04\overline{a_y}$ T and velocity v=2.5sin10^{3}t$\overline{a_z}$ m/s. Calculate the motional electric field intensity and emf induced in the conductor. **10**

Q.5 a) Derive Maxwell- Faraday's electromagnetic induction equation in the time domain and explain them in frequency domain. **10**

b) An a. c. voltage source $v = V_m \sin\omega t$ is connected across a parallel plate capacitor C. Find the relation between displacement and conduction current of the wires. **10**

Q.6 a) Derive wave equation and its simplest form for partial conducting medium. **10**

b) Given $\overline{E}(x,t) = 10^3 \sin(6X10^8 t - \beta x)\overline{a_y}$ V/m in free space, sketch the wave at t=0 and at time t_1, when it has travelled $\lambda/4$ along the x-axis. Find t_1, β and λ. **10**

72

SE- sem-IV- choice Based – Electrical - ADIC 4/6/18

Q. P. Code: 38799

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

N.B. **(1)** Question no.1 is compulsory.
(2) Attempt any three from the remaining.
(3) Numbers to the right indicate full marks to that question

Q.1 Answer any **FIVE** from the following. 20

(a) State the ideal op-amp characteristics with their significance.
(b) Draw and explain block diagram of op-amp.
(c) Compare op-amp close loop configurations in inverting and non-inverting mode.
(d) i) Simplify the Boolean expression and implement using gates

$$Y = AB\overline{C} + A\overline{B} + ABC + \overline{(A + \overline{BC})}$$

ii) Perform binary subtraction using 2's complement for decimal numbers.
$(65)_{10} - (20)_{10}$
(e) Define for Digital ICs: i) Fan-in and Fan-out ii) Noise immunity
(f) Convert the following: i) (A7E3.F9)16 to binary ii) 10011010_2 to decimal

Q.2 **(a)** With neat circuit diagram and waveforms, explain operation of op-amp as a Summing amplifier. 10
(b) With neat functional block diagram, explain operation of IC 555 timer as monostable multivibrator. Draw the waveforms for output voltage and capacitor voltage. 10

Q.3 **(a)** Simplify the following using K-map implement using NAND gates 10
$f(A,B,C,D) = \sum m\,(0,1,2,5,9,13,14,15) + d(4,6,7,10)$
(b) Convert 10
i) JK Flip flop to T Flip flop
ii) Compare TTL and CMOS logic family

Q.4 **(a)** Draw and explain op-amp as differentiator. Also draw its input and output waveforms. 10
(b) Design and implement full subtractor circuit using logic gates 10

Q.5 **(a)** Design and implement 4 bit binary to gray code converter. 10
(b) Implement the following function using 8:1 multiplexer 10
$f(A,B,C,D) = \sum m(0,1,3,5,6,7,8,10,12,14)$

Q.6 **(a)** Explain types of Voltage regulators. 10
(b) Design 3 bit synchronous up counter using JK flip flop 10

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(72) SE - sem-IV - choice Based - Electrical - EM 8/6/18

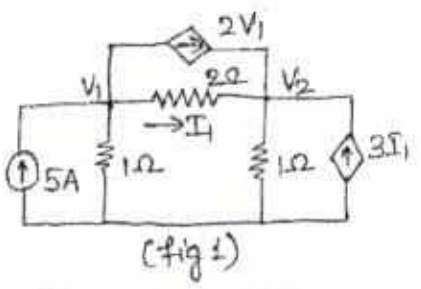
Q. P. Code: 39895

(3 Hours) [Total Marks: 80

N.B.: (1) Question No. **1** is **compulsory.**
(2) Answer any **three** from the remaining **five** questions.
(3) **Assume** suitable **data** if necessary and justify the same.
(4) **Figures** to the **right** indicate the marks.

1 Answer **any four**. [20]

(a) Using nodal analysis, find voltages V_1 and V_2. (refer fig 1)



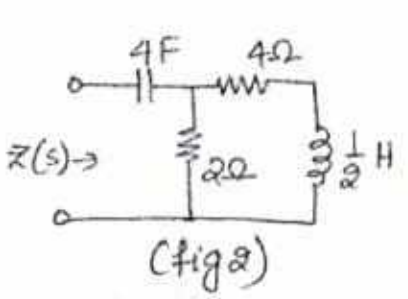
(fig 1)

(b) List out the properties of a tree.

(c) Using Laplace transform, obtain the expression for current in a series RC circuit when a unit ramp signal is applied.

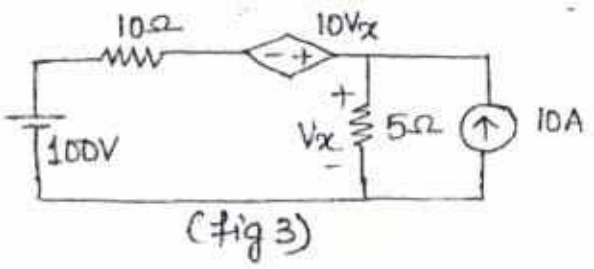
(d) Derive the condition for reciprocity in transmission parameters.

(e) Find poles and zeros of the impedance of the following network and plot them on the s-plane. (refer fig 2)



(fig 2)

2 (a) Using Thevenin's theorem, find the current in the 10Ω resistor. (refer fig 3) [8]



(fig 3)

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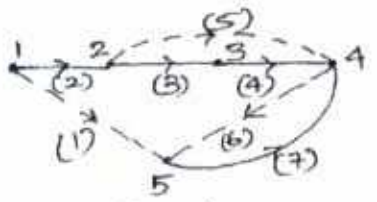
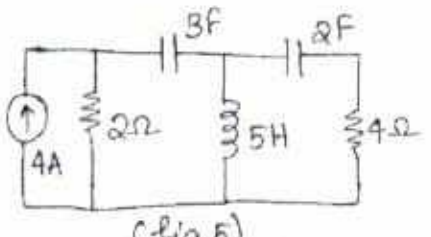
(b) For the graph shown, write the tieset matrix and f-cutset matrix. (refer fig 4) [8]



(fig 4)

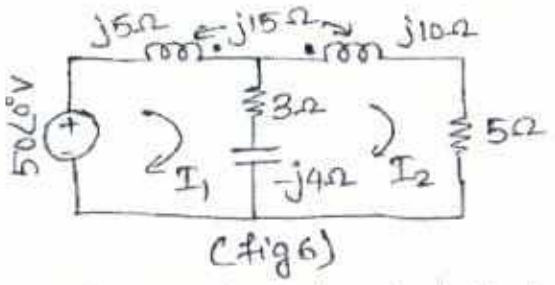
(c) Draw the dual of the network shown. (refer fig 5) [4]



(fig 5)

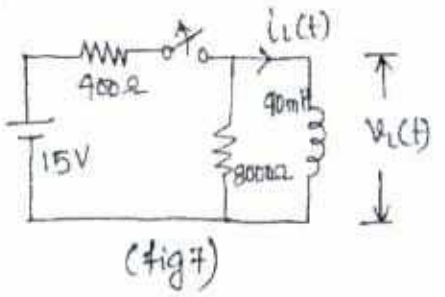
3 (a) Explain the concept of super mesh and super node with an example. [5]

(b) Write the mesh equations for the circuit shown. (refer fig 6) [5]



(fig 6)

(c) For the network shown in figure, steady state is reached with the switch closed. The switch is opened at t = 0. Obtain expressions for $i_L(t)$ and $v_L(t)$. (refer fig 7) [10]



(fig 7)

4 (a) Using differential method, derive the expression for current in a series RL circuit. Draw its characteristics and define time constant. [6]

(b) Mention the restrictions on pole and zero locations for driving - point functions. [4]

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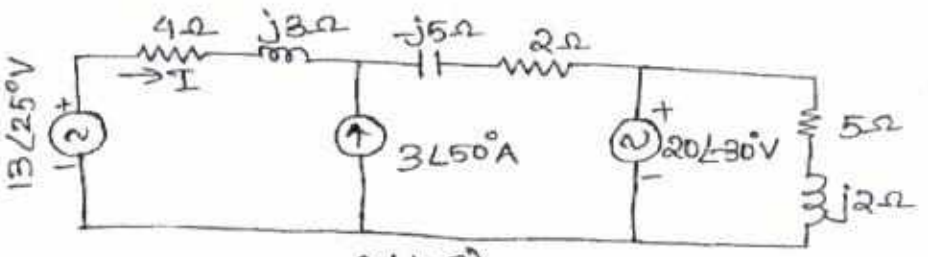
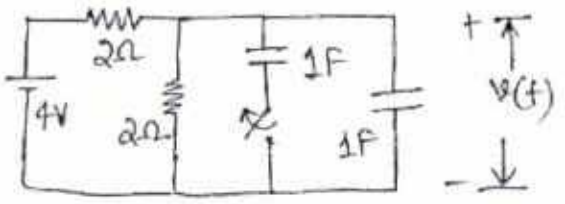
4 (c) Find the current I in the network shown, using superposition theorem. (refer fig 8) **[10]**



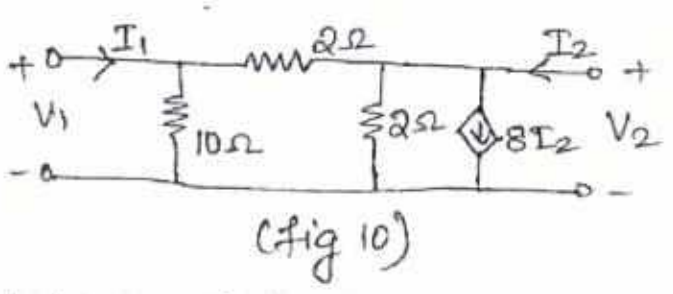
(fig 8)

5 (a) The network shown in figure has acquired steady state at $t < 0$ with the switch closed. The switch is opened at $t = 0$. Determine v(t). (refer fig 9) **[10]**



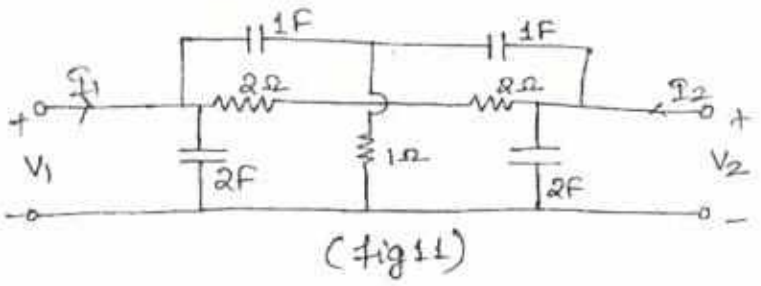
(fig 9)

(b) For the network shown in figure, find Z and h – parameters. (refer fig 10) **[10]**



(fig 10)

6 (a) Find the short circuit parameters for the network shown. (refer fig 11) **[10]**



(fig 11)

(b) The voltage V(s) of a network is given by **[10]**

$$V(s) = \frac{3s}{(s+2)(s^2+2s+2)}$$

Plot its pole – zero diagram and hence obtain v(t) using graphical method.

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