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

Note: 1) Question 1 is compulsory.
2) Attempt any 3 questions from Question 2 to Question 6
3) Figures to the right indicate full marks.

Q1 Attempt All questions

A If $A = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$ then find the Eigen values of $A^3 + 5A + 8I$ **5**

B Find Laplace transform of $f(t) = te^{3t} \sin 4t$ **5**

C Find the half range Fourier sine Series for $f(x) = x^2 + 1$, where $x \in (-\pi, \pi)$ **5**

D Prove that f(z) = $x^2 - y^2 + 2ixy$ is analytic and also find its derivative **5**

Q2

A Using Green's theorem in a plane to evaluate the line integral **6**

$$\oint_C (x^2 - y)dx + (2y^2 + x)dy$$

Around the boundary of the region defined by $y=x^2$ and $y=4$

B Find the Eigen values and Eigen vectors of the matrix **6**

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

C Show that the function $v = 3x^2y+6xy- y^3$ is harmonic function and find the corresponding analytic function. **8**

Q3

A If $\bar{F} = x^2zi-2y^3z^3j + xy^2z^2k$ find div$\bar{F}$ and curl$\bar{F}$ **6**

B Find the orthogonal trajectories of the family of curves $3x^2y - y^3 = c$ **6**

C Verify Cayley-Hamilton theorem for the matrix A and hence find A^{-1} and A^4 **8**

where $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$

Q4

A Using Stokes theorem to evaluate $\int_C \bar{F} \cdot d\bar{r}$ **6**

Where $\bar{F} = 4xzi - y^2j + yzk$ and C is the area in the plane z=0 bounded by x=0, y=0 and $x^2 + y^2 = 1$

B Evaluate $\int_0^\infty \frac{e^{-t}\sin t}{t} dt$, using Laplace transforms **6**

C Using Convolution theorem find $L^{-1}\left[\frac{s^2}{(s^2+1)(s^2+4)}\right]$ **8**

Q5

A Find $L\{tcos^3t\}$ **6**

B Consider the vector field $\bar{F}$ on $\mathbb{R}^3$ defined by **6**

$$\bar{F}(x,y,z) = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$$

Show that $\bar{F}$ is irrotational.

C Expand $f(x) = lx - x^2, 0 \leq x \leq l$ **8**
in a half-range (i)cosine series (ii) sine series

Q6

A Obtain Fourier series expansion of $f(x) = 4 - x^2$ in (-2, 2) **6**

B Prove that the matrix A is diagonalisable **6**

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

C

i) Find $L^{-1}\left\{\log\left(\sqrt{\frac{s+2}{s+3}}\right)\right\}$ **4**

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

Time:3 Hrs **Marks:80**

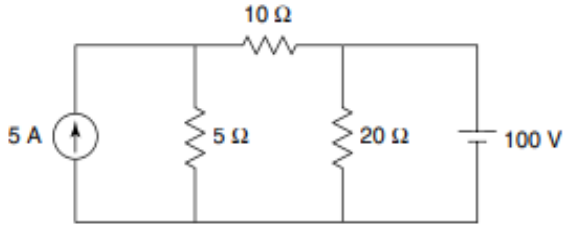
Note:

- Question No. 1 is compulsory.
- Answer any **three** from the remaining five questions.
- Assume suitable data if necessary and justify the same.

Q1 Each question carries five marks 20M

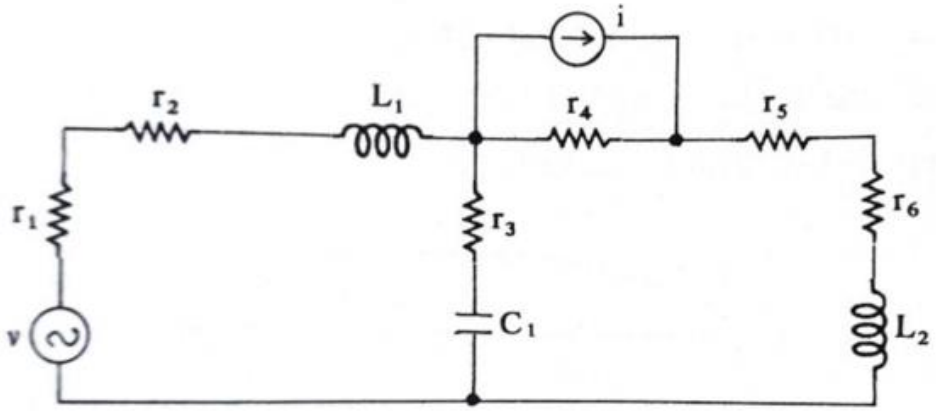
a Derive condition for symmetry for (A-B-C-D) parameters.

b Determine the current through the 20 ohm in the following circuit

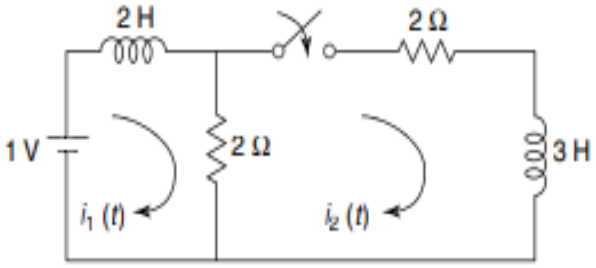


c State and Explain Maximum Power Transfer Theorem.

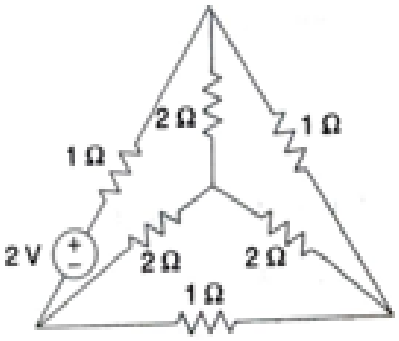
d Draw the dual of given network.



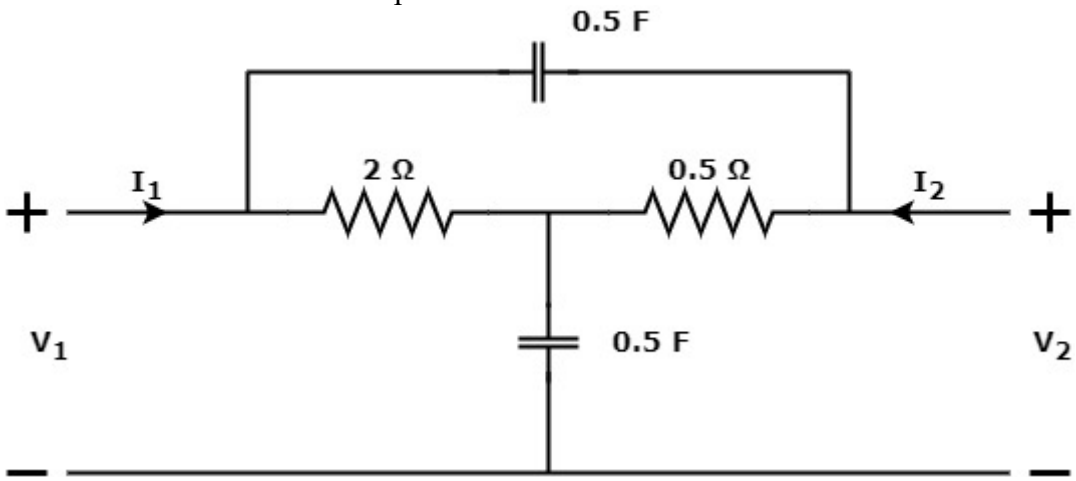
Q2 a In the network shown, the switch is closed at t = 0, the steady-state being reached before t=0. Determine the current $i_1(0^+)$ and $i_2(0^+)$. 10M



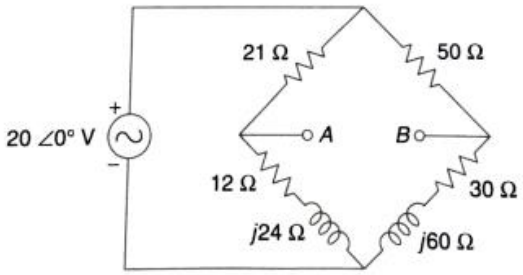
b For the following circuit,draw (a) graph, (b) tree, and (c) write the fundamental tieset matrix. 10M



Q3 a Determine the Y parameters of the network shown . 10M

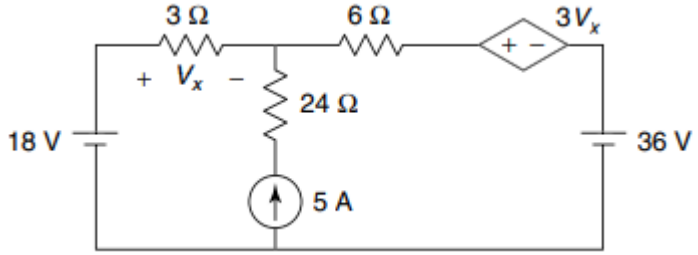


b Obtain Thevenin's Equivalent network of following figure. 10M



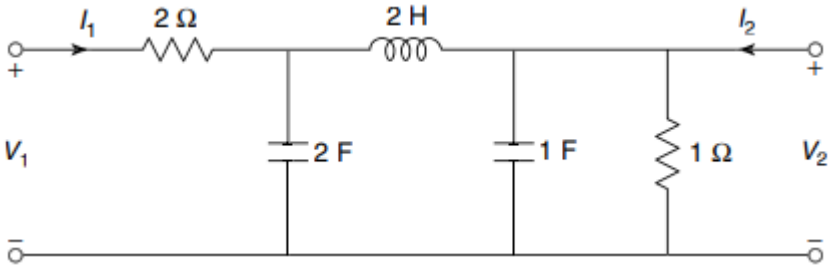
Q4 a Express Z parameters in terms of Yparameters and h parameters 10M

b Find the voltage V_x for the following circuit using Superposition theorem. 10M

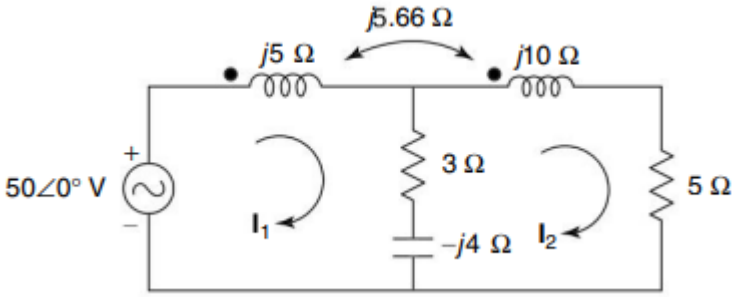


Q5 a Derive the condition for reciprocity and symmetry for A-B-C-D parameters 10M

b For the given ladder network, determine voltage transfer function V2/V1 10M



Q6 a Determine the voltage across the 3Ω resistor using mesh analysis. 10M



b Plot Pole zero diagram and obtain V(t) of given network 10M

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

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

N.B: (1) Question No. 1 is compulsory.

(2) Attempt any three from the remaining questions.

(3) Figures to the right indicate full marks.

(4) Each question is of 20 Marks

Q.1	Attempt any 4 questions		
A	What are the applications of potentiometer circuit? Explain any one.	**5**
B	What are the similarities between electric and magnetic circuit? Explain the difference between electric and magnetic circuit.	**5**
C	Explain with neat diagram Swinburne's test on DC machine.	**5**
D	Explain hysteresis and eddy current losses. How can these losses be reduced?	**5**
E	What is resolution and sensitivity of digital meters?	**5**
Q.2			
A	Explain in brief the principle of electro-mechanical energy conversion and develop a model of electro-mechanical energy conversion device.	**10**
B	Draw and explain speed-torque characteristic of DC shunt motor and DC series motor.	**10**
Q.3			
A	Explain Schering bridge with neat diagram.	**10**
B	Explain rheostatic braking and plugging of DC shunt motor.	**10**
Q.4			
A	Explain the working principle, construction of moving coil instruments and hence derive the torque equation.	**10**
B	Explain Hall effect transducer.	**10**
Q.5			
A	Explain the concept of singly excited machines and derive the expression for the electromagnetic torque.	**10**
B	Illustrate the working of ramp type digital voltmeter (DVM) with the help of block diagram and waveforms.	**10**
Q.6			
A	Explain the static and dynamic characteristics of measuring instruments	**10**
B	Explain the construction and working principle of digital Tachometer.	**10**

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

N.B. 1) Question 1 is compulsory
2) Attempt any three from question no.2 to 6
3) Assumptions made should be clearly stated

Q1. Solve any Four **20**

a. Define per unit system
b. State advantages of hydro power plant over thermal power plant.
c. Enlist all types of insulators used in transmission line.
d. Explain the ACSR conductor used in overhead transmission line with neat diagram
e. Draw a diagram of cable cut-section showing all the layers in it.

Q2.

a. Derive the expression for change in base of impedance (Zp.u.new) **10**
b. Give classification of nuclear power plants and draw a neat generalised diagram of nuclear power plant and elaborate construction and working in detail **10**

03

a. State various methods to improve string efficiency and elaborate any one in detail **10**
b. Define string efficiency and derive the formula for three-disc suspension insulation string. **10**

Q4.

a. Draw nominal π method model for medium transmission line and derive the expression for sending end voltage, sending end current, % voltage regulation and % efficiency **10**
b. Classify transmission lines as per distance and explain their representation in brief. **10**

Q5.

a. Explain skin effect and proximity effect. **10**
b. Derive an equation for the capacitance of a single-phase overhead transmission line. **10**

Q6.

a. Elaborate touch and step potential. **10**
b. Derive the expression of inductance in three phase transposed system. **10**

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

Question no 1. Attempt ANY FOUR questions (20)

1. Draw circuit diagram and input/output waveforms of diode as negative series clipper.
2. Explain with formulae load and line regulation in the case of a voltage regulator.
3. What is the need for biasing in BJT amplifiers?
4. Explain the working of op-amp as a zero crossing detector.
5. Draw construction diagram of p-channel depletion type MOSFET.
6. Explain ideal characteristics of Op-amp IC 741

Question no 2. Attempt the following questions (20)

1. Draw and Explain full wave bridge rectifier along with capacitor filter with neat circuit diagram and all required waveforms.
2. Draw and explain Basics of Opto-isolator. List applications of it.

Question no 3. Attempt the following questions (20)

1. What are the different DC biasing techniques used for BJT? Analyze any one methods in detail.

2. **Fig.1 shows the voltage divider bias method. Draw the d.c. load line and determine the operating point Q (VCE, IC). Assume the transistor to be of silicon.**

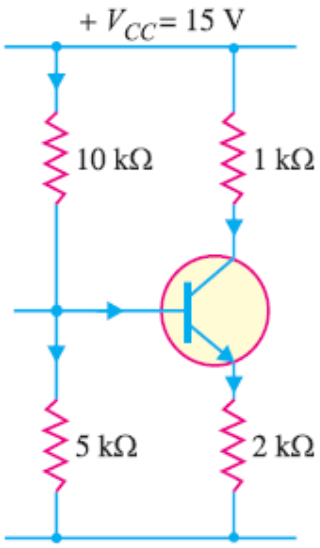

Fig 1

Question no 4. Attempt the following questions **(20)**

1. Draw and explain constructional details and transfer characteristics of n-channel depletion type MOSFET.
2. What are the different DC biasing techniques used for MOSFET? Analyze any one methods in detail.

Question no 5. Attempt the following questions **(20)**

1. Draw and explain op-amp as unity gain inverting adder for the three input voltages V1, V2 and V3.
2. Draw and explain differentiator circuit using op-amp with all waveforms and formulae.

Question no 6. Attempt the following questions **(20)**

1. Illustrate the working of IC555 as an Mostable multivibrator. list applications of it.
2. Design a voltage regulator using LM 317 to provide output voltage of 9V. Assume LM 317 regulator with load regulation providing minimum load current is greater than 10 mA Refer following fig.