(3Hrs) **Marks: 80**

N.B.

1. **Question No.1 is Compulsory**.
2. Answer any three out of remaining five questions
3. Assume any suitable data wherever required but justified the same
4. Illustrate answer with sketches wherever required

Q 1 Answer **any four** from the following questions. **(20)**

a. Derive the equation for capacitance of three phase line equilateral

b. State advantages of Per Unit System.

c. Describe the significance of transposition of three phase overhead transmission lines.

d. Illustrate how the concept "**Method of Images**" can be used to analyze the effect of earth on transmission line capacitance

e. Illustrate the term step potential and touch potential.

Q 2 a) Calculate the inductance of each conductor in a 3-phase, 3-wire system when the conductors are arranged in a horizontal plane with spacing such that D_{31} = 4m; D_{12} = D_{23} = 2m. Assume, conductors are transposed and have a diameter of 2·5 cm. **(10)**

b) 3-phase, 50 Hz, 16 km long overhead line supplies 1000 kW at 11kV, 0·8 p.f. lagging. The line resistance is 0·03 Ω per phase per km and line inductance is 0·7 mH per phase per km. Calculate ABCD parameters, sending end voltage, sending end current and voltage regulation of the transmission line. **(10)**

Q 3 a) Derive expression for capacitance of 3 phase line with unsymmetrical spacing. **(10)**

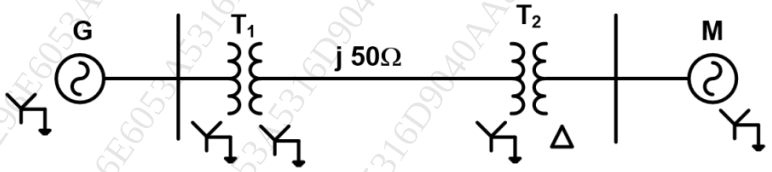
b) Figure shows one line diagram of a power system. Draw impedance diagram of the network. Choose a base of 100MVA, 220kV in 50Ω line. Ratings of the equipment are: **(10)**

Generator: 40 MVA, 25kV, X'' = 20%

Syn. Motor: 50 MVA, 11kV, X'' = 30%

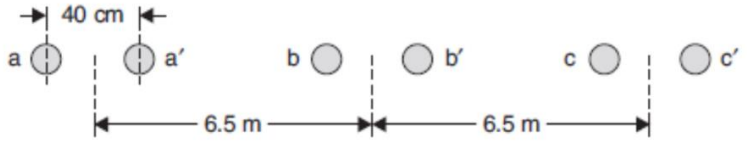
Transformer T1: 40 MVA, 33/220kV, X= 15%

Transformer T2: 30 MVA, 11/220kV, X = 15%



Q 4 a) Derive the expressions for A, B, C, D constant and draw phasor diagram for medium transmission line in nominal π method. **(10)**

b) A single circuit 460 kV line using two bundle conductors per phase as shown in Fig. The dia of each conductor is 5.0 cm. Calculate (i) capacitance per phase, (ii) charging current per phase, iii) Charging volt amperes. Assuming complete transposition of the line. **(10)**



Q 5 a) Define Neutral grounding. Discuss the advantages of neutral grounding. Illustrate solid grounding in detail. **(10)**

b) Name the various components of Power cable. Illustrate the significance of inner sheath (Bedding) in cable. **(05)**

c) Derive the expression for flux linkages with the conductor due to internal flux linkage of a conductor itself with ignoring the effect of any other conductor. **(05)**

Q 6 a) Derive the expression for inductance of single phase two wire line. **(10)**

b) What do you mean by insulation resistance of the cable? Derive the expression for insulation resistance of single core cable. **(10)**

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

Instructions:

1. Question No: 1 is compulsory.
2. Answer any three from the remaining five questions.

1 **(5 x 4)**

a) Recall the h-parameter equivalent model of Common Emitter voltage divider bias configuration and define all the h-parameters.

b) Interpret the Drain-source characteristics of n-channel depletion type MOSFET with a neat figure for different values of V_{GS}.

c) Draw the circuit diagram of op-amp based integrator circuit and write the expression of voltage gain.

d) State the application of Opto-isolator with a neat figure.

2 a) Discuss the need of biasing in BJT amplifiers. Illustrate the voltage divider biasing technique in detail. **(10)**

b) Draw the h-parameter equivalent model of a voltage divider bias Common emitter BJT amplifier and derive expression of voltage gain. **(10)**

3 a) With a neat figure explain the construction and working principle of n-channel depletion type MOSFET. **(10)**

b) Illustrate the different biasing techniques employed in MOSFET amplifiers. **(10)**

4 a) Explain op-amp as a non-inverting amplifier. Design a non-inverting amplifier for voltage gain of 11. **(10)**

b) Illustrate with neat diagram, the application of Op-amp as adder circuit. Derive the output expression. **(10)**

5 a) Explain the construction and working of Schottky diode. **(10)**

b) Explain the block diagram of op-amp. Draw its frequency response characteristics. **(10)**

6 Write short notes on **ANY TWO**

1) Astable Multivibrator using IC555 **(20)**

2) Zener diode as clipper

3) LM317 as Adjustable voltage Regulator

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Time: 3 hour **Max. 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**	**Marks**
a)	If $A = \begin{bmatrix} -1 & 0 & 0 \\ 2 & -3 & 0 \\ 1 & 4 & 1 \end{bmatrix}$ then find the eigen values of A^3	**5**
b)	Find Laplace transform of $f(t) = te^t \cos 2t$	**5**
c)	Find the Fourier Series for $f(x) = x^2$, where $x \in (-\pi, \pi)$	**5**
d)	Determine the constant a, b, c, d if $f(z) = x^2 + 2axy + by^2 + i(dx^2 + 2cxy + y^2)$is analytic.	**5**
Q2		
a)	A vector field $\bar{F}$ is given by $\bar{F} = (ysinz - sinx)i + (xsinz + 2yz)j + (xycosz + y^2)k$ Prove that $\bar{F}$ is irrotational.	**6**
b)	Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$	**6**
c)	Show that the function u = sinx coshy + 2cosx sinhy + $x^2 - y^2 + 4xy$ satisfies Laplace's equation, also find analytic function.	**8**
Q3		
a)	If $\bar{F} = xye^{2z}i + xy^2coszj + x^2cosxyk$ find div$\bar{F}$ and curl$\bar{F}$	**6**
b)	Find an analytic function whose real part is u = $y^3 - 3x^2y$. Also find the corresponding imaginary part.	**6**
c)	Show that the matrix $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 3 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ is diagonalizable and hence find the transforming matrix and diagonal matrix.	**8**

Q4

a) Find $\nabla\phi$ at point (1, -2, -1), where $\phi = 4xz^2 + x^2yz$ **6**

b) Evaluate $\int_0^\infty e^{-2t} sin^3 t \ dt$, using Laplace transforms **6**

c) Using Partial Fraction method find $L^{-1}\left[\frac{s}{(s^2+1)\ (s^2+4)\ \ (s^2+9)}\right]$ **8**

Q5

a) Find $L\left\{t\sqrt{1+sint}\ \right\}$ **6**

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

$$\bar{F}(x,y,z) = y\,\hat{\boldsymbol{\imath}} + (zcos(yz) + x)\,\hat{\boldsymbol{\jmath}} + (y\cos(yz))\,\hat{\boldsymbol{k}}$$

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

c) Find the Fourier Series for $f(x)$ in $(-\pi, \pi)$where **8**

$f(x) = 1 + \frac{2x}{\pi}$ $\quad -\pi \leq x \leq 0$

$= 1 - \frac{2x}{\pi}$ $\quad 0 \leq x \leq \pi$

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ \ldots\ldots\ldots$

Q6

a) Obtain Fourier series expansion of $f(x) = 9 - x^2$ in $(0, 2\pi)$ **6**

b) Find Eigen values and Eigen vectors of **6**

$$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$$

c) **4**

i) Find $L^{-1}\left\{\log\left(\sqrt{\frac{(s+a)}{(s+b)}}\right)\right\}$

4

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

(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.

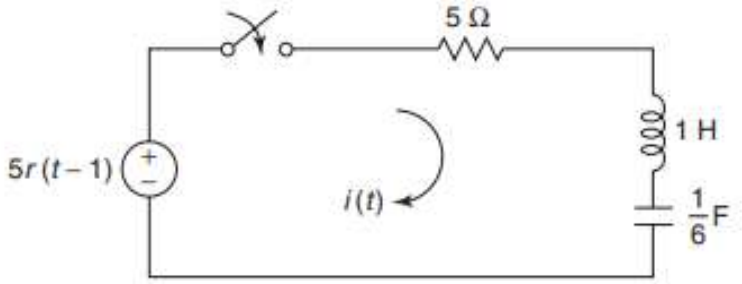
1. Attempt all questions.

(a) Obtain Z parameters in terms of Y parameters. (05)
(b) Find poles and zeroes of following function and plot pole zero diagram. (05)

$$F(s) = \frac{s^2+25}{(s+1)(s^2+9)}$$

(c) Explain the condition for symmetry and reciprocity in ABCD parameters. (05)
(d) Obtain ABCD parameters in terms of h parameters. (05)

2. (A) For the network shown in figure below, determine the current i (t) when the switch is closed at t = 0 with zero initial conditions. (10)



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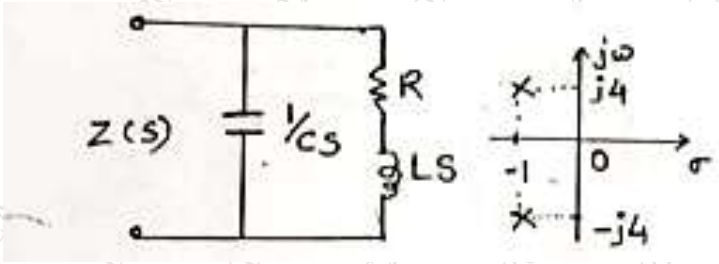
(B) Write suitable definition or expression for the following: (10)

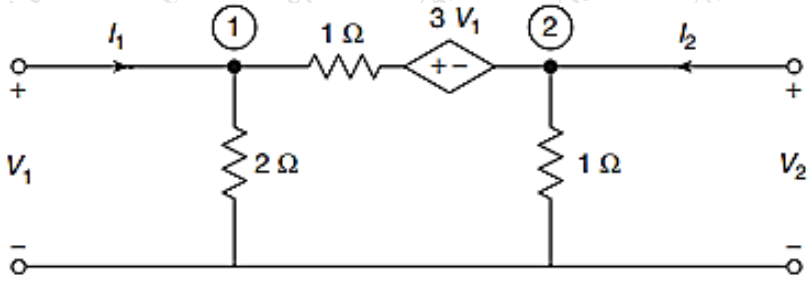
i. Transient Response ii. Steady State Response

iii. Zero Input Response iv. Zero State Response

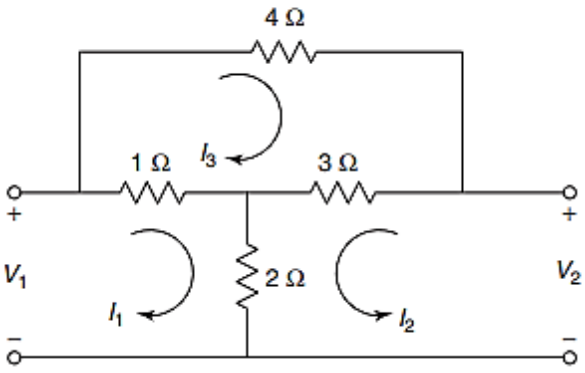
3. (A) The pole zero diagram of the driving point impedance function of the network is shown below. At dc the input resistance is resistive and equal to 2 Ω. Determine values of R, L and C. (10)



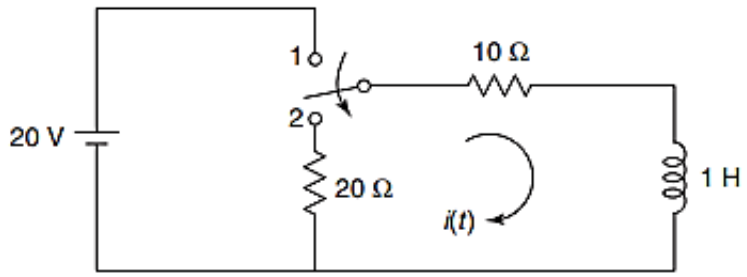
(B) Find Z and Y parameters of given two port network shown. (10)



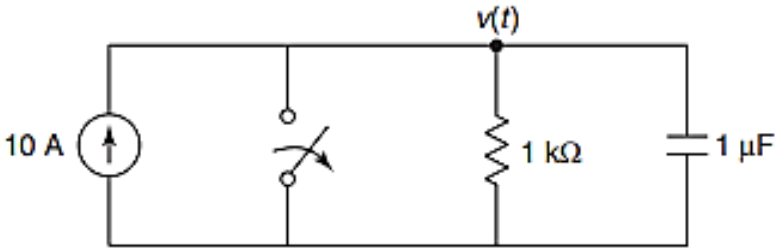
4. (A) Find Z, Y, h and ABCD parameters of given two port network shown. (10)



(B) In the network shown in figure below, the switch is changed from the position 1 to the position 2 at t = 0, steady position having reached before switching. Find the values of i, di/dt and d^2i/dt^2 at $t = 0^+$. (10)



5. (A) In the given network of figure, the switch is opened at t = 0. Solve for V, dv/dt and d^2v/dt^2 at $t = 0^+$. (10)

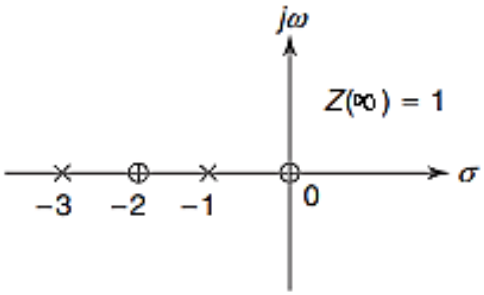


(B) The voltage V(s) of a network is given by, (10)

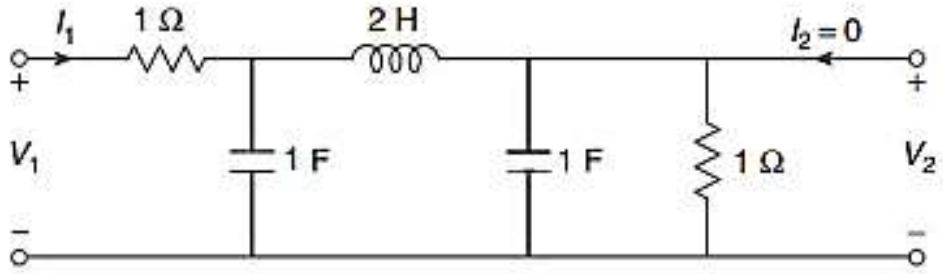
$$V(s) = \frac{3s}{(s+2)(s^2+2s+2)}$$

Plot its pole-zero diagram and hence obtain v(t).

6. (A) Obtain the impedance function Z(s) for which pole-zero diagram is shown in figure below: (10)



(B) Determine the voltage transfer function $\frac{V2}{V1}$ for the network shown in figure below: (10)



(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	Explain energy stored in magnetic field		**5**
B	Explain the losses occurring in DC machine.		**5**
C	What are the advantages of digital meters over analog meters?		**5**
D	What are the applications of potentiometer circuits?		**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	Explain rheostatic braking and plugging of DC shunt motor.		**10**
Q.3			
A	Explain Maxwells inductance bridge to measure self-inductance, derive the equation of self-inductance and draw phasor diagram.		**10**
B	Draw and explain speed-torque characteristic, speed-armature current characteristics and torque-armature current characteristics of DC shunt motor.		**10**
Q.4			
A	Explain with neat diagram Swinburne's test on DC machine.		**10**
B	Illustrate the working of ramp type digital voltmeter (DVM) with the help of block diagram and waveforms.		**10**
Q.5			
A	Explain the concept of doubly excited machines and derive the expression for the electromagnetic torque.		**10**
B	Explain Schering bridge with neat diagram.		**10**
Q.6			
A	What are transducers? Give a brief classification of transducers with examples.		**10**
B	Explain the construction and working principle of digital Tachometer.		**10**