Duration: 3hrs **[Max Marks:80]**

N.B. : (1) Question No 1 is **Compulsory.**
(2) **Attempt any Three questions out of the remaining Five**.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

		Marks
Q1.	**Solve any Four**	20
a.	Give the classification of cables based on operating voltages?	
b.	Compare the chief sources of energy used for the generation of electrical energy.	
c.	Discuss the terms voltage regulation and transmission efficiency as applied to transmission line.	
d.	What is per unit system? State its advantages?	
e.	Discuss the various conductor materials used for overhead lines. What are their relative advantages and disadvantages?	
Q2.		20
a.	What is neutral grounding? Explain any two methods of neutral grounding?	10
b.	Explain the functions of the following with respect to hydroelectric power plant: (i) Dam (ii) spillways (iii) surge tank (iv) headworks (v) draft tube.	10
Q3.		20
a.	Draw nominal T method model for medium transmission line and derive the expression for sending end voltage, sending end current, % voltage regulation and % efficiency.	10
b.	State the importance of earthing. Explain what tower footing resistance is.	10
Q4.		
a.	Explain the following methods of cable grading: (i) Capacitance grading (ii) Intersheath grading	10
b.	Derive expression for inductance of a three-phase line with symmetrical spacing.	10
Q5.		
a.	Explain various methods of improving string efficiency.	10
b.	Explain with a neat diagram effect of Earth on the Capacitance of Single-phase transmission line.	10
Q6.		20
a.	Derive expression of impedance in per unit for change of base.	10
b.	Explain step and touch potential.	10

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

N.B (1) Question 1 is compulsory.
(2) Solved any 3 from remaining
(3) Make any suitable assumption wherever required.

Q.1. Attempt **any four** of the following.

a) Define the Characteristics of a practical OP-AMP 5M
1) Input offset voltage 2) CMRR 3) PSRR 4) Slew rate

b) Explain the construction and working of Schottky diode. 5M

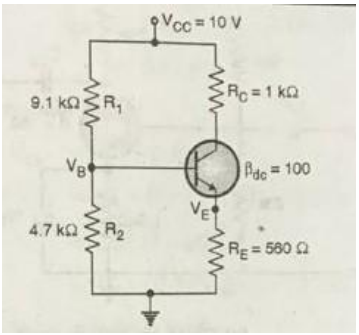
c) Explain Diode as negative series clipper. 5M

d) What are the advantages of voltage divider bias circuit? 5M

e) Differentiate between BJT and FET 5M

Q.2. a) What are the different DC biasing techniques used for MOSFET? Analyse any two techniques in detail. 10M

b) Calculate the Q-point values of Ic and Vce for the voltage divider bias circuit shown below. Assume a silicon transistor . 10M



Q.3. a) Draw Schmitt trigger circuit and explain its working. Also draw the transfer characteristic. 10M

b) Explain the operation of an astable multivibrator using IC 555.calculate the frequency of oscillation if $R_{A=}R_B$=8.5KΩ and C=0.01μF. 10M

Q.4. a Explain the operation of LC filter in full wave rectifier with neat diagram and waveform 10M

b) What are the types of comparator? Explain the operation of a non-inverting comparator. Draw input and output voltage waveforms 10M

Q.5. a) Draw the block diagram of a regulated dc power supply and explain the function of each block in it. 10M

b) Write a short note on thermal stabilization and compensation. 10M

Q.6. a) Draw and explain the drain characteristics and transfer characteristics of a n-channel depletion MOSFET. 10M

b) With the help of an internal block diagram explain the principle of operation of a three pin fix voltage IC regulator. What do you understand by the thermal shut down? 10M

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(Time : 3 Hours) **[Total marks: 80**

Note: 1). Question 1 is compulsory.

2) Attempt any 3 questions from Question 2 to Question 6

Q1	**Attempt All questions**	**Marks**
A	If $A = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$ then find the eigen values for the matrix $A^3 + 5A + 8I + A^{-1}$	**5**
B	Find Laplace transform of $f(t) = te^{-t}\sin(4t)$	**5**
C	Find the Fourier Series Expansion $f(x) = x$,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	Using Green's theorem in a plane to evaluate the line integral $\oint_C (xy^2 - y)dx + (x + y^2)dy$ Where C is the triangle with vertices at (0,0), (2,0) and (2,2) and it is traversed in anticlockwise direction	**6**
B	Find the matrix $A_{2\times 2}$ whose eigen values are 4 and 1 and their corresponding eigen vectors are $v_1 = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ and $v_2 = \begin{bmatrix} -2 \\ 1 \end{bmatrix}$	**6**
C	Find the analytic function $f(z) = u + iv$ such that $u - v = \frac{\cos x + \sin x - e^{-y}}{2\cos x - e^{y} - e^{-y}}$ *when* $f\left(\frac{\pi}{2}\right) = 0$	**8**
Q3		
A	Find the direction derivative of $\phi(x, y, z) = \sin(xy) + e^{3xz}$ in the direction of the vector $v = \boldsymbol{i} - 2\boldsymbol{j} + 2\boldsymbol{k}$ at the point $P = \left(1, \frac{\pi}{4}, 1\right)$	**6**
B	Find an analytic function $f(z)$ whose real part is given $u(x, y) = x^3 - 3xy^2 + 2x + y$	**6**
C	Find the Eigen values and Eigen vectors of $A = \begin{bmatrix} \frac{37}{60} & \frac{17}{60} & \frac{17}{60} \\ \frac{1}{5} & \frac{7}{10} & \frac{1}{5} \\ \frac{1}{12} & -\frac{1}{12} & \frac{5}{12} \end{bmatrix}$ And show that it is diagonalizable matrix and find its transforming matrix and the diagonal form	**8**

Q4

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

Where $\bar{F} = (x-y-z)i + (y-z-x)j + (z-x-y)k$ over the paraboloid $x^2 + y^2 = 4 - z\,, z \geq 0$

B Find the orthogonal trajectories of family of curves given by **6**

$x^3y - xy^3 = c$

C Using Convolution theorem, find the inverse Laplace transform of **8**

$$\phi(s) = \frac{s+1}{(s^2+2s+2)(s^2+2s+5)}$$

Q5

A Evaluate $\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\, dt$, using Laplace transforms **6**

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

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

Show that $\bar{F}$ is conservative and find its scalar potential.

C Find the Fourier Series for $f(x)$ in $(0,2\pi)$where **8**

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

Hence deduce that

$$\sum_{n \in Odd\ natural\ numbers} \frac{1}{n^4} = \frac{\pi^4}{96}$$

Q6

A **6**

Obtain half range sine series in $(0,\pi)$ for $f(x) = x(\pi - x)$,

Hence show that

$$\frac{\pi^3}{32} = 1 - \frac{1}{3^3} + \frac{1}{5^3} - \frac{1}{7^3} + \cdots$$

B **6**

Using Cayley Hamilton theorem find

$$A^6 - 12A^5 + 30A^4 + 72A^3 - 207A^2 - 110A + 330I$$

Where $A = \begin{bmatrix} 2 & 3 & 1 \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{bmatrix}$

C **4**

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

4

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

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

N.B.: - (1) Question No.**1** is compulsory.
(2) **Attempt** any **Three** questions out of the remaining **five** questions.
(3) Assume suitable data if necessary and justify the same.

Q 1. Answer **all questions**.

A) Define with suitable example i) Tree and Co-tree ii) Graph and Oriented graph. **05**

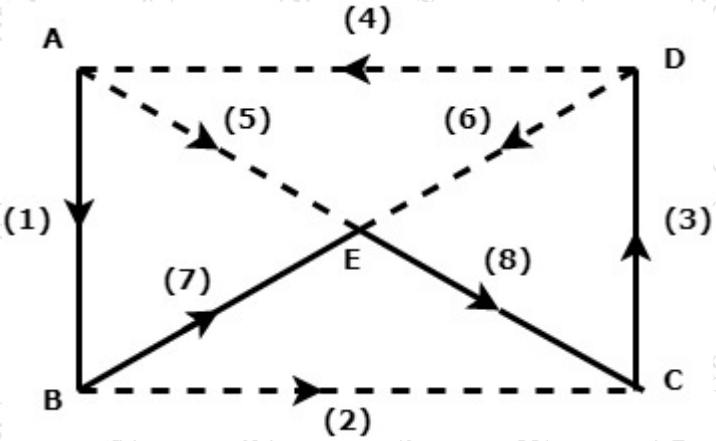
B) Find poles and zeroes of following function and plot pole zero diagram. (05) **05**

$$F(s) = \frac{s^2+4}{(s+2)(s^2+9)}$$

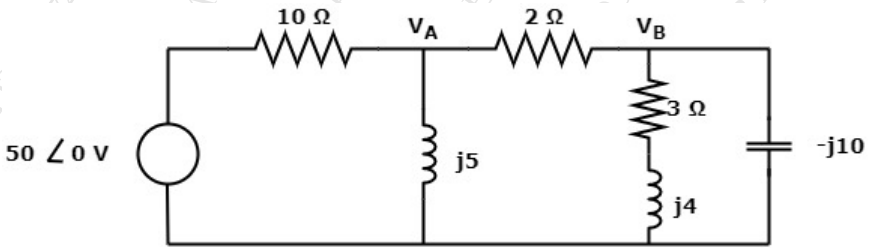
C) State and explain maximum power transfer theorem **05**

D) Obtain Y parameters in terms of Z parameters.

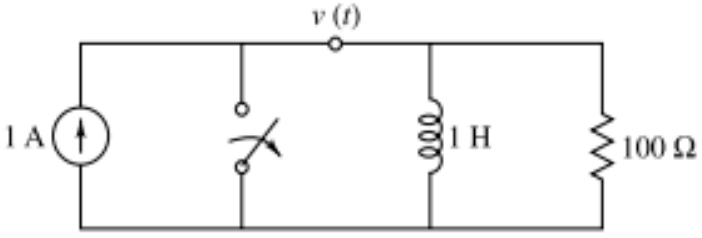
Q2a) For the graph shown below, write f-tieset and f-cutset matrix.



Q2b) Determine V_A and V_B in the network shown below. **05**

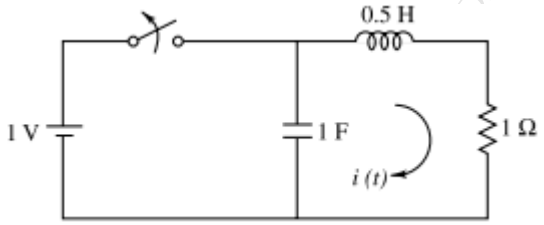


Q 3a) **10**



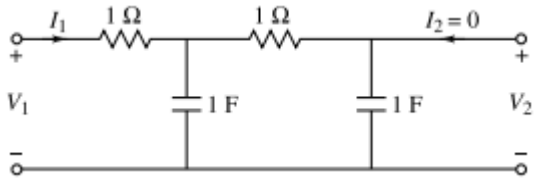
Find $v, \frac{dv}{dt}, \frac{d^2v}{dt^2}$ when switch is opened at t=0

Q3 b)



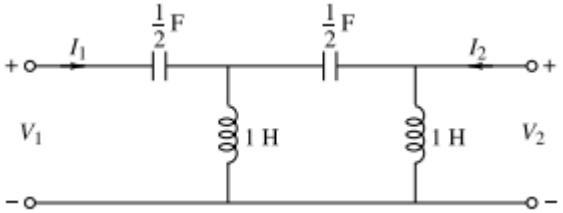
Switch is opened at t=0, steady state condition is reached before t=0. Find i(t) using laplace transform.

Q4 a) For the network shown in, determine transfer function v_2/v_1



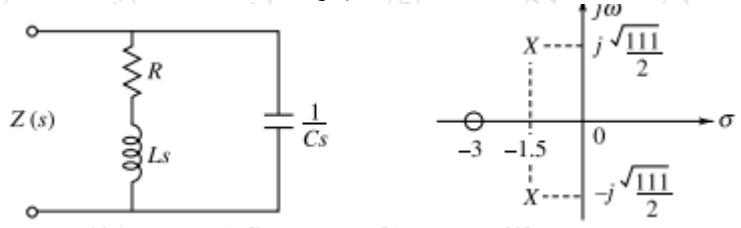
Q4 b) Obtain h parameters in terms of ABCD parameters

Q5 a) Determine Y-parameters for the network shown

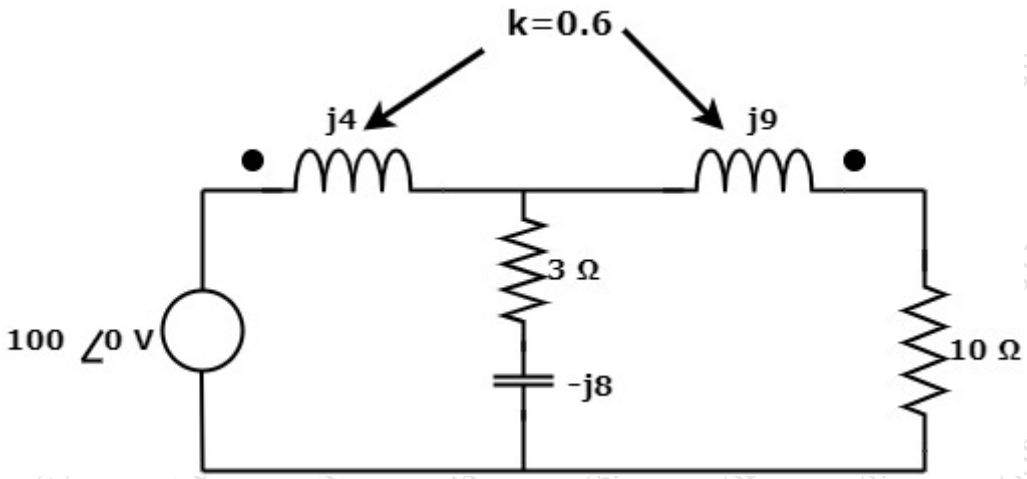


Q5 b) Write down restrictions on Pole and Zero Locations for Driving-Point Functions and Transfer Functions.

Q 6a) A network and its pole-zero configuration are shown in Fig. 10.53. Determine the values of R, L and C if Z (j0) = 1. **10**



Q 6b) Calculate mesh currents in the circuit shown below. **10**



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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	**Marks**
A	State Faraday's first and second law of electromagnetic induction?	**5**
B	Explain Kelvin's double bridge.	**5**
C	Explain why starter is required in DC machines?	**5**
D	Differentiate between PMMC and MI instrument.	**5**
E	What is rotating MMF?	**5**
Q.2		**Marks**
A	Explain in brief the principle of electro-mechanical energy conversion and develop a model of electro-mechanical energy conversion device.	**10**
B	Explain Dynamometer type Wattmeter.	**10**
Q.3		**Marks**
A	Explain calibration of voltmeter and ammeter using potentiometer.	**10**
B	Explain Retardation test on DC motor.	**10**
Q.4	Explain in detail armature reaction and methods to reduce armature reactions in DC Motor.	**Marks**
A		**10**
B	Explain Q meter with neat diagram.	**10**
Q.5		**Marks**
A	Explain the concept of doubly excited machines and derive the expression for the electromagnetic torque.	**10**
B	Differentiate between working of thermistor and thermocouple.	**10**
Q.6		**Marks**
A	Explain the static and dynamic characteristics of measuring instruments	**10**
B	Explain the construction and working principle of digital storage Oscilloscope.	**10**

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