Time 3 Hours **Max. Marks: 80**

Note: (1) Question No. 1 is Compulsory.
(2) Answer any three questions from Q.2 to Q.6.
(3) Use of Statistical Tables permitted.
(4) Figures to the right indicate full marks.

1. (a) Find the constants a, b, c, d, e if
f(z)= $(ax^4+bx^2y^2+cy^4+dx^2-2y^2)$ +i $(4x^3y-exy^3+4xy)$ is analytic. (5)
(b) Find $L\{e^{-t}\sin 2t\cos 3t\}$. (5)
(c) Use Cayley Hamilton theorem for A= $\begin{bmatrix}1 & 4\\ 2 & 3\end{bmatrix}$ to find A^3 and A^{-1}. (5)
(d) Obtain the Fourier Series of $f(x) = x^4$, in (-1,1). (5)

2. (a) Find $L^{-1}\left(\frac{s^2}{(s^2+5)(s^2+4)}\right)$ (6)
(b) Find the analytic function f(z)=u + iv where u + v = e^x (cosy + sin y). (6)
(c) Find a Fourier series to represent the function

$$f(x) = \begin{cases} 0, & -\pi < x \le 0 \\ \frac{1}{4}\pi x, & 0 < x < \pi \end{cases}$$

Hence, deduce that $\frac{\pi^2}{8} = \frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots$.... (8)

3 (a) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix}1 & 2 & 3\\ 0 & -1 & 1\\ 0 & 0 & 2\end{bmatrix}$ (6)
(b) Find the Laplace transform of $e^{-4t}\int_0^t u\ sin3u\ du$ (6)
(c) Solve $\frac{\partial^2 u}{\partial x^2}-\frac{\partial u}{\partial t}=0$ by Bender-Schmidt method, given
$u(0,t)=0, u(4,t)=0, u(x,0)=x^2(16-x^2)$
Assume h=1 upto t = 1 sec (8)

4 (a) Find the orthogonal trajectory of the family of curves given by $e^x cosy - xy = c$ (6)

(b) Find $L^{-1}\left[\frac{(s+3)^2}{(s^2+6s+18)^2}\right]$ using convolution theorem (6)

(c) Show that $A = \begin{pmatrix}2 & 2 & 1\\ 1 & 3 & 1\\ 1 & 2 & 2\end{pmatrix}$ is diagonalizable. Determine a transforming matrix and a diagonal matrix. (8)

5 (a) Find half range cosine series for $f(x) = \begin{cases} 1, & 0 \le x \le 1 \\ x, & 1 \le x \le 2 \end{cases}$ (6)

(b) By using Laplace transform, evaluate $\int_0^\infty \frac{sin2t+sin3t}{te^t} dt$ (6)

(c) Solve by Crank-Nicholson simplified formula $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0, 0 \le x \le 1$ subject to the condition

$u(0,t) = 0, u(1,t) = 0, u(x,0)$ =100 (x- x^2), h = 0.25 for one time step. (8)

6 (a) Find $L^{-1}\left[log \frac{(s^2+4)}{(s+2)^2}\right]$ (6)

(b) Find sin A where A = $\begin{bmatrix} \pi/2 & \pi \\ 0 & 3\pi/2 \end{bmatrix}$ (6)

(c) Find a Fourier series for $f(x)$ in $(0, 2\pi)$ Where

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

Hence, deduce that $\frac{\pi^2}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \cdots$ .... (8)

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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.

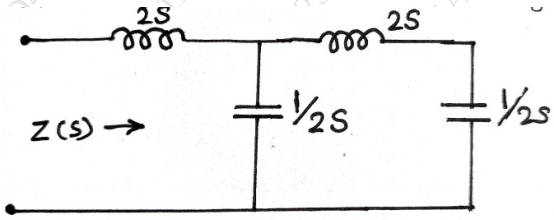
(3) Figures to the right indicate full marks.

(4) Each question is of 20 Marks

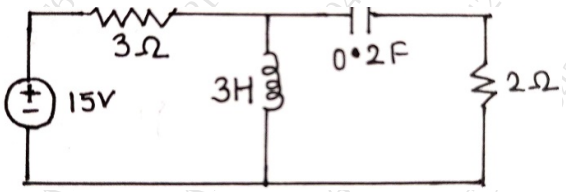
Q1. Attempt all questions

(a) Obtain Z parameters in term of Y parameters Marks:05

(b) Determine the driving point impedance of network shown in figure Marks:05

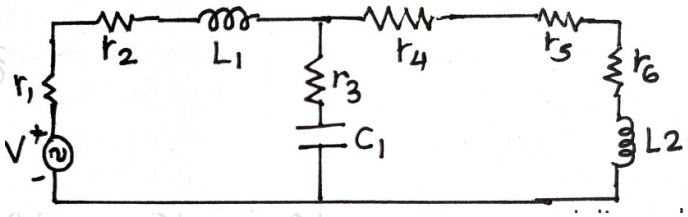


(c) Draw the dual of the network shown in figure. Marks:05

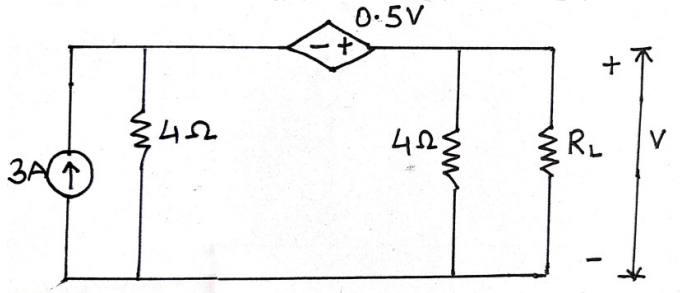


(d) State and explain Maximum power Transfer Theorem. Marks:05

Q2. (a) For the given network draw the oriented graph and write f-cutset and f-tieset matrix Marks:10

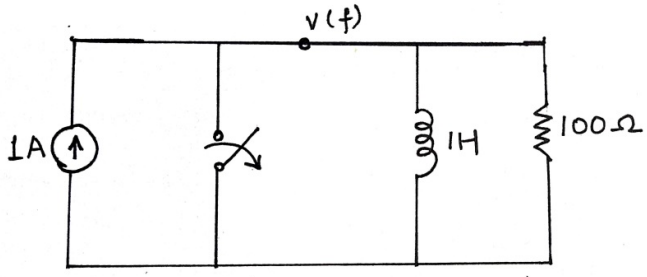


(b) What will be the value of R_L to get the maximum power delivered to it.What is the value of this power. Marks:10

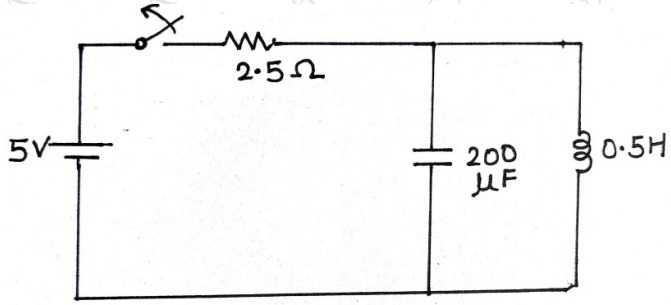


3(a) In the network shown in figure at t=0, the switch is opened. Marks:10

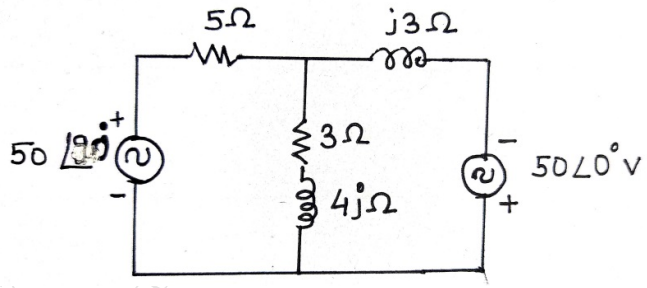
calculate v, dv/dt and d^2v/dt^2 at $t=0^+$



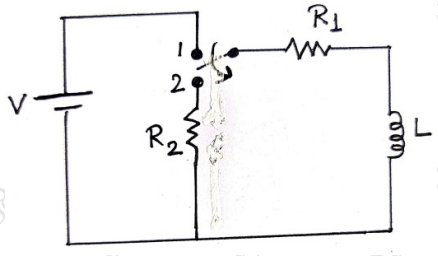
(b) In the network shown in figure the switch is closed and steady state is attained. At at t=0, switch is opened. Determine the current through the inductor. Marks:10



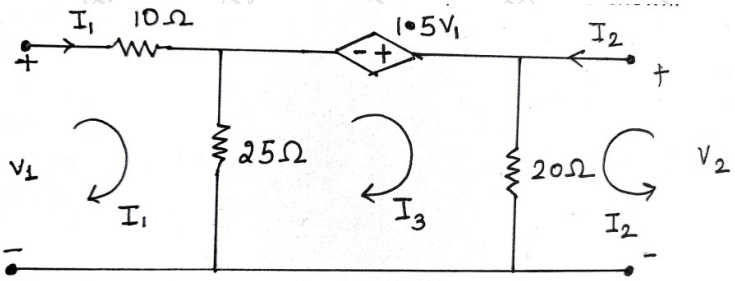
Q4. (a) State and explain Superposition theorem. Find current through 3+4j ohm impedance. Marks:10



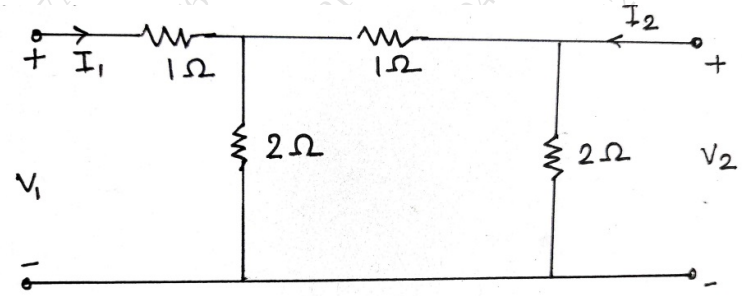
(b) In the network shown in figure the switch is initially at position 1. On the steady state having reached, the switch is changed to position 2. Find current i(t) Marks:10



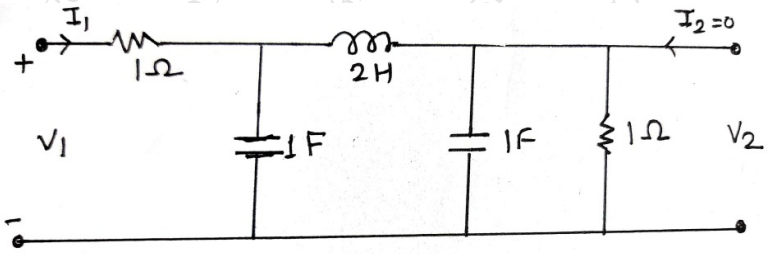
Q5.(a) Find ABCD parameters of given two port networks shown. Marks:10



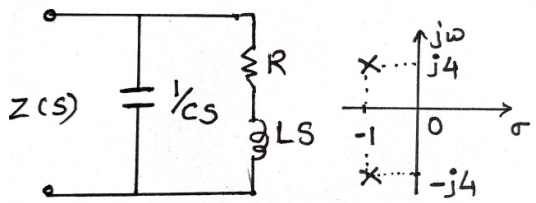
(b) Find Z parameters for the network shown. Check whether condition of Reciprocity is verified? Marks:10



Q6. (a) Determine voltage transfer function V_2/V_1 for given network. Marks:10



(b) 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 2Ω. Determine value of R,L,C Marks:10



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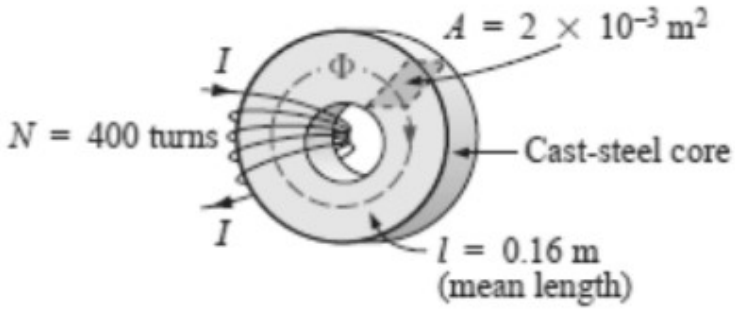
(3 Hours) **[Total Marks:80]**

N.B. **(1)** Question no.1 is compulsory.
(2) Attempt any three from the rest.
(3) Make any suitable assumption wherever required.

Q.1 Answer any four.

(a)	What is the armature reaction in DC machine?	5M
(b)	Define different types of errors.	5M
(c)	What is ammeters shunts & voltmeter multiplier,	5M
(d)	Differentiate between series and parallel magnetic circuit.	5M
(e)	Write difference between Resolution & sensitivity of digital meters	5M

Q.2 **(a)** Derive torque equation of Doubly excited system. 10M
(b) For the series magnetic circuit of Figure 10M
a) Find the value of I required to develop a magnetic flux of Ø =4 x 10^{-4} Wb
b) Determine μ and μr for the material under these conditions. For B= 0.2 T, the value of H (Cast steel) =170 AT/m



Q.3 **(a)** Explain construction & working of MI instrument and derive the torque equation. 10M
(b) Explain three pointers starter in DC motor with neat diagram, why starter is required in dc motor? 10M

Q.4 **(a)** Explain calibration of ammeter and voltmeter using potentiometer. 10M
(b) With respect to EMEC explain following terms i) Leakage flux ii) MMF iii) Rotating MMF 10M

Q.5 **(a)** Explain working principles of digital Voltmeter, Ammeter 10M
(b) What are different methods for speed control of DC motor explain Field flux control in detail with diagram and characteristics. 10M

Q.6 Write a short note on any two
(a) Hopkinson's test on DC Machine 10M
(b) Energy and co energy stored in magnetic field. 10M
(c) Instrument transformers 10M

Duration: 3 Hours **[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.

Q1 Attempt any **four** **[20]**

a Draw a single line diagram of a typical AC supply system and explain.

b List the various types of Insulators? Explain Pin type Insulator.

c Explain step and touch potential.

d Why long transmission lines are transposed?

e What is per unit system? State its advantages?

Q2

a A 3 – unit insulator string is fitted with a guard ring. The capacitance of the link pins to metal work and guard ring can be assumed to be 15% and 5% of the capacitance of each unit. Determine the voltage distribution and string efficiency. **[10]**

b Draw phasor diagram for a nominal Π (pi) circuit of a transmission line. Derive expression for sending end voltage and current. **[10]**

Q3.

a A 200 km long 3-phase overhead line has a resistance of 48.7 ohms per phase, inductive reactance of 80.20 ohms per phase and capacitance (line to neutral) 8.42 nF (nano farad) per km. It supplies a load of 13.5 MW at a voltage of 88 kV and power factor 0.9 lagging. Using nominal T circuit, find the sending end voltage, current, regulation and power angle. **[10]**

b Write a short note on Grading of Cables. **[10]**

Q4.

a Derive the expression for capacitance per phase per km of a single phase line taking into account the effect of ground. **[10]**

b Explain Skin effect and Proximity effect. **[10]**

Q5.

a What is neutral grounding? Explain any two methods of neutral grounding? **[10]**

b Derive expression for inductance of a three phase line with un-symmetrical spacing. **[10]**

Q6.

a Write a short note on **[10]**
Tuned Power line and Surge impedance loading.

b Discuss the measurement of earth resistance and soil resistivity. **[10]**

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Time: 3 hours Max. Marks:80

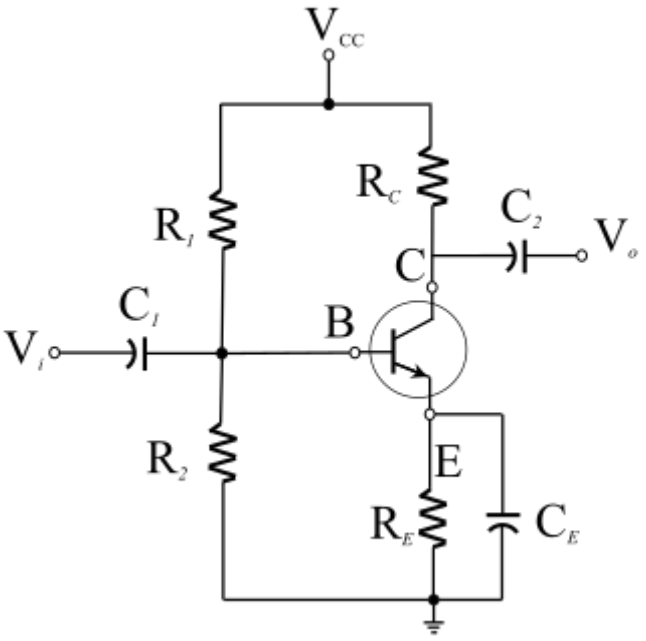
1. Question No.1 is compulsory.
2. Attempt any three from the rest.
3. Figure to the right indicates full marks.
4. Assume suitable data if it is necessary.

Q1) Answer any four of the following (entire syllabus)

a. Explain Diode as positive series clipper (05)
b. Explain BJT as a switch (05)
c. Draw and explain the characteristics of MOSFET (05)
d. Draw a block diagram of Op-Amp and explain the function of level shifter block (05)
e. What do you mean by line and load regulation in the case of a voltage regulator? (05)
f. Explain Zener diode (05)

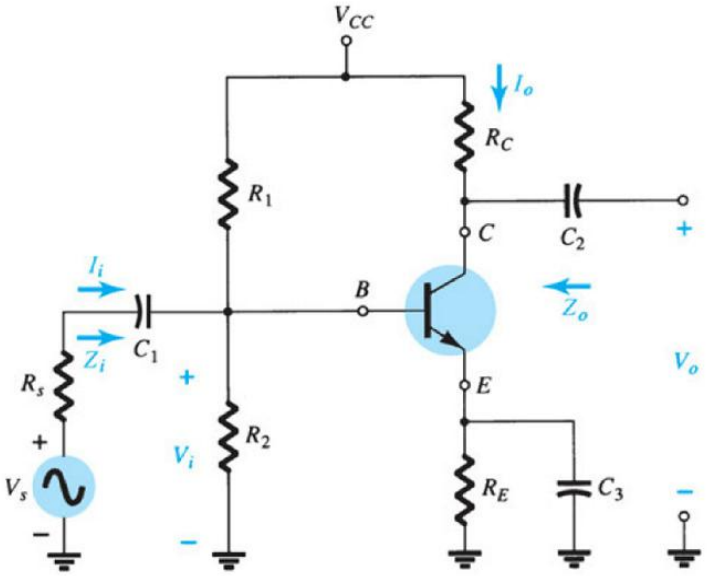
Q2)

a. Analyse full wave bridge wave rectifier along with capacitor filter. Draw all the waveforms and diagrams required to justify your answer. (10)
b. In the following circuit of voltage divider bias calculate the Q point. (10)
Given Data: V_{CC}=22 V, R_1= 39KΩ, R_2=3.9KΩ, R_C=10KΩ, R_E=1.5KΩ, β=100



Q3)

a. For a given BJT CE amplifier (voltage divider bias), derive an expression for voltage gain, current gain, input impedance and output impedance using h-parameter (Small signal analysis) (10)



b. What are the different DC biasing techniques used for MOSFET? Analyse any one technique in detail. Derive all necessary expressions for the same. (10)

Q4)

a. Explain Op-Amp as an inverting amplifier and design an inverting amplifier for voltage gain Av= -12 (assume input resistance R_1=1KΩ) (10)
b. Write a short note on LED and Photodiode. Also, explain how this combination can be used in an optoisolator. (10)

Q5)

a. Explain Op-Amp as an Instrumentation amplifier (10)
b. Explain the Astable multivibrator using IC 555. Calculate the frequency of oscillation if R_A=R_B= 7.5kΩ and C=0.01μF (10)

Q6)

a. Derive expressions for voltage gain and output impedance of any one MOSFET CS amplifier circuit. (10)
b. Explain Op-Amp as a voltage-summing amplifier and derive an expression for voltage gain. (10)
