

Duration: 3hrs

[Max Marks: 80]

- N.B.:** (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) Figures in the right margin indicate the marks.
(4) Assume suitable data, if required and state it clearly.

- 1** Attempt any **FOUR** [20]
- a Compare accuracy and precision with suitable examples. [5]
- b Using Routh's stability criterion, comment on the stability of the given system, having the characteristic equation $s^4+4s^3+13s^2+36s+5=0$. [5]
- c What are active and passive transducers? Explain the various criteria for the selection of a particular transducer. [5]
- d Explain how stability of the system can be analyzed using the Nyquist plot. [5]
- e Explain the correlation between the time domain and frequency domain characteristics. [5]
- 2** a Explain with a neat diagram the working principle of LVDT. State one application of LVDT. [10]
- b Discuss the working principle of Resistance Temperature Detector (RTD) and its use in detail. [10]
- 3** a Derive expression for inductance measurement using Hay's bridge along with a neat diagram. [10]
- b Explain Kelvin's double bridge and its application in very low resistance measurement. Derive the balanced equation of Kelvin double bridge. [10]
- 4** a Sketch the root locus for the system with an open-loop transfer function given by [10]
- $$G(s)H(s) = \frac{K}{s(s+1)(s+3)}$$
- b Sketch the Bode diagram for the following transfer function and obtain Gain margin and Phase margin. [10]
- $$G(s)H(s) = \frac{0.75(1+0.2s)}{s(1+0.5s)(1+0.1s)}$$
- 5** a Sketch the polar plot for the system with an open-loop transfer function given by [10]
- $$G(s)H(s) = \frac{1}{s(s+2)}$$
- b For a unity feedback system having open loop transfer function $G(s)H(s) = \frac{10(s+3)}{s(s+1)(s+2)}$. Find i) Position error constant ii) Velocity error constant and iii) Acceleration error constant. [10]

- 6 Attempt any **FOUR** [20]
- a Define the terms a) hysteresis b) sensitivity and d) linearity. [5]
 - b Write a short note on Mason's gain formula and its use. [5]
 - c Explain performance characteristics of a second order system. [5]
 - d Draw the phasor diagram and derive the balanced equation of Schering bridge [5]
for the measurement of unknown capacitance.
 - e Explain the lead compensator in detail. [5]
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(3 Hours)

Total Marks: 80

- N.B.**
1. Question No. 1 is **Compulsory**
 2. Out of remaining questions, attempt **any three**
 3. **Assume** suitable data if required
 4. Figures to the right indicate **full marks**

1. Attempt **any four**
 - (a) Perform subtraction using 2's complement method
i) $(68-24)_{10}$ ii) $(44-60)_{10}$ [5]
 - (b) State and prove De-Morgan's theorem [5]
 - (c) Convert the given Boolean expression to minterms $F(A,B,C,D) = Y = ABC + AC$ [5]
 - (d) Define and explain the following terms in case of logic families:
Figure of merit, Fan-in and Fan-Out, Current and Voltage parameters, Noise Margin [5]
 - (e) Write short notes on FPGA and CPLD [5]
2.
 - (a) Draw the block diagram of BCD adder using IC 7483 and show with example the addition of two BCD numbers [10]
 - (b) Develop a mod 6 Synchronous Counter using T F/Fs which counts in the sequence 0-1-2-3-4-5-0. Take care of lockout condition [10]
3.
 - (a) Minimize the following SOP using K-Map and implement using universal gates. $F = \sum m(0,2, 6,7,8,9, 10, 11, 12, 13) + d(14, 15)$ [10]
 - (b) Obtain the minimal expression using tabular method $F = \sum m(1,2, 3,5,6,7,8,9, 12, 13,15)$ [10]
4.
 - (a) What is shift register? Explain SISO type of shift register with an example [10]
 - (b) Implement a Full adder using PLA [10]
5.
 - (a) Draw and explain the working of a 4-bit Johnson counter with timing diagram [10]
 - (b) Sketch and explain the working of a 4-bit Asynchronous down counter using JK flip flop. Sketch each output with reference to clock [10]
6. Solve the following
 - (a) Give classification of semiconductor memories and explain DRAM in brief [5]
 - (b) Write VHDL code to build a 4:1 Multiplexer [5]
 - (c) Convert J-K-Flip Flop to T-Flip Flop [5]
 - (d) Convert J-K Flip-Flop to D-Flip-Flop [5]

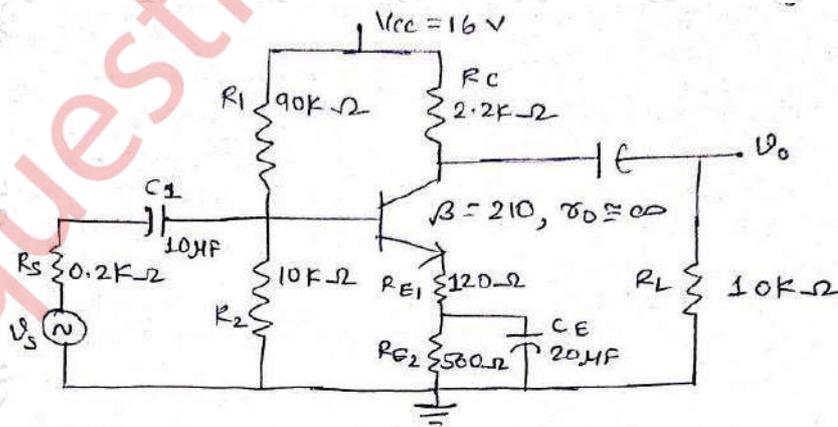
04/06/2025 SE EXTC SEM-III C-SCHEME EDC QP CODE: 10087092

Duration: 3hours

[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.

- 1 Attempt any **FOUR** [20]
- a Calculate the reverse saturation current of a diode if the current at 0.2V forward bias is 0.1mA at a temperature of 25°C and the ideality factor is 1.5. [5]
- b Draw Drain and Transfer characteristics of E-MOSFET. [5]
- c What is Differential gain and Common mode gain related to differential amplifier And define CMRR. [5]
- d Compare Small signal amplifiers and large signal amplifiers. [5]
- e Explain the concept of DC load line and AC load line w.r.t the CE amplifier output characteristics.
- 2 a Explain High frequency analysis of CS E- MOSFET amplifier with necessary equations and circuit diagrams. [10]
- b Determine the input impedance, output impedance and voltage gain for the given circuit. [10]



- 3 a State different types of Coupling in multistage amplifiers with suitable diagrams and explain any one coupling method with its advantages and disadvantages. [10]

02/06/2025 SE EXTC SEM-III C-SCHEME EM-III QP CODE: 10086009

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.

- 1.(a) Find the Laplace Transform of $f(t) = \int_0^t e^{-3u} \sin 4u \, du$. (5)
- (b) If $A = \begin{bmatrix} 2 & 1 & -2 \\ 0 & 1 & 4 \\ 0 & 0 & 3 \end{bmatrix}$, find the eigen values of $A^2 - 2A + I$. (5)
- (c) Find half-range sine series for $f(x) = \begin{cases} 1, & 0 < x < a/2 \\ -1, & \frac{a}{2} < x < a \end{cases}$. (5)
- (d) Find the constants a, b, c, d, e if $f(z) = (ax^4 + bx^2y^2 + dx^2 + cy^4 - 2y^2) + i(4x^3y - exy^3 + 4xy)$ is analytic. (5)
- 2.(a) Evaluate $\int_0^\infty \frac{\cos at - \cos bt}{t} dt$ using Laplace Transform. (6)
- (b) Show that the function $v = (x^4 - 6x^2y^2 + y^4) + (x^2 - y^2) + 2xy$ is harmonic and find the corresponding analytic function $f(z)$ in terms of z . (6)
- (c) Find the Fourier Series for $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases}$, $x \in [0, 2]$. (8)
- 3.(a) Find the orthogonal trajectory of the family of curves given by $2x - x^3 + 3xy^2 = a$. (6)
- (b) Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both solenoidal and irrotational. (6)
- (c) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$ hence find A^{-1} . (8)
- 4.(a) Use Stoke's Theorem to evaluate $\int \vec{F} \cdot d\vec{r}$ where $\vec{F} = (2x - y)i - yz^2j - y^2zk$ and S is the surface of the hemisphere $x^2 + y^2 + z^2 = a^2$, lying above xy plane. (6)
- (b) Find the inverse Laplace Transform of $\frac{s+2}{s^2(s+3)}$. (6)
- (c) Show that the matrix $A = \begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ is diagonalisable. Find the transforming and diagonal matrix. (8)

5.(a) Find the Fourier Series for $f(x) = x^2, -\pi \leq x \leq \pi$. (6)

(b) Find $L\{\cos ht \int_0^t e^u \cosh u \, du\}$ (6)

(c) Find $L^{-1}\left\{\frac{1}{(s-a)(s+a)^2}\right\}$ using Convolution Theorem. (8)

6.(a) Evaluate by Green's theorem $\int (x^2 - y)dx + (y^2 + x)dy$ over the closed curve C of the region bounded by $y = 4$ and $y = x^2$. (6)

(b) Find the inverse Laplace Transform of $\log\left(1 + \frac{a^2}{s^2}\right)$. (6)

(c) Find the eigen values and eigen vectors of $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$. (8)

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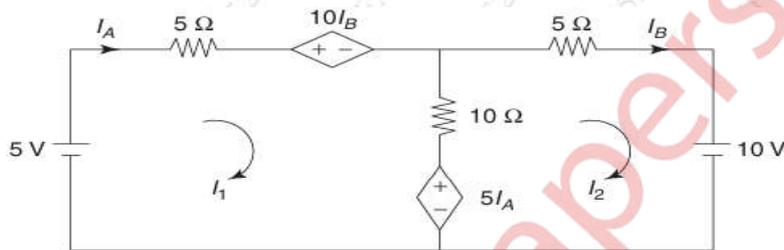
Question No. 1 Compulsory

Question No. 2 to Question No. 6 Solve any Three

Q1 Solve any Four out of Five

5 marks each (20)

A Determine the branch currents in the network shown



B Derive condition of symmetry and reciprocity for h parameters

C Obtain the pole zero plot of the following function

$$\frac{(S + 1)^2(S + 5)}{(S + 2)(S + 3 + j2)(S + 3 - j2)}$$

D Test whether the polynomial $P(s) = S^4 + S^3 + 3S^2 + 2S + 12$ is Hurwitz.

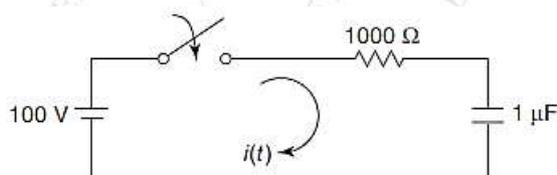
E The reduced incidence matrix of an oriented graph is given below. Draw the oriented graph and write fundamental tiset matrix and cutset matrix.

$$A = \begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

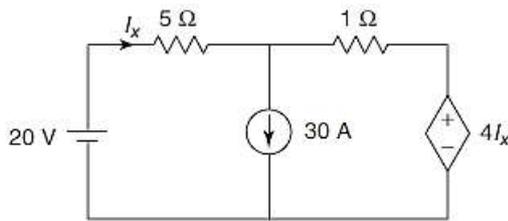
Q2

10 marks each

A In the network, the switch is closed at $t = 0$. With the capacitor uncharged, find value for i , di/dt , d^2i/dt^2 at $t = 0^+$



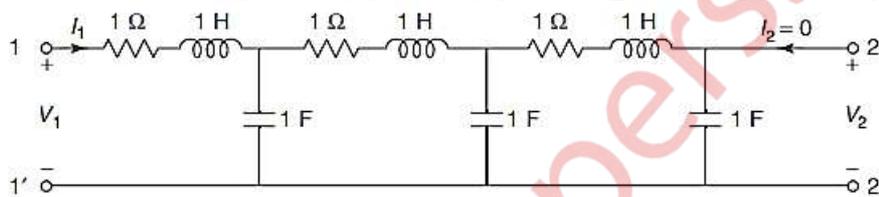
B Find the current I_x using superposition theorem:



Q3.

10 marks each

A For the ladder network of Fig, find the driving point-impedance at the 1 – 1' terminal with 2 – 2' open.



B Synthesize in Cauer –I and Cauer – II form

$$Z(s) = \frac{(s+2)(s+6)}{2(s+1)(s+3)}$$

Q4.

10 marks each

A Test if $F(s) = \frac{S^3 + 6S^2 + 7S + 3}{S^2 + 2S + 1}$ is a positive real function.

B Currents I_1 and I_2 entering at Port 1 and Port 2 respectively of a two-port network are given by the following equations:

$$I_1 = 0.5V_1 - 0.2V_2$$

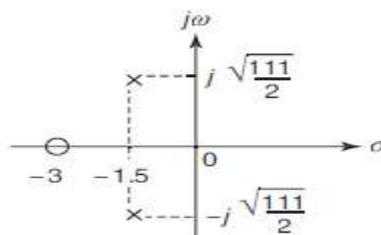
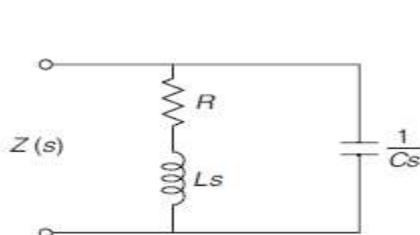
$$I_2 = -0.2V_1 + V_2.$$

Find Y, Z and ABCD parameters for the network.

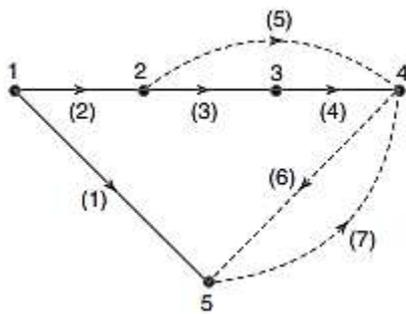
Q5.

10 marks each

A A network and its pole-zero configurations are shown. Determine the values of R,L and C if $Z(j0) = 1$



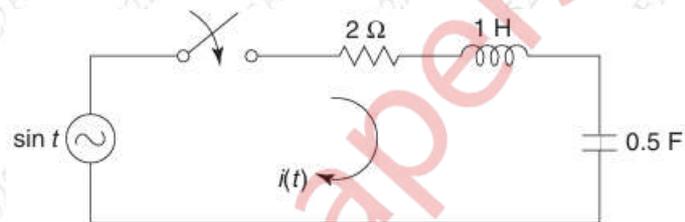
B Find reduced incidence matrix, Tie set matrix and Cutset matrix of given graph-



Q6.

10 marks each

A For the network shown switch is closed at $t = 0$. Determine the current $i(t)$ assuming zero initial conditions.



B Find the value of resistance R_L in network for maximum power transfer and calculate the maximum power.

