**Registration No.:** | | | | | | | | | | |

**Total Number of Pages: 02** **B.Tech/IDD**
**EEPC2001**

**3rd Semester Regular Examination: 2024-25**
**Electrical Circuit Analysis**
**ELECTRICAL & C.E, ELECTRICAL, EE, EEE, ETC, ECE, ECE, AEIE, EEVDT**
**Time: 3 Hours**
**Max Marks: 100**
**Q.Code: R565**

**Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.**
**The figures in the right-hand margin indicate marks.**

**Part-I**

**Q1** **Answer the following questions:** **(2 x 10)**

**a)** State the order of the mentioned matrices (I) Reduced incidence matrix (II) complete incidence matrix (III) Tie set matrix (IV) Cut set matrix.

**b)** State and explain Millman's theorem giving an example.

**c)** State the condition of reciprocity and symmetry of ABCD parameters.

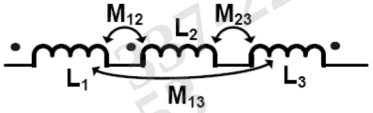
**d)** Draw T- and π- networks and write the z and y parameters in terms of its side and middle arm impedances respectively.

**e)** Write the expressions of selectivity, bandwidth, and Q factor in a series RLC circuit.

**f)** Find the Laplace inverse of $\frac{2s}{(s+1)^2}$.

**g)** The current in the inductor is given by $i(t) = \frac{1}{L}\int_0^t v(t)dt + i(0)^+$
What is the equivalent circuit in s-domain?

**h)** Draw a first order active filter. Briefly explain its characteristics.




**i)** Find the equivalent inductance in figure above.

**j)** What are the necessary and sufficient conditions for a rational function F(s) = P(s)/Q(s) to be a positive real function?

**Part-II**

**Q2** **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

**a)** Explain the significance of cutset matrix with a suitable example.

**b)** State and explain Reciprocity theorem with a suitable example.

**c)** Using Millman's theorem, find the voltage across 10Ω resistor as shown in Fig.1.

**d)** Write the loop equations in matrix form for the given network in Fig.2.

**e)** Derive the open circuit voltage ratio V2(s)/V1(s) for the circuit shown in Fig.3. Draw its pole-zero plot.

**f)** A resistance of 4Ω and an inductance of 0.1H are connected in series and excited by a voltage v = 100sin40t. Find an expression for the current. The initial current in the circuit is zero.

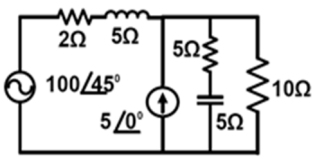


Fig.1

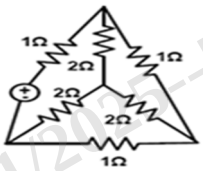


Fig.2

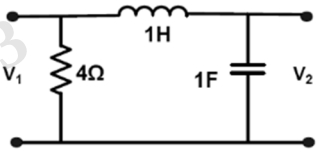


Fig.3

**g)** For a series R-L-C circuit, show that $\omega_0^2 = \omega_1.\omega_2$, where $\omega_0$, $\omega_1$ and $\omega_2$ have their usual meanings.

**h)** Find the expression for current in a series R-C circuit with a rectangular pulse of width 'T' and magnitude 'E' using Laplace Transform. Assume zero initial condition for the capacitor.

**i)** Find the expression for current in a series R-L-C circuit with a DC voltage of 10V, the values of the elements are 2Ω, 1H, and ½ F respectively. Assume zero initial condition.

**j)** Explain the terms Self-inductance, Mutual Inductance, and Coefficient of coupling. Establish the relation of the above terms.

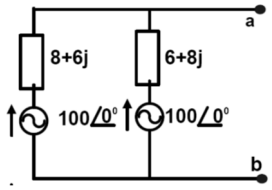
**k)** Test the polynomial $Q(s) = s^8 + 3s^7 + 10s^6 + 24s^5 + 35s^4 + 57s^3 + 50s^2 + 36s + 24$ for its Hurwitz character.

**l)** A function is given as $F(s) = \dfrac{(s^2+1)(s^2+16)}{s(s^2+4)}$ . Realize it in the Foster-I form.

## Part-III

**Only Long Answer Type Questions (Answer Any Two out of Four)**

**Q3** **a)** State and prove Maximum Power Theorem. Describe all the three cases. **(10)**

**b)** 

Determine the maximum power in a load resistor connected across the terminals a, b of the network shown above. **(6)**

**Q4** **a)** The response of a network to an impulse function is given by $0.25(e^{-0.5t} - e^{-2.5t})$. Determine the response of the network to a step function. **(8)**

**b)** By applying Laplace Transform method derive the expressions for transient current (at t = 0+) in case of (i) a series R-L circuit and (ii) a series R-C circuit by assuming zero initial conditions and a sudden switching of the networks to a step input at t = 0. **(8)**

**Q5** **a)** Deduce the expression for z- parameters in terms of h-parameters for a 2-port network and vice versa. **(8)**

**b)** Two 2-port networks-1 and 2 have ABCD parameters $A_1 = 1.5$, $B_1 = 11\Omega$, $C_1 = 0.25$ siemens and $D_1 = 2.5$ for network-1 and $A_2 = 5/3$, $B_2 = 4\Omega$, $C_2 = 1$ siemens and $D_2 = 3$ for network-2. If two networks are connected in parallel, obtain the admittance parameters of the resulting network. **(8)**

**Q6** **a)** Test the function for positive realness. $Z(s) = \dfrac{s^3+5s^2+9s+3}{s^3+4s^2+7s+9}$ **(6)**

**b)** Obtain the Cauer forms for the function. $Z(s) = \dfrac{(s+1)(s+3)}{s(s+2)}$. **(10)**