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

Total Number of Pages: 03 **B.Tech/IDD**
EEPC2001

3rd Semester Regular/Back Examination: 2025-26
SUBJECt: Electrical Circuit Analysis
BRANCH(S): EE, AEIE, ECE, EEE, EEVDT, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC
Time: 3 Hours
Max Marks: 100
Q.Code: U615

Answer Q1 (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) Find the complete incidence matrix of the given graph. (Fig. 1)

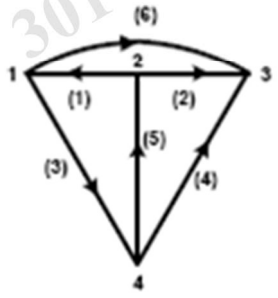

Fig. 1

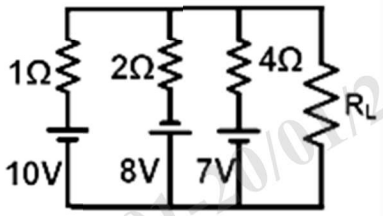

Fig. 2

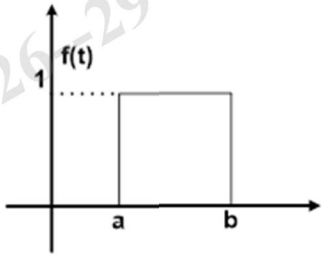

Fig. 3

b) Apply Millman's theorem to find the current in the load resistor (R_L = 5Ω) in the circuit shown in Fig. 2.

c) State the initial and final value theorem. Briefly explain its significance with examples.

d) Find the Laplace Transform of the rectangular pulse as shown in Fig. 3.

e) State the number of poles and zeroes, and obtain the locations in real-imaginary plane.

$$F(s) = \frac{25(10s+4)(s+6)}{s(s^2+1)}$$

f) Is the polynomial Q(s) = $s^3 + 6s^2 + 11s + 6$ Hurwitz? Check.

g) Explain the term "Coefficient of Coupling" and its significance for coupled circuits.

h) Draw the characteristics of 1st order LP, HP, BP, and BS filters versus its respective ideal filter counterparts.

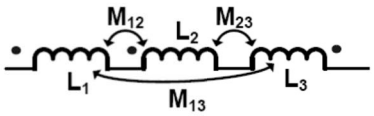

Fig. 4

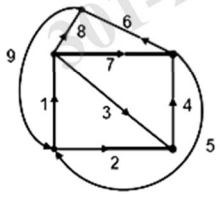

Fig. 5

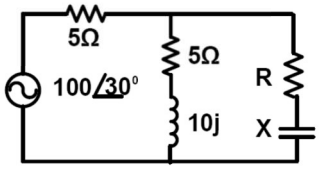

Fig. 6

i) Find the equivalent inductance in Fig. 4.

j) Write the h-parameter equations of a two-port network. Define h_{11}, h_{12}, h_{21}, and h_{22}.

Part-II

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

a) The linear oriented graph is given as in Fig. 5. Considering a tree, mark all the fundamental cut sets and form the cutest matrix.

b) Determine for the network shown in Fig. 6, (i) the values of R and X that will result in maximum power being transferred across terminals AB, and (ii) the value of the maximum power.

c) Verify Reciprocity Theorem for the network shown in Fig. 7.

d) Explain the concept of duality and dual networks.

e) A resistance of 4 Ω and an inductance of 0.1 H 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.

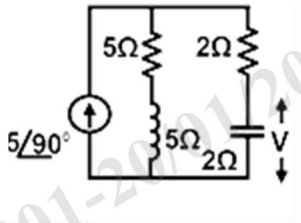

Fig. 7

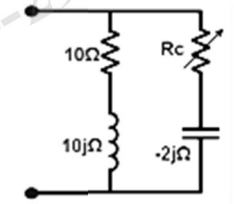

Fig. 8

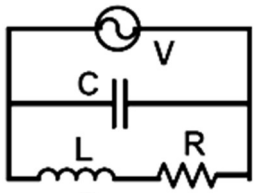

Fig. 9

f) Calculate the value of R_c in the given circuit to yield resonance in Fig. 8.

g) Find the frequency of resonance for the parallel resonance circuit in Fig. 9.

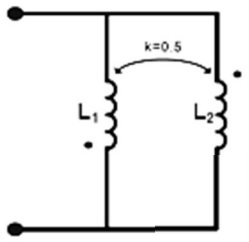

Fig. 10

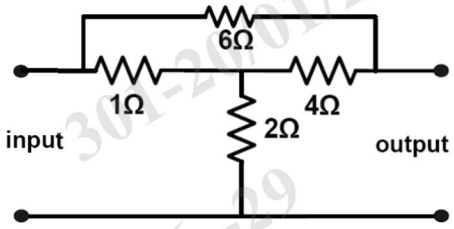

Fig. 11

h) In the circuit of Fig. 10, find the equivalent inductance.

i) State and explain the standard test functions (impulse, step, and ramp functions). Also establish the relations among its Laplace transforms.

j) What are the necessary and sufficient conditions for a rational function F(s) = P(s)/Q(s) to be positive real. State at least 3 properties of a PRF.

k) Find the z and h parameters of the two-port network in Fig. 11.

l) Using Cauer-I form, synthesize the function $F(s) = \frac{(s^2+1)(s^2+16)}{s(s^2+4)}$.

Part-III

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

Q3 **a)** Determine the Z and ABCD parameters of given network as shown in Fig. 16. **(10)**

b) For the given network shown in Fig. 17, find the transfer functions $G_{21}(s)$, and driving point impedance $Z_{11}(s)$. **(6)**

Q4 **a)** Write the loop equations in matrix form for the given network in Fig. 13 with source 10 V. **(6)**

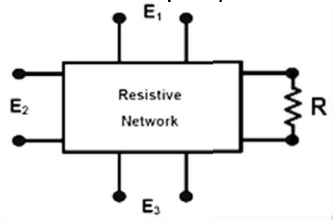

Fig. 12

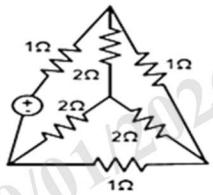

Fig. 13

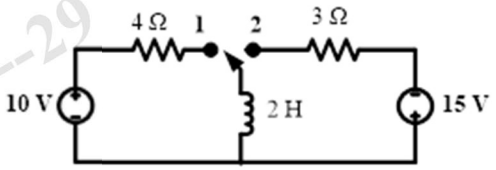

Fig. 14

b) In the network shown (Fig. 12), the power dissipated in 'R' when E_1, E_2, or E_3 acting alone is (i) 20W, 80W, and 5W respectively (ii) 30W, 270W, and 120W respectively. Calculate the maximum power that can dissipate due to the simultaneous action of all the sources. Calculate for both (i) and (ii), what will be the minimum power dissipated in 'R' when all the sources are acting simultaneously? **(10)**

Q5 **a)** In the circuit shown above (Fig. 14), initially the switch is at position-1. Then it is moved to position-2 at t = 0 sec. Obtain the expression of the current in the circuit for t > 0+. Solve the above by t-domain analysis & Laplace transform method. Compare the two methods. **(10)**

b) Assuming zero initial conditions, find i(t) in the circuit given in Fig. 15. **(6)**

Q6 **a)** Synthesize the Foster-I and II form of the following LC driving point impedance. **(12)**

$$Z(s) = \frac{(s^2+1)(s^2+8)}{s(s^2+4)}$$

b) State various properties of a driving point immittance function. Explain with example. **(4)**

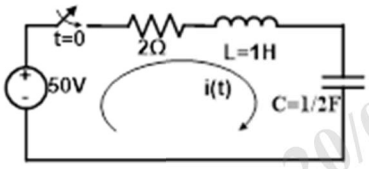

Fig. 15

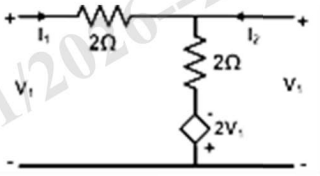

Fig. 16

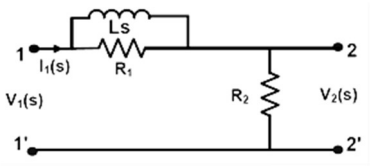

Fig. 17