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

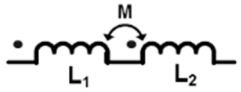
Total Number of Pages: 02 **B.Tech**
REE3C002

3rd Semester Back Examination: 2024-25
NETWORK THEORY
BRANCH(S): AEIE, EEE, EIE, ELECTRICAL, ELECTRICAL & C.E.
Time: 3 Hours
Max Marks: 100
Q.Code: R577

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 Substitution Theorem with an example.
b) State Thevenin's theorem for a circuit containing sinusoidal ac sources.
c) Explain the significance of dot convention in electric circuits.
d) The Z-parameters of a two-port network are given as $Z_{11} = 5\Omega$, $Z_{22} = 7\Omega$, $Z_{12} = Z_{21} = 3\Omega$. Draw its T-equivalent circuit.
e) Represent a common emitter (CE) transistor as a 2-port network using h-parameters.
f) Define an Impulse function and write its Laplace Transform.
g) 

Find the equivalent inductance in the figure given above.
h) Find the complex power, when the given voltage is 125 + 30j Volt and current is 25 + 12j Amp.
i) Differentiate between series and parallel resonance.
j) Write the conditions for symmetry for a 2-port network in z, y, h, and ABCD parameters.

Part-II

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

a) State and explain Reciprocity theorem with an example.
b) What is 'Duality' in electrical networks? Explain with suitable examples.
c) Find the equivalent inductance of the set up as shown in Fig.5.
d) The Z-parameters of a two-port network are given as $Z_{11} = (2s + 1/s)$, $Z_{12} = Z_{21} = 2s$, $Z_{22} = (2s + 4)$. Find the T-equivalent of the network.
e) For a series R-L-C circuit, show that $\omega_0^2 = \omega_1.\omega_2$, where ω_0, ω_1, and ω_2 have their usual meanings.
f) For an initially relaxed series RC circuit, derive the expression for the charging current through it for a unit step excitation.
g) Find the initial and final value of the function f(t), whose Laplace Transform is given as $F(s) = \frac{(s+4)}{(s+1)(s+3)}$.
h) Write short notes on the various types of interconnections possible in two-port networks.

i) 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.

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

k) Derive the expression for average power over a time period (T) where $v(t) = V_m \sin(\omega t + \beta)$ and $i(t) = I_m \sin(\omega t + \alpha)$.

l) Describe the various types of responses in a series R-L-C circuit with a step input.

Part-III

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

Q3 **(a)** State and explain (all three cases) Maximum Power Transfer Theorem. **(10)**

(b) Calculate the value of the load resistance R_L, that would draw maximum power from the rest of the circuit as shown in Fig.1. **(6)**

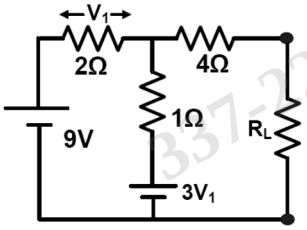


Fig.1

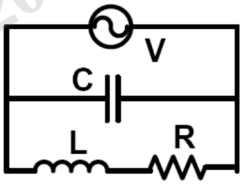


Fig.2

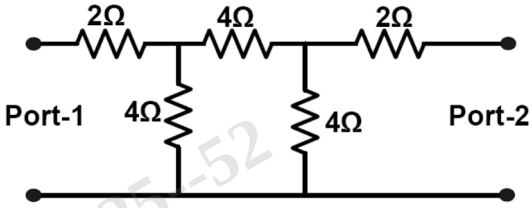


Fig.3

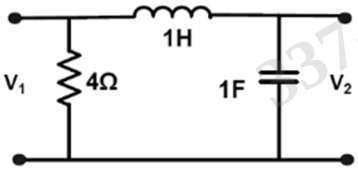


Fig.4

Fig.5

Q4 **(a)** Derive the relationship for bandwidth, cut-off frequencies and Quality factor for a series RLC circuit. **(10)**

(b) Find the frequency of resonance for the following parallel resonance circuit in Fig.2 **(6)**

Q5 **(a)** 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. **(10)**

(b) 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. **(6)**

Q6 **(a)** Calculate the transmission or ABCD parameters for the two port network shown in Fig.3. Hence find out the impedance parameters by applying the conversion technique. **(10)**

(b) Derive the open circuit voltage ratio $V_2(s)/V_1(s)$ for the circuit shown in Fig.4. Draw its pole-zero plot. **(6)**