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

**Total Number of Pages : 04** **Course : B.Tech**
**Sub_Code : REC4C003**

**4th Semester Regular/ Back Examination: 2022-23**
**SUBJECT: NETWORK THEORY**
**BRANCH(S): ECE, ELECTRONICS & C.E, ETC**
**Time : 3 Hour**
**Max Marks : 100**
**Q.Code : M597**

**Answer Question No.1 (Part-1) 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

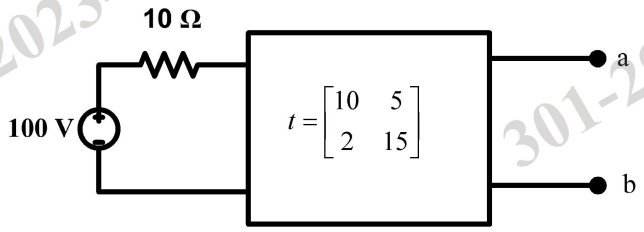
**Q1** **Answer the following questions:** **(2 x 10)**

**a)** For an ideal transformer having n:1 turn ratio, obtain the two-port network representation in terms of h-parameter.
**b)** When a three-phase supply system is called balanced supply system?
**c)** State reciprocity theorem. What is the limitation of this theorem?
**d)** What is DOT convention?
**e)** How does an inductor act at $t = 0^+$ and $t = \infty$.
**f)** What is the significance of poles and zeros of a transfer function?
**g)** Distinguish between steady state and transient response.
**h)** State the limitation of Final value theorem.
**i)** Explain the principle of duality with suitable example.
**j)** State the condition of reciprocity and symmetry in a two port network in terms of h-parameter.

## Part-II

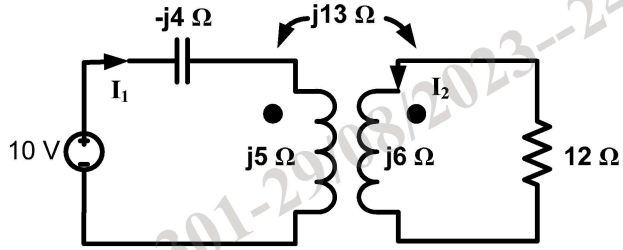
**Q2** **Only Focused-Short Answer Type Questions - (Answer Any Eight out of Twelve)** **(6 × 8)**

**a)** Obtain the Thevenin equivalent representation across the terminal a-b of the two-port network shown in figure below.




**b)** A coil having an inductance of 100 mH is magnetically coupled to another coil having an inductance of 900 mH. The coefficient of coupling between the coils is 0.45. Calculate the equivalent inductance of the two coils when connected in (i) Series aiding, (ii) Parallel aiding, (iii) Series opposing, and (iv) Parallel opposing

**c)** Find the currents $I_1$ and $I_2$ in the coupled circuit shown in the figure below.

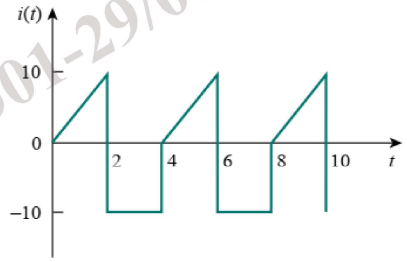



**d)** Determine the inverse Laplace Transform of:

$$F(s)=\frac{20}{(s+3)(s^2+8s+25)} \text{ and } F(s)=\frac{1}{[s^2(s+3)]}$$

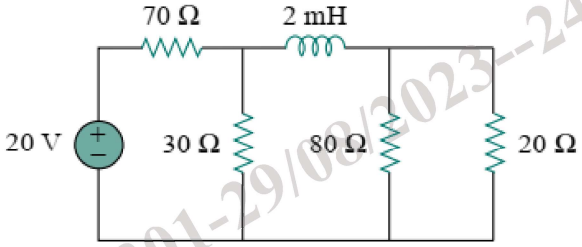
**e)** Three impedances $Z_1$ = (10.5 + j20) Ω, $Z_2$ = (20 + j33.5) Ω and $Z_3$ = (10 - j15) Ω are delta connected to a 415 V, three phase system. Determine the phase currents, line currents and total power consumed by the load.

**f)** Determine the rms value of the current waveform shown in figure below.



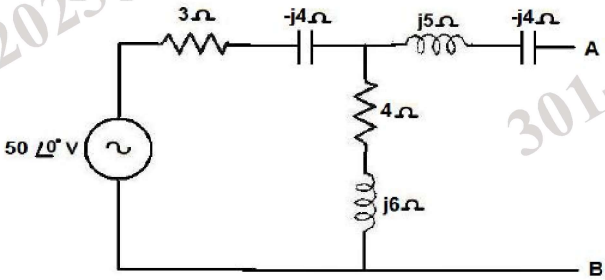

If the current is passed through a 2-Ω resistor, find the average power absorbed by the resistor.

**g)** Calculate the time constant of the following circuit.




**h)** Derive the expression for the maximum power transfer from an ac circuit to a load consisting of variable resistor only.

**i)** Determine the Norton equivalent of the network shown below.

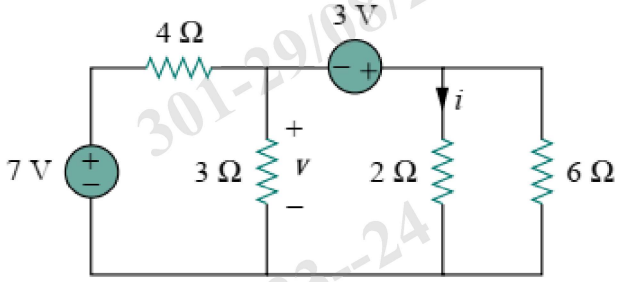



**j)** Determine the Laplace transform of the following:

$$x(t)=5u(t/3) \text{ and } x(t)=5e^{-t/2}u(t)$$

**k)** The output of a linear system is $y(t) = 10e^{-t}\cos(4t)u(t)$ when the input is $x(t) = e^{-t}u(t)$. Find the transfer function of the system and its impulse response.

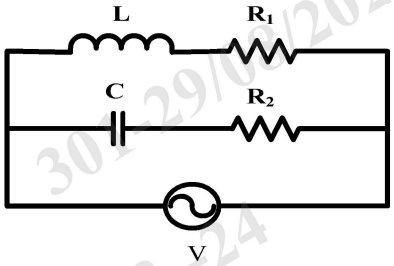
**l)** Using Nodal analysis calculate the voltage across 3 Ω resistor and current flowing through 2 Ω resistor for the circuit shown below.




## Part-III

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

**Q3** **a)** For the following circuit, obtain the condition for resonance. Also prove that the circuit will resonate at all frequency when $R_1 = R_2 = \sqrt{\frac{L}{C}}$ **(8+8)**



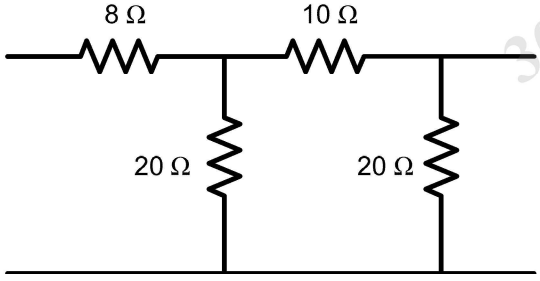

**b)** Assuming $R_1$ = 15 Ω, $R_2$ = 81 Ω, and $X_C$ = 43.2 Ω compute the value of inductor for which the circuit shown in **Q3 (a)** shall resonate for a 100V, 60 Hz supply.

**Q4** **a)** State and explain compensation theorem with suitable example. **(8+8)**

**b)** Define RMS value. Derive the expression for RMS value of current when a sinusoidal current source ($i = I_m \sin(\omega t)$) delivers power to a purely resistive load (R).

**Q5** **a)** Write short notes on various interconnections of two port networks. **(8+8)**

**b)** Determine the transmission parameter of the following network.



**Q6** **a)** Derive the expression for voltage across capacitor of a series RC circuit excited by a unit step voltage signal. Also sketch the voltage waveform across the capacitor and the resistor for t > 0. **(8+8)**

**b)** Determine the expression for the voltage across capacitor for t < 0 and t > 0 for the following network.