Reg. No. : | | | | | | | | | | |

Question Paper Code: 41354

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Third Semester

Electronics and Instrumentation Engineering

14UEI304 - ELECTRICAL CIRCUITS AND NETWORKS

(Common to Instrumentation and Control Engineering)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. If a 10*V* battery is connected across the parallel resistors of 3 Ω, 5 Ω , 10 Ω and 20 Ω , how much voltage is there across 5 Ω resistor?

   (a) 10*V* (b) 3*V* (c) 5*V* (d) 20*V*

2. The nodal method of circuit analysis is based on

   (a) KVL and Ohm's law (b) KCL and Ohm's law
   (c) KCL and KVL (d) KVL, KCL and Ohm's law

3. A practical current source consists of

   (a) an ideal current source in series with a resistance
   (b) an ideal current source in parallel with a resistance
   (c) an ideal voltage source in series with an internal resistance
   (d) an ideal voltage source in parallel with an internal resistance

4. Maximum power is transferred when load impedance is

   (a) equal to source resistance (b) equal to half of source resistance
   (c) equal to zero (d) equal to infinite

5. What is the total reactance of a series RLC circuit at resonance?

   (a) equal to X_L (b) equal to X_C (c) infinite (d) zero

6. The maximum value of the coefficient of coupling is

(a) 100%
(b) more than 100%
(c) 90%
(d) between 90% and 100%

7. The time constant of a series RC circuit is

(a) $\frac{1}{RC}$ (b) $\frac{R}{C}$ (c) $\frac{C}{R}$ (d) RC

8. Transient current in an RLC circuit is oscillatory when

(a) $R = 2\sqrt{\frac{L}{C}}$ (b) $400V$ (c) $R > 2\sqrt{\frac{L}{C}}$ (d) $R < 2\sqrt{\frac{L}{C}}$

9. In a three-phase system, the volt ampere rating is given by

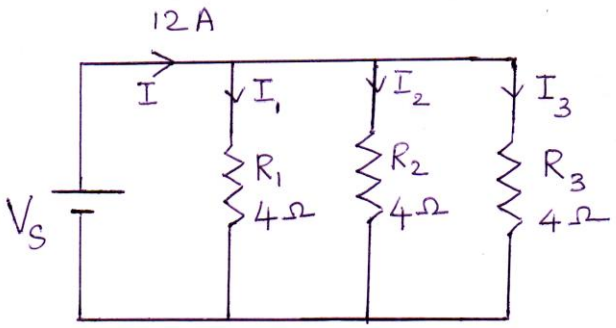
(a) $3V_L I_L$ (b) $\sqrt{3}V_L I_L$ (c) $V_L I_L$ (d) $3\sqrt{3}V_L I_L$

10. In two wattmeter method of power measurement, when the power factor is 0.5

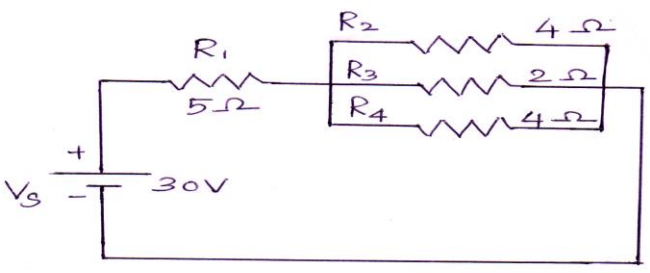
(a) the readings of the two wattmeters are equal and positive
(b) the readings of the two wattmeters are equal and opposite
(c) the readings of the two wattmeters is zero
(d) the total power is measured by only one wattemeter

PART - B (5 x 2 = 10 Marks)

11. Determine the total current in the circuit shown in below figure.



12. Determine the current through each resistor in the circuit shown in below figure.



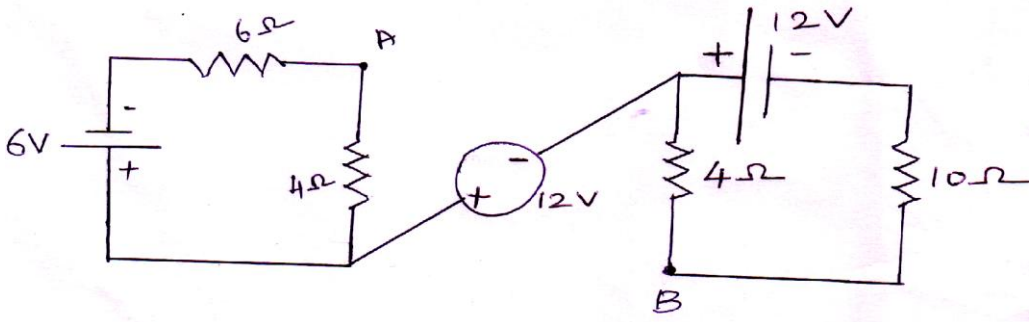
13. Define quality factor.

14. Distinguish between natural response and forced response.

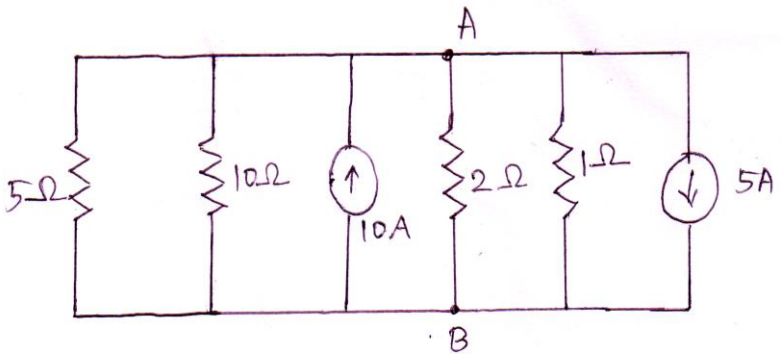
15. Draw the inter-connection between a three-phase, delta-connected source and delta-connected load.

PART - C (5 x 16 = 80 Marks)

16. (a) (i) What is the voltage across *A* and *B* in the circuit shown in below figure. (8)

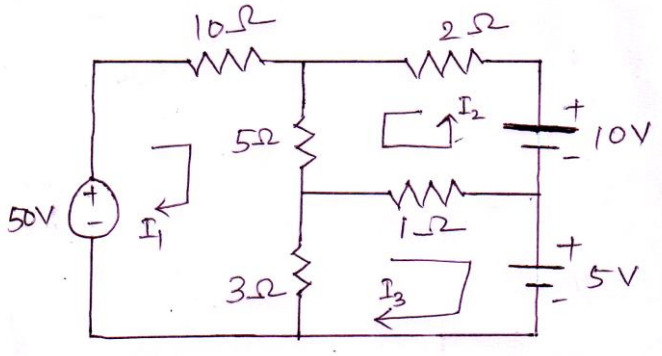


(ii) For the circuit shown in the below figure, find the voltage across the 10Ω resistor and the current passing through it. (8)

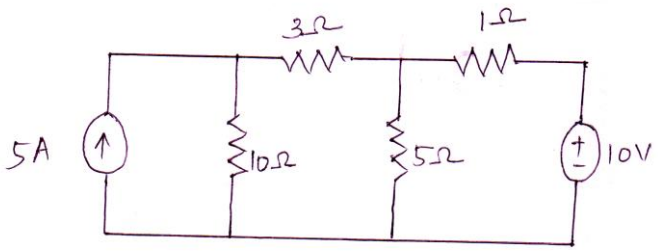


Or

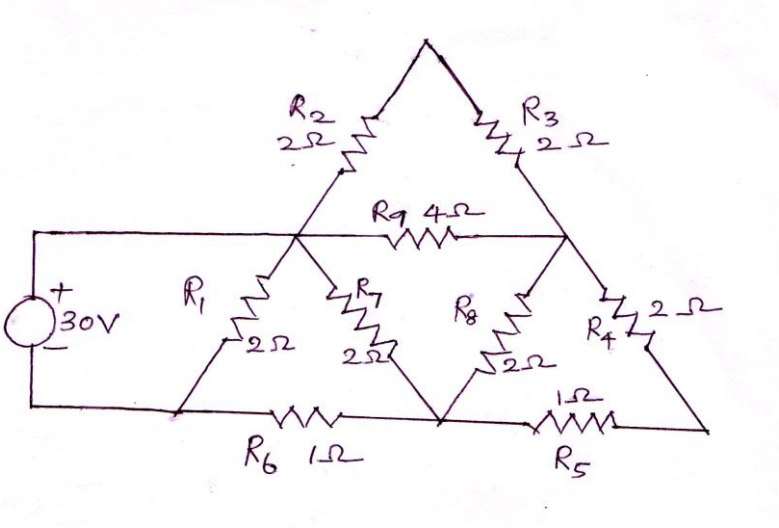
(b) (i) Determine the mesh current I_1 in the circuit shown in below figure. (10)



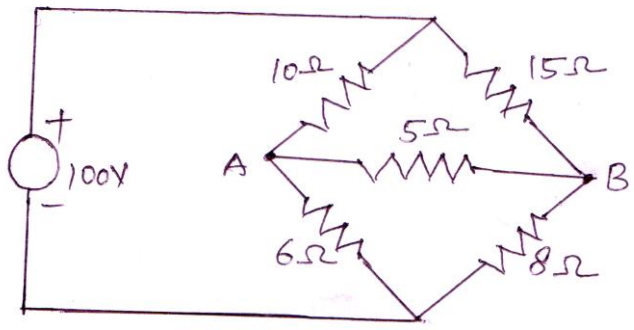
(ii) Write the node voltage equations and determine the currents in each branch for the network shown in below figure. (6)



17. (a) (i) Determine the current delivered by the source in the circuit shown in figure. (10)

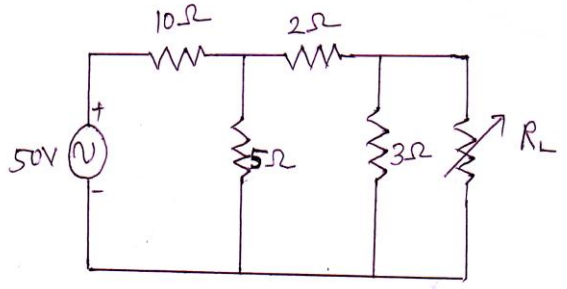


(ii) Use Thevenin's theorem to find the current through the 5Ω. (6)

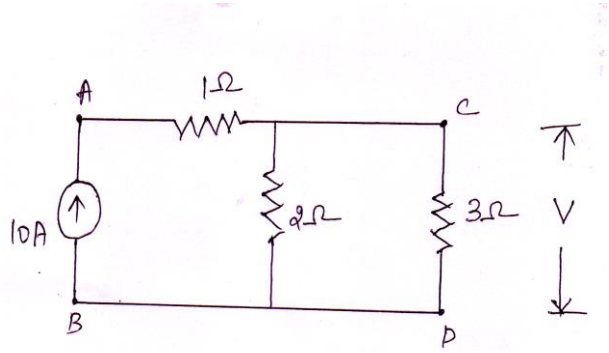


Or

(b) (i) Determine the maximum power delivered to the load in the circuit shown in below figure. (12)



(ii) Verify the reciprocity theorem in the circuit shown in below figure. (4)



18. (a) Derive bandwidth for a series RLC circuit as a function of resonant frequency. (16)

Or

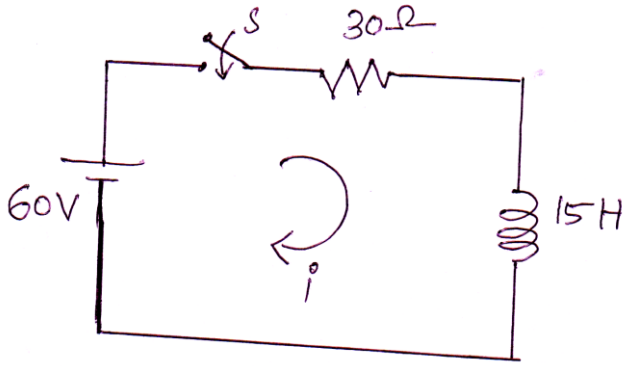
(b) (i) Derive the formula for mutual inductance in terms of coefficient of coupling and self inductance. (12)

(ii) With a neat sketch, explain briefly about the single tuned circuit. (4)

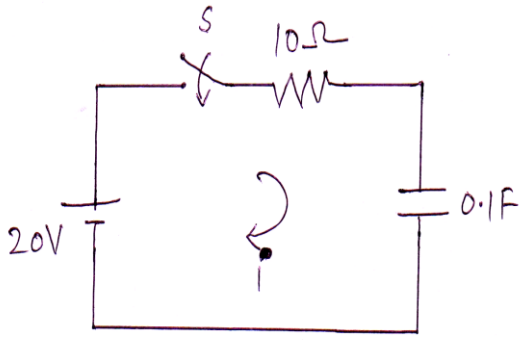
19. (a) Derive an expression for current response of a series RLC circuit when excited by a constant voltage source. (16)

Or

(b) (i) A series RL circuit with $R = 30\Omega$ and $L = 15H$ has a constant voltage $V = 60V$ applied at $t = 0$. Determine the current I, the voltage across resistor and voltage across inductor shown in below figure. (8)



(ii) A series RC circuit consists of resistor of 10 Ω and capacitor of 0.1*F*. A constant voltage of 20 *V* is applied to the circuit at *t* = 0. Obtain the current equation. Also determine the voltages across the resistor and the capacitor. (8)



20. (a) With a neat circuit and phasor diagram, explain the three phase power measurement by two wattmeter methods. (16)

Or

(b) (i) A 400*V* three-phase supply feeds an unbalanced three-wire star-connected load. The branch impedance of the load are $Z_R = (4 + j8)\Omega$; $Z_Y = (3 + j4)\Omega$ and $Z_B = (15 + j20)\Omega$. Find the line currents and voltage across each phase impedance. Assume RYB phase sequence. (12)

(ii) A balanced star-connected load of $(4+3j)\Omega$ per phase is connected to a balanced 3-phase $400V$ supply. The phase current is 12*A*. Find

(i) the total active power

(ii) reactive power and

(iii) total apparent power. (4)

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