A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: U2305

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Second Semester

Electrical and Electronics Engineering

21UEE205- ELECTRIC CIRCUIT ANALYSIS

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. According to Kirchoff's voltage law, CO1- U

   (a) The algebraic sum of all the e.m.f's in the circuit is zero

   (b) Algebraic sum all the voltage drops in the circuit is zero

   (c) Algebraic sum of e.m.f's plus algebraic sum of voltage drops is equal to zero

   (d) All of these

2. An alternating voltage is given by V = Vm sin157t.The frequency of the alternating voltage is _____ CO1- U

   (a) 50Hz (b) 25Hz (c) 100Hz (d) 75Hz

3. The form factor of sinusoidal wave form is ____ CO1- U

   (a) 1.414 (b) 1.11 (c) 0 (d) 1.5

4. In a three-phase system, the voltages are separated by _____ CO1- U

   (a)45° (b) 90° (c) 120° (d) 180°

5. When the power transferred to the load is maximum, the efficiency of power transfer is CO1- U

   (a) 25%. (b)100%. (c) 75%. (d) 50%

6. In maximum power transfer theorem, internal resistance must be CO1-U

   (a) Greater the internal resistance (b) equal to zero

   (c) Equal to load resistance (d) equal to internal resistance

7. The power factor is unity for the _____ resonant circuit. CO1- U

(a) Series (b) parallel (c) both (a) & (b) (d) none of the above

8. In a series resonance circuit, series resonance occurs when? CO1-U

(a) $X_L = 1$ (b) $X_C = 1$ (c) $X_L = X_C$ (d) $X_L = - X_C$

9. The time constant of an R-C circuit is? CO1- U

(a) RC (b) R/C (c) R (d) C

10. If the roots of an equation are real and equal, then the response will be? CO1-U

(a) over damped (b) damped (c) critically damped (d) under damped

PART – B (5 x 2= 10 Marks)

11. Two resistors of 4Ω and 6Ω are connected in parallel. If the total current is 30A. Find the current through each resistor. CO1-U

12. Write the equations for power measurements in three phase circuits CO1-U

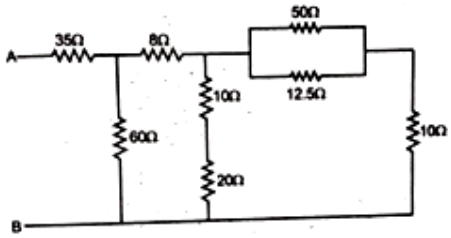
13. Draw the Norton's equivalent circuit CO1-U

14. Define bandwidth CO1-U

15. What is the time constant of RL circuit with R=10Ω and L=20mH. CO1-U

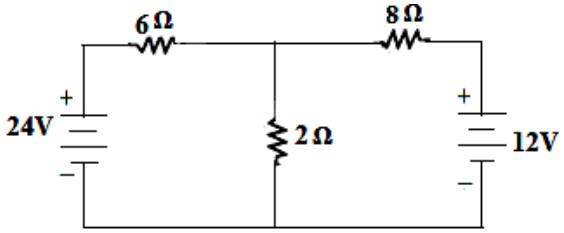
PART – C (5 x 16= 80Marks)

16. (a) In the circuit shown below, solve the total resistance and the current through each branch. CO2-App (16)



Or

(b) By using Kirchhoff's laws, find the current supplied by the batteries and the current through 2 Ω resistors for the circuit below CO2 -App (16)

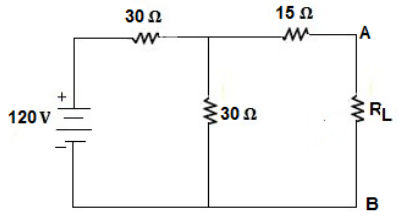


17. (a) A series circuit has R=10 Ohm, L = 50mH and C = 100μf and supplied with 200V, 50c/s. find (1) Inductive reactance (2) Capacitive reactance (3) Impedance (4) Current (5) Power factor(6)Power (7) Voltage drop across each element. CO2- App (16)

Or

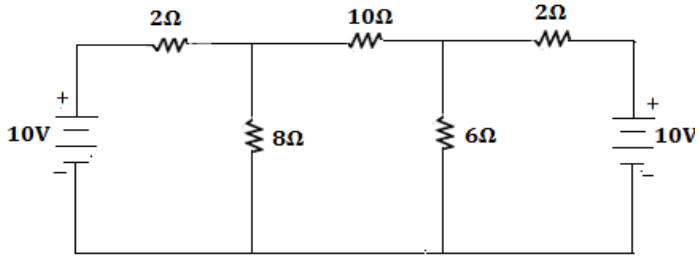
(b) With a neat circuit and phasor diagram explain the three phase power measurement by two wattmeter method. CO2- App (16)

18. (a) For the circuit given below calculate the value of the load resistance for maximum power transferred from source to load. Also find the value of maximum power in $\boldsymbol{R_L}$ CO2- App (16)



Or

(b) By using nodal voltage analysis, find the current through 10 ohm resistor CO2- App (16)



19. (a) (i) A series RLC circuit has R = 5Ω, L = 40mH and C = 1μF. Calculate resonant frequency, Quality factor of the circuit, half power frequency f_1 and f_2 and separation between half power frequencies. CO4- Ana (8)

(ii) Derive an expression for resonance frequency of series resonance circuit CO4- Ana (8)

Or

(b) (i) Explain the single tuned and double tuned circuits.(8) CO4-Ana (16)

(ii) Derive the formula for mutual inductance in terms of coefficient of coupling and self-inductance. (8)

20. (a) Consider a series RL circuit consisting of a resistor (R = 100 Ω) and an inductor (L = 1 H). The circuit is initially at rest, and a voltage step of 10 V is applied at t = 0. Analyze the circuit's transient response and answer the following questions: CO4-Ana (16)

(a) Calculate the time constant (τ) of the circuit.

(b) Determine the natural response of the circuit and explain its behavior over time.

(c) Calculate the initial current (i0) in the circuit when the voltage step is applied.

(d) Determine the complete solution for the current (i(t)) in the circuit as a function of time.

(e) Calculate the time taken for the current to reach 90% of its final value.

Or

(b) Consider an RLC circuit consisting of a resistor (R) of 20 Ω, an inductor (L) of 1 H, and a capacitor (C) of 10 μF. The circuit is initially at rest. At t = 0, a sinusoidal voltage source of 50 V, with a frequency of 1 kHz, is applied across the circuit. Using Laplace transforms, determine the expression for the current in the circuit and plot its transient response. CO4-Ana (16)