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Question Paper Code: R1325

.E. / B.Tech. DEGREE EXAMINATION, DEC 2025

First Semester

Computer Science and Business Systems

R21UEE125- PRINCIPLES OF ELECTRICAL ENGINEERING

(Common to AI&DS and CSE(AI&ML) Branches)

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The unit of electric potential difference is CO1-U
(a) Ampere Q (b) Volt (c) Ohm (d) Coulomb
2. Kirchoff's Voltage Law (KVL) is based on the principle of CO1-U
(a) Conservation of charge (b) Conservation of energy
(c) Conservation of power (d) Conservation of current
3. The S.I. unit of power is CO1-U
(a) Henry (b) Coulomb (c) Watt (d) Watt-hour
4. Electrical appliances are not connected in series because CO1-U
(a) Series circuit is complicated (b) Power loss is more
(c) Appliances have different current ratings (d) None of the above
5. Form factor is defined as the ratio of CO1-U
(a) Peak/average (b) RMS/average (c) RMS/peak (d) Peak/average
6. When an alternating current passes through an ohmic resistance the electrical CO1-U
power converted into heat is
(a) Apparent power (b) True power (c) Reactive power (d) None of the above
7. A capacitor stores 0.24 coulombs at 10 volts.It's capacitance is CO1-U
(a) 0.024 F (b) 0.12 F (c) 0.6 F (d) 0.8 F

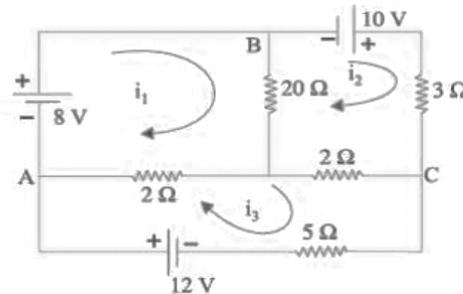
8. If three 15 μ F capacitors are connected in series ,the net capacitance is CO1-U
 (a) 5 μ F (b) 30 μ F (c) 45 μ F (d) 50 μ F
9. Mutual inductance between two magnetically coupled coils depends on CO1-U
 (a) Permeability of the core material (b) Number of turns of the coils
 (c) Cross sectional area of their common core (d) All of the above
10. The following circuit elements will oppose the change in circuit current CO1-U
 (a) Inductance (b) Capacitance (c) Resistance (d) All the above

PART – B (5 x 2= 10 Marks)

11. Explain voltage and current and summarize their relationship in a resistive circuit. CO1-U
12. Describe about Thevenin’s theorems. CO1-U
13. Explain about RMS and Average Value. CO1-U
14. Describe about electric field intensity and electric field strength. CO1-U
15. Describe about Faraday’s laws of electromagnetic induction. CO1-U

PART – C (5 x 16= 80 Marks)

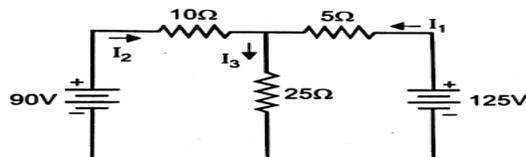
16. (a) (i) Apply mesh analysis to determine the current flowing through the shared 5 Ω resistor. CO3-App (16)



- (ii) A two-loop circuit has a shared 6 Ω resistor. Loop-1 contains a 15 V source and a 3 Ω resistor. Loop-2 contains a 10 V source and a 2 Ω resistor. Apply mesh analysis to determine the current through the 6 Ω resistor and compute the energy dissipated in it over 5 seconds.

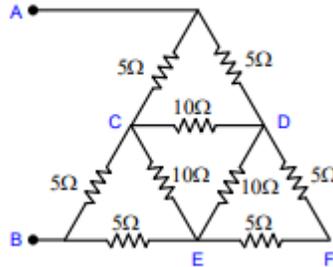
Or

- (b) (i) Apply mesh analysis to solve the current supplied by the batteries in the network shown in figure. CO3- App (16)



(ii) Using source transformation, an independent current source 5 A in parallel with 2Ω supplies a load 6Ω . Transform to an equivalent voltage source and find load current and voltage across load.

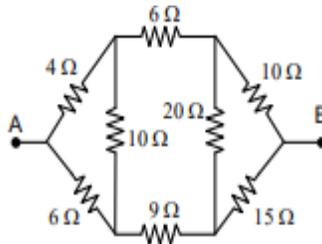
17. (a) (a) Use Resistance reduction method for the circuit given below CO2- App (16)
determine the total current taken from the source. The supply voltage is 50 V



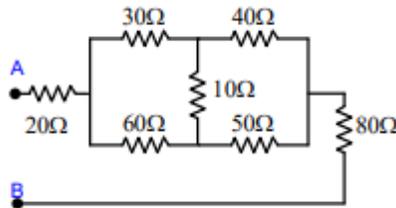
(b) Apply Star-Delta transformation of a sample network to explain how a complex resistive network can be simplified.

OR

- (b) (i) By using the transformations formula determine the equivalent resistance between terminals A and B CO2- App (16)



(ii) For the given series –parallel combinations, find the equivalent resistance between A and B.



18. (a) A Series RLC circuit has $R= 10\Omega$, $L= 50\text{mH}$ and $C=100\mu\text{F}$ and is supplied with 200 V 50 Hz, Find CO2- App (16)
- Impedance
 - Current,
 - Power,
 - Power factor,
 - the Voltage drop

or

- (b) A coil of resistance 5Ω and inductance 100 mH is connected in series with a $200 \mu\text{F}$ capacitor across a 200V , 50Hz supply. Calculate the value of inductive reactance, capacitive reactance, impedance of the whole circuit in complex form, current, power factor, total power, voltage across the coil and the capacitor. Draw the phasor diagram depicting the voltage and current. CO2- App (16)
19. (a) A parallel-plate capacitor of plate area ($A = 0.02\text{m}^2$) and plate separation ($d = 1\text{mm}$) is filled with a dielectric of relative permittivity ($\epsilon_r = 4$). Calculate:
- a) Capacitance of the capacitor
 - b) Electric field between the plates when a voltage of 100 V is applied
 - c) Energy stored in the capacitor
- or
- (b) Two capacitors, ($C_1 = 4 \mu\text{F}$) and ($C_2 = 6 \mu\text{F}$), are connected in series across a 12 V battery. Determine:
- a) The equivalent capacitance
 - b) Voltage across each capacitor
 - c) Energy stored in each capacitor
20. (a) Analyze the working principle of the transformer and derive the expression for the primary induced EMF in terms of the primary voltage and the turns ratio. Discuss the role of mutual induction in transformer operation. CO5-Ana (16)
- or
- (b) (i) A single-phase transformer has a primary voltage of 230 V and a secondary voltage of 460 V , with a turns ratio of $1:2$. The load on the secondary side draws a current of 10 A . Calculate the current on the primary side. Also, calculate the apparent power supplied by the transformer. CO5-Ana (16)
- (ii) A 100 kVA transformer operates with a primary voltage of 11 kV and a secondary voltage of 400 V . Analyze the KVA rating of the transformer. If the total losses in the transformer are 2 kW at full load, calculate the efficiency of the transformer under full load conditions.