*Total No. of Questions: 6* *Total No. of Printed Pages:3*

**Enrollment No.....**

Faculty of Engineering

End Sem Examination Dec 2024

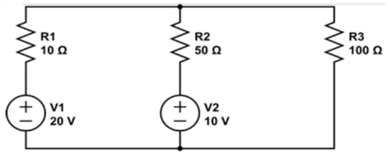
EN3ES11 Principles of Electrical Engineering

Programme: B.Tech. Branch/Specialisation: CSBS

**Duration: 3 Hrs.** **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

| | | | Marks | BL | PO | CO | PSO |
|---|---|---|---|---|---|---|---|
| Q.1 | i. | Which of the following correctly describes an ideal voltage source?<br>(a) It has infinite internal resistance<br>(b) It provides a constant current across the load<br>(c) It has zero internal resistance<br>(d) It varies voltage with current changes | **1** | 01 | 01-02 | 01 | |
| | ii. | In a circuit with a 12 V battery and three series connected resistors of 3 Ω, 4 Ω, and 5 Ω, the total power consumed will be-<br>(a) 2 W (b) 4 W<br>(c) 8 W (d) 12 W | **1** | 01 | 01-02 | 01 | |
| | iii. | Norton's Theorem states that any linear two-terminal network can be represented by:<br>(a) A voltage source and series resistor<br>(b) A current source and parallel resistor<br>(c) A dependent source and resistor<br>(d) A voltage source and parallel resistor | **1** | 02 | 01 | 02 | |
| | iv. | The Superposition Theorem applies to circuits which are-<br>(a) Linear and bilateral<br>(b) Nonlinear and unilateral<br>(c) Only resistive<br>(d) Only capacitive | **1** | 02 | 01 | 02 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| v. | The peak factor for a sinusoidal AC waveform is:<br>(a) 1.11 (b) 1.414 (c) 1.732 (d) 2.0 | **1** | 01 | 01, 03, 06 | 03 |
| vi. | In AC circuits, the power factor is defined as the ratio of:<br>(a) Apparent power to active power<br>(b) Active power to reactive power<br>(c) Active power to apparent power<br>(d) Reactive power to apparent power | **1** | 01 | 01, 03, 06 | 03 |
| vii. | When a dielectric material is placed between the plates of a capacitor, the capacitance:<br>(a) Decreases (b) Increases<br>(c) Remains the same (d) Becomes zero | **1** | 02 | 01, 07 | 04 |
| viii. | The magnetic flux of magnetic circuit is analogous to _____ of electric circuit.<br>(a) Voltage (b) Inductance<br>(c) Resistance (d) Current | **1** | 02 | 01 | 05 |
| ix. | A thermocouple is used to measure:<br>(a) Pressure (b) Temperature<br>(c) Voltage (d) Humidity | **1** | 02 | 01, 07 | 04 |
| x. | Which of the following earthing is used in residential buildings?<br>(a) Plate earthing (b) Chemical earthing<br>(c) Strip earthing (d) Both (a) and (b) | **1** | 02 | 01 | 05 |
| Q.2 i. | State Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). | **2** | 02 | 01-02 | 01 |
| ii. | Define passive and active circuit elements. Give examples of each. | **3** | 01 | 01-02 | 01 |
| iii. | Find the current through each branch using mesh analysis method-<br>  <br> | **5** | 03 | 01 | 02 |
| OR iv. | Explain all types of dependent and independent sources with their symbol. | **5** | 02 | 01-02 | 01 |



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Q.3 i. | Write down the statement of Superposition theorem. | **2** | 01 | 01 | 02 |
| ii. | State and prove the maximum power transfer theorem with a suitable example. | **8** | 02 | 01 | 02 |
| OR iii. | Derive the formula for Δ to Y and Y to Δ transformation. | **8** | 02 | 01 | 02 |
| Q.4 i. | Define the following terms:<br>(a) Active power (b) Reactive power<br>(c) Apparent power (d) Power factor | **4** | 02 | 01, 03, 06 | 03 |
| ii. | Draw & explain the voltage triangle, impedance triangle and power triangle of an R – L A.C. circuit. | **6** | 03 | 01, 03, 06 | 03 |
| OR iii. | Drive the relation between line and phase quantity of a three-phase delta-connected balanced load system. | **6** | 03 | 01, 03, 06 | 03 |
| Q.5 i. | What are composite capacitors? How do they differ from regular capacitors? | **3** | 02 | 01, 07 | 04 |
| ii. | Explain the working principle of a single-phase transformer and derive its EMF equation. | **7** | 03 | 01, 07 | 04 |
| OR iii. | State Faraday's law of electromagnetic induction. Also discuss self and mutual inductance. | **7** | 03 | 01, 07 | 04 |
| Q.6 | Attempt any two: | | | | |
| i. | Write short note on piezoelectric and thermo-couple transducers. | **5** | 03 | 01 | 05 |
| ii. | Explain different types of wiring systems. | **5** | 03 | 01 | 05 |
| iii. | Explain the types of earthing. Why earthing is necessary? | **5** | 03 | 01 | 05 |

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## Marking Scheme

## EN3ES11 (T) Principles of Electrical Engineering (T)

| | | | |
|---|---|---|---|
| Q.1 | i) | (c) It has zero internal resistance | **1** |
| | ii) | (d) 12 W | **1** |
| | iii) | (b) A current source and parallel resistor | **1** |
| | iv) | (a) Linear and bilateral | **1** |
| | v) | (b) 1.414 | **1** |
| | vi) | (c) Active power to apparent power | **1** |
| | vii) | (b) Increases | **1** |
| | viii) | (d) Current | **1** |
| | ix) | (b) Temperature | **1** |
| | x) | (d) Both (A) and (B) | **1** |

| | | | |
|---|---|---|---|
| Q.2 | i. | State Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). | **2** |
| | | Each Law statement (1*2) -2 marks | |
| | ii. | Define passive and active circuit elements. Give examples of each. | **3** |
| | | Each definition (1.5*2) -2 marks | |
| | iii. | Find the current through each branch using mesh analysis. | **5** |
| | | Equation of each mash 1 mark (1 mark *2) -2 mark | |
| | | Current in $R_1$ branch = 0.3076 A -1 mark | |
| | | Current in $R_2$ branch = 0.1384 A -1 mark | |
| | | Current in $R_3$ branch = 0.1692 A -1 mark | |
| OR | iv. | Explain all types of dependent and independent sources with their symbol. | **5** |
| | | Independent sources with symbol -2 mark | |
| | | Dependent sources with symbol -3 mark | |

| | | | |
|---|---|---|---|
| Q.3 | i. | Write the statement of the Superposition theorem. | **2** |
| | | Statement -2 mark | |
| | ii. | State and prove the Maximum power transfer theorem with a suitable example for a DC circuit. | **8** |
| | | Statement -2 mark | |
| | | Proof with suitable example -6 mark | |
| OR | iii. | Explain star-to-delta and delta to star transformation. | **8** |
| | | Star to delta -4 mark | |
| | | Delta to star -4 mark | |

| | | | |
|---|---|---|---|
| Q.4 | i. | Define the following terms: | **4** |
| | | Each Definition is one mark -4 mark | |
| | ii. | Explain the RMS value and maximum value in sinusoidal voltage. How RMS value 0.707 times to maximum value. | **6** |
| | | Definition of RMS value and maximum value -4 mark | |
| | | Derivation of RMS value to maximum value -2 mark | |
| OR | iii. | Drive the relation between line and phase quantity of a three-phase delta-connected balanced load system. | **6** |
| | | Diagram for star and delta connection (1 mark *2) -2 marks | |
| | | relation for delta connected system -4 marks | |

| | | | |
|---|---|---|---|
| Q.5 | i. | What are composite capacitors, and how do they differ from regular capacitors? | **3** |
| | | Definition of composite capacitor -2 mark | |
| | | Difference -1 mark | |
| | ii. | Explain the working principle of a single-phase transformer and derive its EMF equation. | **7** |
| | | Principle of single phase transformer -4 mark | |
| | | Emf equation -3 mark | |
| OR | iii. | State Faraday's law of electromagnetic induction. And discuss self and mutual inductance. | **7** |
| | | Statement of Faraday's law -2 mark | |
| | | Self and mutual inductance -5 mark | |

Q.6 Attempt any two:

[2] [3]

| | | | |
|---|---|---|---|
| i. | Piezoelectric and thermo-couple transducers | | **5** |
| | Piezoelectric transducers | -2.5 mark | |
| | Thermo-couple transducers | -2.5 mark | |
| ii. | Explain different types of wiring systems. | | **5** |
| | Name of different types of wiring system | -2 marks | |
| | Explanation of all | -3 marks | |
| iii. | Explain types of earthing and why it is necessary. | | **5** |
| | types of earthing | -3 marks | |
| | Why it is necessary | -2 marks | |

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