# EE 101: ELEMENTS OF ELECTRICAL ENGINEERING

**Time: 3 Hours**

**Marks: 70**

Instructions:

(1) All questions are compulsory.
(2) Figures to the right indicate full marks.
(3) Answer to two sections must be written in separate answer books.
(4) Assume suitable data if necessary.

## Section I

Q:1 (a) Explain star to delta transformation. **(04)**

(b) What do you mean by time constant? Obtain an expression of time constant for capacitor while charging. **(04)**

(c) Calculate the current through 5Ω resistance using Norton's theorem for following. **(04)**
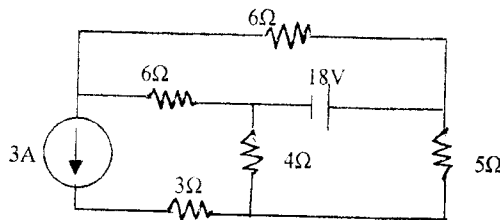


Q:1 (a) Derive an expression for the capacitance of a parallel plate capacitor with composite medium. **(04)**

(b) An 8μF capacitor is connected in series with a 0.5 MΩ resistor across a 200v dc supply. Calculate (i) the time constant (ii) the initial charging current (iii) the time taken for the potential difference across the capacitor to grow to 160 V and (iv) the current and the potential difference across the capacitor in 4 seconds after it is connected to the supply. **(04)**

(c) State and explain Thevenin's theorem. **(04)**

Q:2 (a) An iron ring of mean diameter 30 cm with a cross sectional area 3.5 cm x 3.2 cm is wound with a coil of 500 turns. The flux in the ring is 1.1 mWb, When the current through the coil is 1.6A, Find, **(06)**

    (i) Relative permeability,

    (ii) M.m.f required to establish flux of 1.0 mWb.

(b) Obtain an equation of equivalent inductance for two magnetically coupled coils connected in parallel with different polarities. **(05)**

### OR

Q:2 (a) What do you mean by co-efficient of coupling and derive an expression for co-efficient of coupling. **(04)**

(b) When two identical coupled coils are connected in series, the inductance of the combination is found to be 100 mH. When the connections to one of the coils are reversed, a similar measurement indicates 20 mH. Find the coupling co efficient between the coils. **(04)**

(c) Discuss : Cadmium – Nickel Oxide Battery **(03)**

Q:3 **Attempt Any Three.** **(12)**

(a) Explain the different types of lightning scheme.

(b) State and explain Joule's law for electric heating.

(c) Draw and explain magnetization characteristics for magnetic material.

(d) Calculate the rating of an electrical heater in KW necessary to raise the temperature of 4.3 Kg of water from 200C to 900C in 15 minutes. Heat loss during this period is 50000 joule and water equivalent of the heater is 200 gm. Also calculate the time taken to heat the same water through the same range if the heater input is halved.

Q:4  (a)  Define average value and get the expression of average value for pure sinusoidal waveform. **(04)**

(b)  Compare: Series Resonance circuit with Parallel Resonance circuit. **(04)**

(c)  A coil of resistance 12Ω and inductance 0.05H, and a non-inductive resistor of 20Ω with a loss free 40µF capacitor are connected in series across a 240 V, 50Hz. Sinusoidal supply. Calculate (a) current (b) voltage across the coil and the capacitor (c) power consumed in the circuit (d) power factor of the circuit. **(04)**

**OR**

Q:4  (a)  Justify "Average power consumed by pure inductive circuit over the full cycle of supplied voltage is zero." **(04)**

(b)  Define.
(i) Phase (ii) Diversity factor (iii) Form factor (iv) Dynamic Impedance **(04)**

(c)  A coil of 0.6 p.f. is connected in series with 120 µF capacitor. When it is supplied from 50 Hz ac supply, the voltage drop across the coil is equal to the voltage drop across the capacitor. Calculate the resistance and the inductive reactance of the coil. **(04)**

Q:5  (a)  Explain two wattmeter method to measure power of 3 - Ø balanced load circuit. **(04)**

(b)  A balanced star-connected, 3-phase load is supplied from a 3-phase 440V, 50Hz supply system. The current in each phase is 20A and lags behind its phase voltage by an angle of 40⁰. **(04)**
Calculate: (i) Parameters of the load
(ii) Reading of two watt meter connected to measure power in the circuit.

(c)  Write a short note on Electric Safety rule. **(03)**

**OR**

Q:5  (a)  Discuss causes and disadvantages of low power factor. And enumerate different methods to improve power factor. **(04)**

(b)  Establish the relation between line and phase quantity of 3 - Ø star connected circuit. **(04)**

(c)  Define. Tariff and discuss two part tariff and kVA maximum demand tariff. **(03)**

Q:6  **Attempt Any Three.** **(12)**

(a)  Explain load curve and its significance.

(b)  Discuss : PMMC type Instrument.

(c)  Two impedances $Z_1 = ( 8 + j6 ) \Omega$, $Z_2 = ( 6 - j8 ) \Omega$ are connected in parallel across 250 V, 50 Hz supply. Calculate current and power factor of each branch. Also calculate overall current.

(d)  Explain graphical representation of AC series resonance circuit.

**END OF PAPER**