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F.E. Semester-I (Revised Course 2016-17)
EXAMINATION JANUARY 2021
Fundamentals of Electrical Engineering

[Duration : Two Hours] **[Total Marks :60]**

Instructions:- 1. Answer THREE FULL QUESTIONS with ONE QUESTION FROM EACH PART.
2. Assume suitable additional data if necessary.

Part-A

1. a. Discuss the analogy between electric and magnetic circuits. **(6)**

   b. Draw the typical layout of a Hydro-electric power plant and explain how it generates electrical energy. **(8)**

   c. A mild steel ring is having a mean circumference of 400mm and cross-sectional area of 500mm^2. It is uniformly wound with a coil of 100 turns around it. The relative permeability is 380. Calculate: reluctance of the ring. (ii) the current required to produce a flux of 800µwb in the ring. **(6)**

2. a. Explain the following terms related to magnetism: **(6)**
   (i) Magnetomotive force (ii) Magnetic potential (iii) Reluctance (iv) Permeability (v) Flux density (vi) Magnetic field strength

   b. Two resistances 20Ω and 40Ω are connected in parallel. A resistance of 10Ω is connected in series with the combination. A voltage of 200V is applied across the circuit. Draw the circuit. Find the current in each resistance and the voltage across 10Ω resistor. Find also the power consumed in all the resistances. **(7)**

   c. State Maximum Power transfer theorem. Derive the condition for maximum power to be transferred. **(7)**

3. a. State and explain Millman's theorem. **(6)**

   b. Explain the Solar Photovoltaic technology for conversion of solar energy to Electrical energy. **(7)**

   c. When two identical coils are connected in series, the inductance of the combination is found to be 80mH. When the connection to one of the coil is reversed, a similar measurement indicates 20mH. Find the coupling coefficient between the two coils. **(7)**

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Part-B

4. a. Define phase difference. With neat waveforms explain the concept of leading and lagging phase angle. Also define the term Power factor. **(6)**

    b. Graphically show the representation of a three phase system and explain the concept of phase sequence. **(6)**

    c. A series R-L circuit takes 10A and dissipates 1000W when connected to a supply of 250V, 50Hz. **(8)**
    Calculate: (i) the impedance (ii) the effective resistance, (iii) the reactance, (iv) the inductance (v) the power factor. Draw the vector diagram.

5. a. Define the following terms as related to ac quantities:
    (i) Waveform (ii) RMS value (iii) Form factor (iv) Frequency (v) Active power
    (vi) Power factor **(6)**

    b. In a star connected, three phase system, derive the relationship between line voltage and phase voltage, line current and phase current and the expression for total power consumed. **(8)**

    c. A 6600/400V, single phase 600KVA single phase transformer has 1200 primary turns. Find (i) Transformation ratio, (ii) number of secondary turns (iii) voltage per turn. (iv) Secondary current when it supplies a load of 400 KW at 0.8 power factor lagging. **(6)**

6. a. Derive the expression for instantaneous current and instantaneous power in an AC circuit containing capacitance only. Draw neat and labeled waveforms and phasor diagram. **(8)**

    b. Briefly explain the following terms with respect to single phase transformer: **(6)**
    (i)   Magnetic leakage (ii) Copper loss (iii) Voltage regulation (iv) efficiency
    Also list down the different losses occurring in a Transformer.

    c. A delta-connected load draws a current of 15A at a lagging power factor of 0.85 from a 400V, 50Hz, three-phase supply. Calculate: (i) resistance and inductance of each phase (ii) power consumed. **(6)**

Part-C

7. a. A 3 phase, 400V, load takes an input of 40KW at 0.45 power factor lagging. Find the reading of each of the two single phase wattmeters connected to measure the input. **(6)**

    b. Describe the construction of a Single phase transformer. **(6)**

    c. Draw and explain the Single line representation of a power system indicating generation, transmission and distribution of electrical power. **(8)**

8.
a. Derive the expression for dynamically induced EMF. **(6)**

b. State and explain Kirchoff's Current law and Kirchoff's voltage law. **(6)**

c. A circuit consists of 100Ω resistor in parallel with a $60\mu F$ capacitor and is connected to a 200V, 50Hz supply. Calculate : (i) the branch currents and the supply current, (ii) the circuit phase angle and (iii) the circuit impedance. **(8)**