Ref: EX/PE/T/124/2018

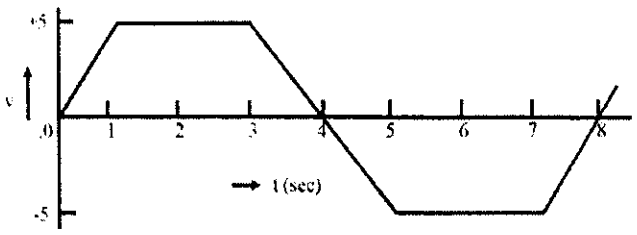
Bachelor of Power Engineering 1st Year 2nd Semester Examination 2018

Subject: Principles of Electrical Engineering

Time 3 Hours **Full Marks 100**

Attempt any 5 questions

1. a) What is a form factor?
   b) Deduce the RMS value of a rectified half-wave sinusoidal signal.
   c) Find the RMS and Average value of the following wave.



3+5+12

2. a) What do you mean by resonance of an AC circuit?
   b) Deduce the expression of resonant frequency of a parallel AC circuit. Assume your conditions.
   c) A series RLC circuit has value: R=100Ω, L=0.02 H, C= 0.02 μF. Calculate frequency of resonance. A variable frequency sinusoidal voltage of 50V is applied to the circuit. Find the frequency at which voltage across L and C is maximum. Also calculate voltage across L and C at frequency of resonance. Find the maximum current in the circuit. **3+5+12**

3. a) What is susceptance and conductance of an AC circuit?
   b) Show that a pure capacitive circuit does not consume any real power.
   c) A resistor, an ideal capacitor and an ideal inductor are connected in parallel to a source of alternating voltage of 160 V at a frequency of 250 Hz. A current of 2 A flows through the resistor and a current of 0.8 A flows through the inductor. The total current through the circuit is 2.5 A. Assess the resistance of the resistor, the capacity of the ideal capacitor and the inductance of the ideal inductor (presume that $I_C > I_L$). The assigned values of voltage and currents are the effective values. **3+5+12**

4. a) What is power factor?
   b) A circuit is having a leading power factor. With assumptions show that the power factor can be made to unity with the help of an inductor.
   c) A factory consumes load of 800kW at 0.8 p.f. (lagging) for 3000 hours per annum and buys energy on tariff of Rs. 100/KVA plus Rs. 0.10/kWh. If the power factor is improved to 0.9 (lagging) by means of capacitors costing @ Rs. 60/kVAR and having a power loss of 100W/KVA, calculate the annual saving incurred. **3+5+12**

5. a) What is balanced load for a 3 phase circuit?
   b) Deduce the expression for power factor in terms of two-wattmeter readings for a 3phase circuit.
   c) Calculate the readings of the two wattmeters (W_1 & W_2) connected to measure the total power for a balanced star-connected load, fed from a 3-phase, 400 V balanced supply with phase sequence as R-Y-B. The load impedance per phase is (20+j15)Ω. Also find the line and phase currents, power factor, total power, total reactive VA and total VA. **3+5+12**

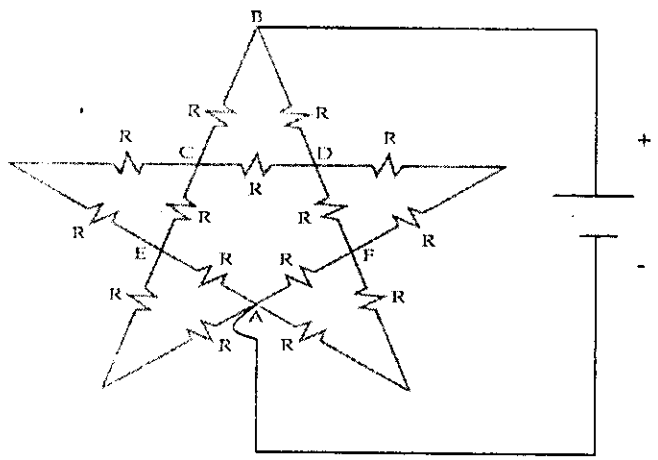
6. a) State Millman's Theorem.
   b) Deduce the expression of voltage between source-neutral & load-neutral by applying Millman's Theorem.
   c) A Y-connected load is supplied from a 400V, 3-phase, 3-wire 50 Hz symmetrical system RYB. The branch circuit impedances are given as: Z_R=10+j10√3; Z_Y=0+j10; Z_B=20√3-j20
   Determine the branch currents using Millman's Theorem. **3+5+12**

7. a) What is symmetrical component?
   b) Deduce the expression of negative sequence component of voltage derived from a set of 3 unbalanced voltages.
   c) One line of a 3phase generator is open circuited, while the other two are short-circuited to the ground. The line currents are . Find the symmetrical components of these currents. Also find the current into the ground.

   3+5+12

8. a) What is transient?
   b) Deduce the expression of transient current in a circuit having R & L (D.C) as its components.
   c) A 40Ω resistor and a 50μF capacitor are connected in series and supplied with an alternating voltage of: v=283 sin 314t. The supply is switched on at the instant when the voltage is zero. Determine the expression for the instantaneous current at time t. If the capacitor is replaced by an Inductance of 0.1 H find the value of transient currents at t = 0.02 seconds **3+5+12**

9. a) Why Y-Δ conversion is necessary?
   b) Deduce the expression of Δ circuit parameters in terms of Y-circuit parameters by Δ-Y conversion method.
   c) Find the resistance between A and B if all resistances are considered to be 1Ω each.



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