Ref. No.: Ex/PE/T/124/2019 (Old)

B.E. Power Engineering First Year Second Semester Examination 2019 (Old)

Subject: Principles of Electrical Engineering

FM: 100 **Time: 3hr**

Answer **any five** of the following: (5×20= 100)

Q1. a) Define Susceptance and Conductance of an AC circuit? **03**

Q1.b) Derive the formula of Quality factor in a series single phase RLC circuit. State your assumptions. **05**

Q1.c) In a circuit, a coil having a resistance of 12Ω and an inductance of 0.075H is in series with another coil having a resistance of 25Ω, an inductance of 0.2H and a capacitor of 50μF. The circuit is connected across a 220V, 50Hz supply. The voltages across the 1st coil and 2nd coil is V_1 and V_2 respectively while the current in the circuit is I. Find the values of (i) the current I (ii) V_1 and V_2 and (iii) p.f. Also draw a vector diagram for the circuit. **12**

Q2. a) Define mmf, reluctance and ampere turns? **03**

Q2. b) How do you find required ampere turns for a composite magnetic circuit? **05**

Q2. c) An iron ring has a cross section of 5 cm^2 and a mean diameter of 30cm. An air gap of 0.3mm has been cut across the section of the ring. The ring is wound with a coil of 250 turns through which a current of 2.3A is passed. If the total magnetic flux is 0.35mWb, find the relative permeability of iron, assuming no magnetic leakage. **12**

Q3. a) Define dielectric constant of a medium. **03**

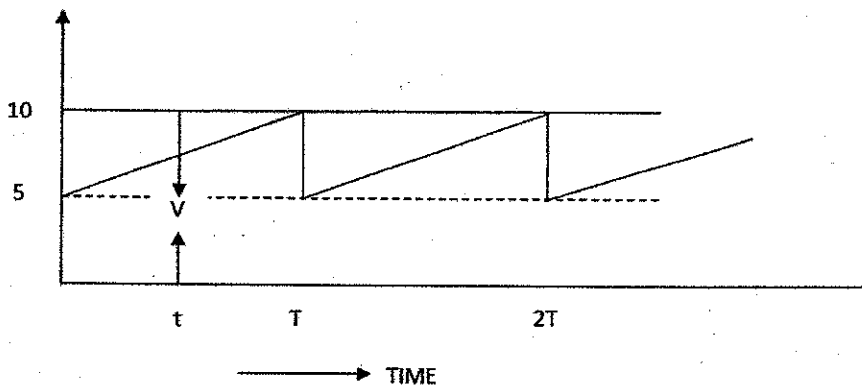
Q3. b) Derive the expression for force of attraction between two oppositely charged plates. **05**

Q3. c) A capacitor consists of two similar square aluminium plates, each 25 cm × 25 cm mounted parallel and opposite to each other. What is their capacitance in μF when distance between them is 1.2 cm and the dielectric is air? If the capacitor is given a charge of 900μC, what will be the difference of potential between plates? How will this be affected if the space between the plates is filled with wax which has a relative permittivity of 4? **12**

Q4. a) What is the significance of r.m.s and average value of a wave? **03**

Q4. b) Deduce the rms value for a generalized triangular waveform? **05**

Q4. c) Determine the r.m.s and average value of the waveform shown in the figure. **12**



Q5. a) What do you mean by power factor? Explain in terms of Active and Reactive Power. **03**

Q5. b) Find the expression of power factor in terms of W_1 and W_2 i.e the two wattmeter readings for three phase power measurement by two wattmeter method. **05**

Q5. c) The power input to a synchronous motor is measured by two wattmeters both of which indicate 75kW. If the power factor of the motor be changed to 0.85 leading, determine the readings of the two wattmeters, the total input power remaining the same. Draw the vector diagram for the second condition of the load. **12**

Q6. a) How capacitances can be utilized for power factor improvement? **03**

Q6. b) Show that a pure capacitive circuit does not consume any real power. **05**

Q6. c) Three impedance coils, each having a resistance of 20Ω and a reactance of 25Ω, are connected in a star to a 440V, 3-ph, 50Hz supply. Calculate (i) the line current; (ii) power supplied and (iii) the power factor. If three capacitors, each of the same capacitance, are connected in delta to the same supply so as to form parallel circuit with the above impedance coils, calculate the capacitance of each capacitor to obtain a resultant power factor of 0.9 lagging. **12**

Q7.a) What are symmetrical components in an AC circuits? **03**

Q7.b) Derive the formula of negative sequence component. **05**

Q7.c) Find out the positive, negative and zero-phase sequence components of the following set of three unbalanced voltage vectors:

$V_A = 10\angle 45^0$; $V_B = 30\angle -60^0$; $V_C = 15\angle 135^0$

Indicate on an approximate diagram how the original vectors and their different sequence components are located. **12**

Q8.a) Why is star delta conversion necessary? **03**

Q8.b) Derive the relation between the equivalent resistances in between star and delta connection. **05**

Q8.c) An unbalanced star-connected load has branch impedances:

$Z_1 = 10\angle 30^0\Omega$, $Z_2 = 20\angle 60^0\Omega$, $Z_3 = 15\angle -45^0\Omega$

These impedances are connected across a balanced 3-phase, 3-wire supply of 220V. Find the line currents and the voltage across the impedance using Y/Δ conversion method. **12**

Q9. a) What do you mean by transients in an AC circuit? **03**

Q9. b) State and prove Millman's theorem? **05**

Q9. c) A Y-connected load is supplied from a 400V, 3-phase, 3 wire symmetrical system RYB. The branch circuit impedances are: $Z_R = 8\sqrt{3}+j10$; $Z_Y = 15+j25\sqrt{3}$; $Z_B = 6-j8$. By Millman's Theorem determine the current in each branch. Phase sequence is RYB. **12**