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First/Second Semester B.E. Degree Examination, July/August 2022
Basic Electrical Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. State and explain Kirchoff's laws. **(06 Marks)**

b. A 10Ω resistance is connected in series with a parallel combination of 15Ω and 20Ω resistors. The circuit is applied with V volts. The power taken by the circuits is 150 watts. Solve for the total current through the circuit and power consumed in all resistors. **(06 Marks)**

c. Derive the Rms and average values of a sinusoidal AC waveform and hence obtain the values of form factor and peak factor. **(08 Marks)**

OR

2 a. State and explain OHM's law and list out its limitations. **(05 Marks)**

b. An alternating current i is given by i = 100sin 314t. Find i) The amplitude ii) Frequency iii) Time period iv) Rms value v) Average value vi) Form factor vii) Peak factor. **(07 Marks)**

c. In Fig Q2(c), find the voltage across 4Ω resistor and the supply voltage V.

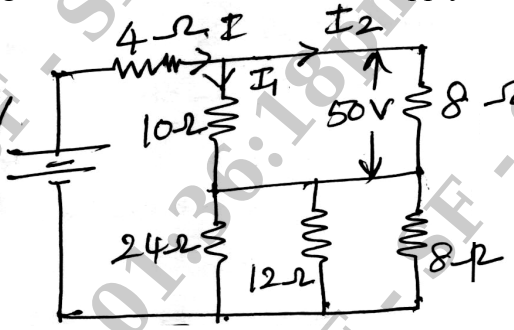

Fig Q2(c) **(08 Marks)**

Module-2

3 a. Show that power consumed in a pure capacitor is zero when a sinusoidal voltage is applied across it. Draw the voltage, current and power wave forms. **(06 Marks)**

b. A series R – L – C circuit with 100Ω, 25μF and 0.15H is connected across 220V, 50Hz supply. Calculate i) Impedance ii) Current iii) Power consumed iv) power factor of the circuit. **(08 Marks)**

c. Obtain the relationship between the line and phase quantities in a three phase balanced star connected system. Also derive the power equation. **(06 Marks)**

OR

4 a. Derive the equation for the current and the power consumed in a series R-C circuit when a sinusoidal voltage is applied across it. Also draw the waveforms of voltage current and power, and relevant phasor diagrams. **(08 Marks)**

b. Show that two wattmeters are sufficient to measure three phase power consumed in a 3-phase load, using relevant phasor diagram. Also derive the expression for the power factor. **(06 Marks)**

c. A parallel circuit consists of 20Ω in series with an inductive reactance of 15Ω in one branch and a resistance of 30Ω in series with a capacitive reactance of 20Ω in the other branch. Determine the current and power dissipated in each branch if the total current drawn is $10\angle -30^\circ$ Amps. **(06 Marks)**

Module-3

5 a. Derive the EMF equation of a single phase transformer. **(06 Marks)**

b. With a neat sketch, illustrate 2 way and three way control of lamps. **(08 Marks)**

c. A single phase, 25 KVA transformer has 1000 primary turns and 2500 secondary turns. The net cross – sectional area of the core is $100cm^2$,when the primary winding is connected to 550V, 50Hz supply, calculate :

i) The maximum value of flux density in the core
ii) The voltage induced in the secondary winding
iii) The primary and secondary full load currents
iv) Voltage induced per turn on primary and secondary. **(06 Marks)**

OR

6 a. Develop an expression for the efficiency of a transformer and hence obtain the condition for the maximum efficiency. **(06 Marks)**

b. In a 100KVA, 2000/200V single phase transformer, the iron and full load copper losses are 960watts and 1200watts respectively. Calculate the efficiency at i) full load, upf ii) half full load, 0.8pf iii) The load KVA corresponding to the maximum efficiency. **(06 Marks)**

c. What is earthing? With a neat figure, explain plate and pipe earthing. **(08 Marks)**

Module-4

7 a. With a neat sketch, explain the construction of a dc generator, and state the function of each part. **(08 Marks)**

b. Derive an expression for the torque developed in the armature of a DC motor. **(06 Marks)**

c. An 8 pole lap connected armature has 960 conductors, a flux of 40mwb/pole and a speed of 400rpm. Calculate the emf generated. If the armature were wave connected, at what speed must it be driven to generate 400V? **(06 Marks)**

OR

8 a. Develop the emf equation of a DC generator. **(06 Marks)**

b. Sketch the torque Vs I_a characteristics and speed Vs I_a characteristics of dc shunt motor and dc series motor and explain. **(08 Marks)**

c. A 4 pole DC shunt motor takes 22A from 220V supply. The armature and field resistances are 0.5Ω and 100Ω respectively. The armature is lap connected with 300 conductors. If the flux per pole is 20mwb, calculate the speed and gross torque. **(06 Marks)**

Module-5

9 a. Explain the concept of rotating magnetic field in case of a 3phase induction motor. **(08 Marks)**

b. Explain how stationary armature is advantageous in case of an alternator. **(05 Marks)**

c. A 16 pole, 3 phase alternator has star connected winding with 144 slots and 10 conductors /slot. The flux per pole is 0.03wb and the speed is 375rpm. Find the frequency and line emf generated. Given : $K_d = 0.96$, $K_p = 1$. **(07 Marks)**

OR

10 a. Derive the Emf equation of a synchronous, generator, with K_p and K_d. **(08 Marks)**

b. Define the slip of an induction motor and derive the expression for frequency of rotor current. **(06 Marks)**

c. A 6 pole induction motor is supplied form a 3ϕ, 50Hz supply has a rotor frequency of 2.3Hz. Solve for the percentage slip and the speed of the motor. **(06 Marks)**