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First / Second Semester B.E. Degree Examination, Jan./Feb. 2023 Basic Electrical Engineering

Time: 3 hrs.

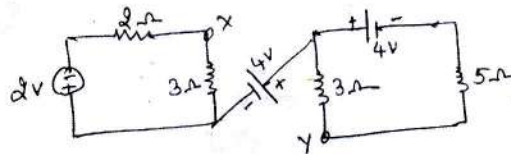
Max. Marks: 80

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

Module-1

- 1
 - a. State and explain Kirchoff's Current law and Kirchoff's Voltage law. (05 Marks)
 - b. A Solenoid of length 50cm and uniform cross sectional area of 5cm^2 is wound with 250 turns on a core at relative permeability of 600. Find out the inductance and energy stored, if a current of 1 Amp is flowing through the coil. (05 Marks)
 - c. Apply Kirchoff's laws to find potential difference between X and Y shown in the network. (06 Marks)

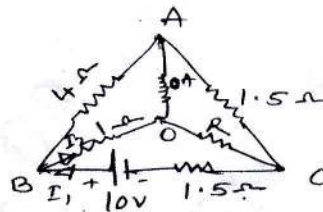
Fig. Q1(c)



OR

- 2
 - a. Derive the equivalent resistance and write the characteristics of series circuits and parallel circuits. (06 Marks)
 - b. Derive the expression for the energy stored in magnetic field. (05 Marks)
 - c. Find the value of R and the current flowing through it in the network shown in Fig. Q2(c), when the current in the branch OA is zero. (05 Marks)

Fig. Q2(c)



Module-2

- 3
 - a. Explain with a neat sketch, the construction of a dc machine. (06 Marks)
 - b. With the help of neat diagram, explain the construction and workings of a induction type energy meter. (05 Marks)
 - c. A d.c. shunt generator has shunt field windings resistance of 100Ω . It is supplying a load of 5kW at a voltage of 250V. Its armature resistance is given 0.22Ω and total brush drop as 2V. Calculate the induced emf of generator. (05 Marks)

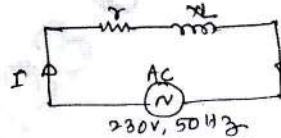
OR

- 4
 - a. Derive the expression for armature torque developed in a d.c. motor. (05 Marks)
 - b. With a neat diagram, explain the construction and working of dynamometer type wattmeter. (06 Marks)
 - c. A 4 pole, wave connected DC shunt motor with 492 conductors and applied input voltage is 500V. The flux per pole is 0.05 wb. The full load current is 20 Amps, the armature and shunt field resistances are 0.1Ω and 250Ω respectively. Calculate the speed and the torque developed in the armature of motor. (05 Marks)

Module-3

- 5 a. Define the following terms with reference to AC quantities : i) Instantaneous value
ii) Time period iii) Frequency iv) Form factor v) Power factor. (05 Marks)
- b. Explain three way control of lamps with truth table and connection diagram. (05 Marks)
- c. An inductive coil draws a current of 2 A, when connected to a 230V, 50Hz supply as shown below Fig. Q5(c). The power taken by the coil is 100 watts. Calculate the resistance and inductance of the coil. (06 Marks)

Fig. Q5(c)

**OR**

- 6 a. Prove that a pure capacitor does not consume any power. (05 Marks)
- b. Write a short note on :
i) Necessity of earthing ii) Precaution to be taken to prevent electric shock. (05 Marks)
- c. A circuit consists of a resistance of 10Ω on inductance of 16 mH and a capacitance of $150\mu\text{F}$ connected in series. A supply of 100V at 50Hz is given to the circuit. Find the current , power factor and power consumed by the circuit. Draw the vector diagram. (06 Marks)

Module-4

- 7 a. Obtain the relationship between line and phase value of voltages and currents in a three phase balanced star connected system. (05 Marks)
- b. Derive the emf equation of alternator. (05 Marks)
- c. A 3 phase Y connected alternator driven at 900 rpm is required to generate a line voltage of 460V at 60Hz on open circuit. The stator has two slots/pole/phase and 4 conductors / slot. Calculate the number of poles and useful flux per pole, if the winding factor is 0.966. (06 Marks)

OR

- 8 a. Define Phase sequence and list out the advantages of three phase system as compared to single phase system. (05 Marks)
- b. Each of the two wattmeters connected to measure the input to a 3ϕ circuit : reads 20kW. What does each instrument reads, when the loads p.f. is 0.866 lagging with the total three phase power remaining unchanged in the altered condition? (05 Marks)
- c. With neat sketches, explain the construction of salient pole and non salient pole type rotors of alternator. (06 Marks)

Module-5

- 9 a. Explain the construction and working principle of single phase transformer. (05 Marks)
- b. Define Slip. Derive an expression for frequency of rotor current. (05 Marks)
- c. A single phase transformer has 400 primary and 1000 secondary turns. The net cross sectional area is 60cm^2 . The supply is 500V, 50Hz. Calculate
i) The peak value of flux density.
ii) Voltage induced in the secondary.
iii) The number of secondary turns to induced a voltage of 2500V. (06 Marks)

OR

- 10 a. Explain the principle of operation of a 3 ϕ Induction motor. (05 Marks)
- b. Explain the various losses in transformer. How these losses can be minimized. (05 Marks)
- c. A 3 phase induction motor with 4 poles is supplied from an alternator having 6 pole and running at 1000 rpm. Calculate
- i) Synchronous speed of the I.M.
 - ii) If speed when slip is 0.04.
 - iii) Frequency of the rotor emf when speed is 600 rpm. (06 Marks)
