



- 4 a. Show that two wattmeters are sufficient to measure three phase power for a balanced star connected load. (06 Marks)
- b. Derive an expression for impedance, phase angle and power for series R-L circuit supplied with AC. (06 Marks)
- c. How is current 10A shared by three impedance  $Z_1 = 2 - j5 \Omega$ ,  $Z_2 = 6.708 \angle 26.56^\circ \Omega$ ,  $Z_3 = 3 + j4 \Omega$  all are connected in parallel? (08 Marks)

**Module-3**

- 5 a. State the principle of operation of transformer. Derive an expression for emf induced in transformer. (06 Marks)
- b. Explain the operation of 3-way control of lamp with the help of diagram and functional table. (06 Marks)
- c. Maximum efficiency at full load and unity power factor of a 1-phase, 25 kVA, 500/1000 V, 50 Hz transformer is 98%. Calculate its efficiency at: (i) 75% of full load, 0.9 p.f. (ii) 50% of full load, 0.8 p.f. (iii) 25% of full load, 0.6 p.f. (08 Marks)

**OR**

- 6 a. Briefly explain (i) Concealed wiring (ii) Service mains (06 Marks)
- b. Write short notes on: (i) Fuse (ii) MCB (06 Marks)
- c. A transformer working at unity power factor has an efficiency of 90% at both half load and at full load of 500 W. Determine the efficiency at 75% of full load. (08 Marks)

**Module-4**

- 7 a. With a neat diagram, explain the constructional details of DC Generator. (06 Marks)
- b. Derive an equation of torque of DC motor. (06 Marks)
- c. A 4-pole lap wound shunt generator delivers 200 A at terminal voltage of 250 V. It has field and armature resistance  $50 \Omega$  and  $0.05 \Omega$  respectively. Neglect brush drop. Calculate: (i) Armature current (ii) Current per parallel path (iii) emf generated (iv) Power developed (08 Marks)

**OR**

- 8 a. Explain the significance of back emf in DC motor. (04 Marks)
- b. Derive an emf equation of DC generator. (06 Marks)
- c. A 250 V DC shunt motor takes 6A line current on no load and runs at 1000 rpm. The field resistance is  $250 \Omega$  and armature resistance is  $0.2 \Omega$ . If the full load line current is 26A, calculate full load speed assuming constant air gap flux. (10 Marks)

**Module-5**

- 9 a. With neat sketch, explain the constructional details of 3-phase alternator. (06 Marks)
- b. Explain the operating principle of three phase induction motor. (06 Marks)
- c. A 6-pole, 3-phase star connected alternator has 90 slots and 8 conductors per slot and rotates at 1000 rpm. The flux per pole is 50 mWb. Find the induced emf across its lines. Assume winding factors of 0.97. (08 Marks)

**OR**

- 10 a. Explain the constructional details of 3-phase induction motor. Draw relevant sketches. (08 Marks)
- b. Derive an expression for frequency of induced emf in case of 3-phase alternator. (04 Marks)
- c. A 3-phase induction motor with 4-poles is supplied from an alternator having 6-poles and running at 1000 rpm. Calculate: (i) Synchronous speed of induction motor (ii) Its speed when slip is 0.04 (iii) Frequency of rotor emf when speed is 600 rpm. (08 Marks)

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