

**PART B**

**(Electrical and Mechanical)**

**SECTION I**

**(Electrical)**

1. (a) Use Nodal analysis to find the currents in various resistors of the circuit shown in Fig. 1. 10

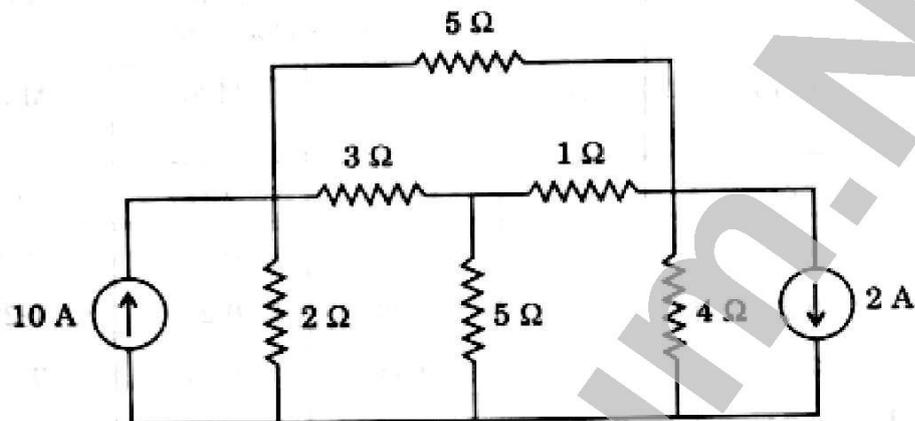


Fig. 1

- (b) State and prove Maximum Power Transfer Theorem for dc circuits. 10
- (c) The self-inductance of a coil of 500 turns is 0.25 H. If 60% of the flux is linked with second coil of 10,000 turns then calculate
- (i) the mutual inductance of the two coils.
  - (ii) the emf induced in the second coil when the current in the first coil changes at the rate of 100 A/s. 10
2. (a) Calculate the rms and average values of current  $i$  represented by the waveform shown in Fig. 2. 10

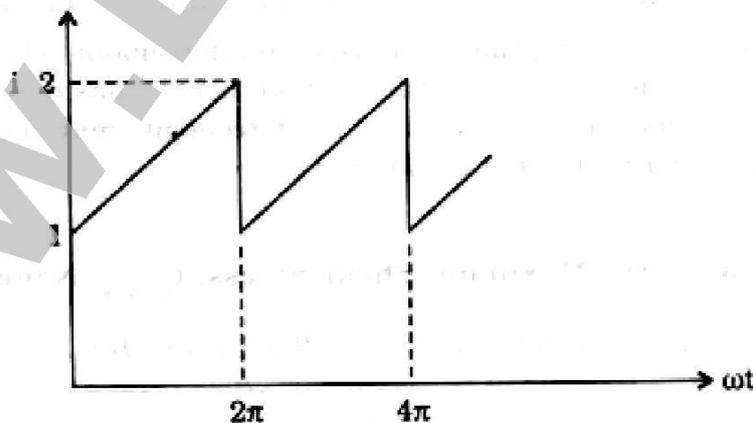


Fig. 2

- (b) An iron choke coil takes 4 A when connected to a 20 V dc supply and takes 5 A when connected to 65 V, 50 Hz ac supply. Determine :
- resistance and inductance of the coil
  - power drawn by the coil
  - the power factor
- (c) With neat diagram explain the construction of moving coil instruments and derive the expression for deflecting torque of moving coil instrument. 10
3. (a) Derive an expression for the emf induced in a transformer winding. Show that emf per turn in primary is equal to emf per turn in secondary. 10
- (b) Give the equivalent circuit of a transformer and define its various parameters. 10
- (c) Explain with neat diagram the differential protection scheme used to protect  $\Delta - Y$  transformer. 10
4. (a) Draw the external characteristics of various types of dc generators in one figure assuming the same no load terminal voltage. Compare these characteristics. 10
- (b) Describe and compare various methods of speed control of dc shunt motors. 10
- (c) A 230 V dc series motor has an armature resistance of  $0.2 \Omega$  and field resistance of  $0.1 \Omega$  at rated voltage. The motor draws a line current of 40 amperes and runs at a speed of 1000 rpm. Find speed of the motor for line current of 20 A at 230 V. Assume that flux at 20 A line current is 60% of the flux at 40 A line current. 10
5. (a) Explain various methods of starting of synchronous motor. 10
- (b) A 3-phase 50 Hz induction motor has a full load speed of 1440 rpm. For this motor calculate the following : 10
- Number of poles
  - Full load slip
  - Rotor frequency
  - Speed of stator field w.r.t. rotor field
  - Speed of stator field w.r.t. rotor structure
- (c) Draw and explain the torque-slip characteristics of a 3-phase induction motor. Also explain the effect of rotor resistance on torque-slip characteristics. 10

6. (a) Define and explain the significance of the following terms : 10
- (i) Load factor
  - (ii) Diversity factor
  - (iii) Demand factor
- (b) Daily load of an industry is 200 kW for first one hour, 150 kW for next 7 hours, 50 kW for next 8 hours and 1 kW for the remaining time. If the tariff in force is Rs. 1000/- per kW of maximum demand per annum plus Rs. 2.25 per kWh, find the electricity expenditure for one year (365 days). 10
- (c) Explain different types of distribution systems with neat sketch. 10