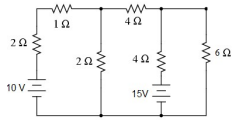
(viii) The peak value of a sine wave is 200V. Its average value is
(a) 127.4V (b) 141.4V (c) 282.4V (d) 100V.

(ix) Transformer core are laminated in order to
(a) reduce hysteresis loss
(b) reduce hysteresis and eddy current loss
(c) minimize eddy current loss
(d) minimize copper loss.

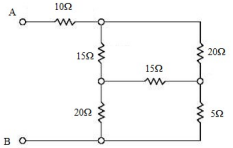
(x) The rating of transformer may be expressed in _____.
(a) kW (b) kVAR (c) KVA (d) horse power.

Group – B

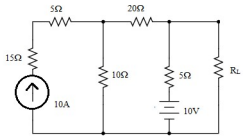
2. (a) Find the current through 6Ω resistance for the circuit below using Thevenin's equivalent circuit.



(b) Find the equivalent resistance across 'AB' for the circuit below.



(c) Find the value of R_L for which power consumed by R_L will be maximum.



6 + 3 + 3 = 12

3. (a) A ring of 40cm mean diameter is made up of iron rod 3 cm in diameter. At one end, a saw cut 1 mm wide is made through it. It is uniformly wound with 500 turns of wire. Calculate the current required by the exciting coil to produce a total flux of 5 mWb. Assume a relative permeability of iron at this flux density as 1000. Neglect leakage and fringing.

(b) Explain the terms self-inductance and mutual-inductance.

(c) A coil having an inductance of 50 mH is carrying a current of 100A. Calculate the self induced e.m.f. in the coil, when the current is (i) reduced to zero in 0.03 second (ii) reversed in 0.03 second.

(d) A coil having an inductance of 90μH is connected in series with a another coil of 200μH and the total inductance of the combination is measured to be 150μH. Determine the coefficient of coupling.

6 + 2 + 2 + 2 = 12

Group – C

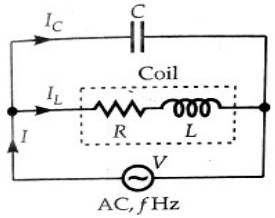
4. (a) Find out the expressions for RMS value, and average value for a full wave rectified output. Also calculate the form factor for the above waveform.

(b) Derive an expression for the average power consumed by a purely resistive circuit on an AC supply in terms of RMS values.

(3+ 3 + 1) + 5 = 12

5. (a) A resistance of 12Ω, inductance of 0.1H and a capacitance of 100μF are connected in series across a 220V AC, 100 Hz supply. Calculate (i) impedance of the circuit (ii) current flowing through the circuit (iii) power factor (iv) voltage across each element.

(b) Derive the expression of resonating frequency for the circuit as shown below. What is the value of power factor at resonance?



(1+1+1+1+ 3) + (4 + 1)= 12

Group – D

6.(a) Derive an expression to determine the power factor when three-phase power is measured by two-wattmeter method. Also draw the phasor diagram for balanced star-connected inductive load.

(b) Power in a three-phase circuit is measured by two wattmeters and the readings of the wattmeters are 5kW and 0.5kW respectively, the latter reading being obtained after reversal of the current-coil connections. The supply to the three phase circuit is 400V, 50Hz.
Find (i) total power (ii) power factor (iii) line current (iv) load power factor when both wattmeters read identical.

(5 + 2) + (1 + 2+ 1 + 1) = 12

7.(a) Derive the torque equation of DC motor.

(b) The armature of a 4-pole, lap-wound shunt generator has 480 conductors. The flux per pole is 0.04Wb. The armature resistance is 0.05Ω and shunt field resistance is 100 Ω. Find the speed of the machine, when supplying 500A at a terminal voltage of 250V.

(c) A dc shunt motor runs at 500 rpm taking 50A from a 230V supply. Armature resistance is 0.2 Ω and field resistance is 100 Ω. Find the speed when current through the armature is 30A.

4 + 4 + 4 = 12

Group – E

8.(a) Draw the equivalent circuit of a transformer on load.

(b) Draw the phasor diagram of a transformer working on an inductive load. Derive an expression for regulation in the above case. Also write the meaning of each phasor used in the phasor diagram.

(c) A 3300/220V, 50Hz single-phase transformer takes a no-load current of 0.8A at a power factor of 0.8 lagging. Find (i) the active/working current (ii) the magnetizing current.

2 + (4 + 4) + 2 = 12

9.(a) Explain how the rotating magnetic field is produced in the three-phrase induction motor.

(b) A three phase 4-pole, 50 Hz induction motor has rotor resistance of 0.015Ω and standstill reactance of 0.25Ω per phase. The full-load speed is 1440 rpm. Calculate (i) synchronous speed (ii) full-load slip (iii) rotor frequency at full-load (iv) slip at which maximum torque will occur (v) the ratio of full-load torque to maximum torque (vi) the ratio of starting torque to maximum torque.

6 + 6 = 12

BASIC ELECTRICAL ENGINEERING
(ELEC 1001)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Thevenin resistance (R_{Th}) is determined with all the
(a) voltage sources open-circuited and all current sources short-circuited
(b) voltage and current sources left as they are
(c) voltage and current sources are replaced by their internal resistances
(d) voltage and current sources open circuited.

(ii) The coefficient of coupling of two coils of 4mH and 9mH is 0.5. then the mutual inductance between them is:
(a) 12 mH (b) 6.5 mH (c) 3mH (d) 13mH.

(iii) The number of parallel paths in the armature winding of a 4-pole, wave connected d.c. machine having 28 coils is
(a) 28 (b) 14 (c) 4 (d) 2.

(iv) In a dc shunt motor, the torque developed is 15Nm at 10A. If the load current is doubled, the new torque will be:
(a) 60Nm (b) 45Nm (c) 80Nm (d) 100Nm.

(v) When the induction motor is at stand still, the slip is
(a) zero (b)1 (c) infinity (d) 0.5.

(vi) For a certain load active power is 100W and reactive power is 100VAR. Calculate the apparent power:
(a) 200VA (b) 100VA (c) 141.4VA (d)120VA.

(vii) Regulation of transformer is minimum at
(a) leading power factor (b) lagging power factor
(c) unity power factor (d) none of these.