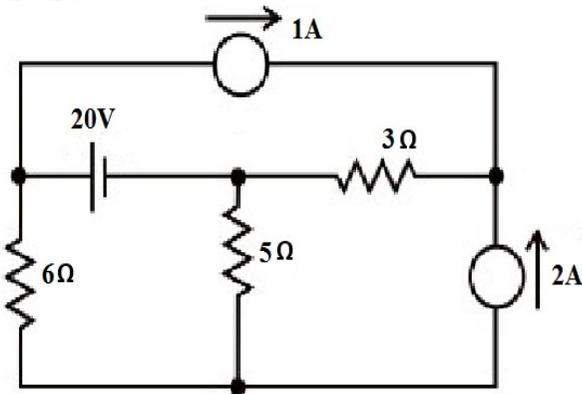


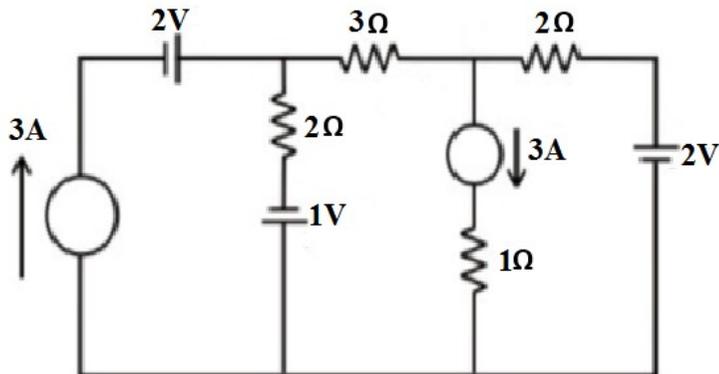
- (viii) Inductive reactance of a coil of inductance 0.2 H at 50 Hz is
 (a) 62.8Ω (b) 628Ω (c) 0.2Ω (d) 20Ω.
- (ix) The no-volt release coil of a 3 point starter carries
 (a) field current (b) armature current
 (c) line current (d) none of these.
- (x) The efficiency of a transformer is maximum when
 (a) copper loss is zero (b) iron loss is zero
 (c) copper loss is 50% of iron loss (d) copper loss = iron loss.

Group - B

2. (a) Using nodal analysis determine the current passing through 6Ω in the following circuit.



- (b) Using superposition theorem determine the current passing through 3Ω resistor in the following circuit.



6 + 6 = 12

- 3. (a) Derive the emf equation of a DC generator.
- (b) A dc shunt generator has an induced emf of 126V while its terminal voltage is 120V. Determine the armature, field and line currents if the armature and field winding resistances are 0.25Ω and 30Ω respectively.
- (c) A 220V DC series motor has armature and field resistances of 0.15Ω and 0.10Ω respectively. It takes a current of 30A from the supply while running at 1000rpm. If an external resistance of 1Ω is inserted in series with the motor, calculate (i) new steady state armature current and (ii) new speed. Assume the load torque remains constant.

4 + 3 + (2 + 3) = 12

Group - C

- 4. (a) Derive the expression of capacitance of coaxial cylindrical conductors. Hence determine the capacitance per unit length of a coaxial cylindrical capacitor having inner and outer diameters of 2cm and 6cm respectively. An insulating material is used in the space between the cylinders having a relative permittivity of 3.

- (b) State and prove Gauss' law.

(6 + 2) + 4 = 12

- 5. (a) Show that the equivalent inductance (L_{eq}) of two coils connected in parallel is

$$L_{eq} = \frac{L_1 L_2 - M^2}{L_1 + L_2 \pm 2M}$$

where L_1 and L_2 are the self inductances of the coils and M is the mutual inductance.

- (b) State Ampere's circuital law.

- (c) What do you mean by hysteresis and eddy current losses?

8 + 2 + 2 = 12

Group - D

- 6. (a) Derive the expressions of r.m.s value and average value of full wave rectified sine wave.
- (b) Define resonance in R-L-C series circuit. Derive the expression of resonating frequency in R-L-C series circuit.

- (c) Three impedances $(6 + j5)\Omega$, $(8 - j6)\Omega$ and $(8 + j10)\Omega$ are connected in parallel. Calculate the current (magnitude and phase) in each branch when total current is 20A.

4 + 2 + 6 = 12

7. (a) How will you measure the power consumed by a balanced star connected three phase circuit with two wattmeters? Draw the circuit and phasor diagram and derive the necessary relation.
- (b) The input power to a three phase motor is measured by two wattmeters whose readings are 12KW and -4KW. The line voltage is 240V. Calculate the power factor of the motor and the line current.
- (c) Write down the relation between line voltage and phase voltage and line current and phase current in 3-phase star connection.

6 + 4 + 2 = 12

Group - E

8. (a) Derive the emf equation of single phase transformer.
- (b) The O.C and S.C test data are given below for a single phase, 5 kVA, 200V/400V, 50Hz transformer:
O.C test from LV side: 200V, 1.25A, 150W
S.C test from HV side: 20V, 12.5A, 175W
Evaluate the equivalent circuit parameters and draw the equivalent circuit of the transformer referred to LV side.
9. (a) Compare between squirrel cage and wound rotor induction motors.
- (b) Define slip.
A 3-phase 6 pole induction motor has a slip of 1% at no load and 3% at full load. Calculate (i) synchronous speed (ii) no load speed (iii) full load speed (iv) frequency of rotor current at full load (v) frequency of rotor current at standstill.
- (c) Name the different starting methods of 3-phase induction motor.

3 + 9 = 12

4 + (1 + 5) + 2 = 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) If the voltage across a capacitor of $50\mu\text{F}$ is 100V, the energy stored in it is
(a) 0.25J (b) 0.25W (c) 0.5J (d) 0.5W.
- (ii) An ideal voltage source has _____ internal resistance and is replaced by a / an _____ circuit.
(a) zero, open (b) zero, short
(c) infinite, open (d) infinite, short.
- (iii) The mutual inductance between two coils is 0.2H. If the current in one coil changes at the rate of 5A/s, the emf induced in the other coil is
(a) 2V (b) 0.5V (c) 1V (d) 0.2V.
- (iv) DC motor used for traction is
(a) series (b) shunt
(c) compound (d) none of these.
- (v) If the peak value of a sine wave is 100 V, then its r.m.s value will be
(a) 70.7V (b) 63.6V (c) 100V (d) 88V.
- (vi) Condition of maximum torque of 3-phase induction motor under running condition is
(a) $R_2 = X_2$ (b) $R_2 = sX_2$
(c) $R_2 = X_2/s$ (d) $R_2 = 2X_2$.
- (vii) For series RLC circuit, the impedance at resonance is
(a) maximum (b) minimum
(c) zero (d) infinite.