ELECTRICAL MACHINES
(MECH 3133)

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) Lap winding is suitable for_____current, _____voltage d.c. generator
(a) high, low (b) low, high
(c) low, low (d) high, high

(ii) The most economical method of finding no load losses of a large d.c. shunt motor is
(a) Hopkinson's test (b) Swinburne's test
(c) Retardation test (d) Field's test

(iii) The main purpose of performing open circuit test on a transformer is to measure its
(a) Copper loss (b) Core loss
(c) Total loss (d) Insulation resistance

(iv) The slight curvature at the lower end of the O.C.C of a self-excited d.c. generator is due to
(a) Residual pole flux (b) High armature speed
(c) Magnetic inertia (d) High field circuit resistance

(v) A 10 KVA transformer has full load copper loss of 120W. When the transformer delivers 5 KVA the copper loss is
(a) 50W (b) 60W
(c)70W (d) 120W

(vi) The fractional value of slip of an induction motor is the ratio
(a) Stator copper loss/stator input (b) Rotor copper loss/rotor input
(c) Rotor copper loss/rotor output (d) Rotor copper loss/stator copper loss

(vii) Rotor resistance control method of speed control of induction motor is applicable for
(a) slip ring induction motor (b) cage induction motor
(c) both slip ring and cage motor (d) neither slip ring nor cage motor

(viii) Three phase alternators are invariably star connected because
(a) higher terminal voltage is obtained
(b) less turns of wire are required
(c) magnetic losses are minimized
(d) smaller conductors can be used

(ix) The main purpose of performing short circuit test on a transformer is to measure its
(a) Copper loss (b) Core loss
(c) Total loss (d) Insulation resistance

(x) A 6 pole, 50 Hz, 3 phase induction motor is running at 950 rpm and has a copper loss in the rotor is 5 kW. Its rotor input is
(a) 100 kW (b) 10 kW
(c) 95 kW (d) 5.3 kW

Group – B

2. (a) Explain the voltage build up process of a d.c. shunt generator.

(b) A d.c. shunt generator has an induced voltage of 220 V. When the machine is loaded the terminal voltage is 200 V. Determine the load current if the field and armature resistances are 100 Ω and 0.2 Ω respectively.

6 + 6 = 12

3. (a) Derive the torque equation of a d.c. motor.

(b) The power input to a 230V dc shunt motor is 8.477 kW. The field resistance is 230 Ω and armature resistance is 0.28 Ω. Determine the input current, armature current and back e.m.f developed.

6 + 6 = 12

Group – C

4. (a) Derive the EMF equation of a transformer.

(b) The open circuit and short circuit test data for a single phase, 50Hz, 5 KVA, 200/400V transformer is given below:

O.C.Test	200V	0.75A	75W
S.C.Test	18V	12.5A	200W

Determine the equivalent circuit parameters of the transformer.

6 + 6 = 12

5. (a) State the condition of parallel operation of two single phase transformers.

   (b) Draw the phasor diagram of transformer operating under leading power factor load.

6 + 6 = 12

Group – D

6. (a) Explain how rotating magnetic field is produced in the air gap of a three phase induction motor when the stator is energized from a balanced 3 phase supply.

   (b) Explain why star delta starting of a 3 phase induction motor is better than direct on line starting.

6 + 6 = 12

7. (a) Explain the various methods of braking for 3 phase induction motor.

   (b) A 3 phase, 6 pole, 50 Hz induction motor has a slip of 2% 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 stand still, (v)frequency of rotor current at no load, (vi) frequency of rotor current at full load.

6 + 6 = 12

Group – E

8. (a) Derive an expression of induced emf of alternator.

   (b) Draw the phasor diagram of alternator operating under:
   (i) leading power factor load,
   (ii) lagging power factor load and
   (iii) unity power factor load.

6 + 6 = 12

9. (a) Explain why a 3 phase synchronous motor is not a self-starting. Hence explain how starting torque is produced.

   (b) Explain with necessary circuit and phasor diagram how power factor of a synchronous motor can be controlled by adjusting its field current.

6 + 6 = 12

Department & Section	Submission Link
ME	https://classroom.google.com/c/MjQ5MzU4ODU0MTgz/a/Mjc0MDMwMjA1Mzg1/details