

GANPAT UNIVERSITY
B.Tech. SEM III (MECHATRONICS ENGINEERING)
REGULAR EXAMINATION NOV-DEC-2011
2MC303: ELECTRICAL MACHINES & DRIVES

Time: 3 Hours**Total Marks: 70****Instruction:**

- (1) All Questions are compulsory.
- (2) Figures to the right indicate full marks.
- (3) Answer to two sections must be written in separate answer books.
- (4) Assume suitable data if necessary.

SECTION: I

- Q-1 (a) Discuss the transformer on load with necessary diagrams. (04)
 (b) Explain the O.C. and S.C. test carried out on single phase transformer. (04)
 (c) A single phase, 10kVA, 500/250V, 50Hz. Transformer has the (04)
 following constants: $X_1=0.2\Omega$, $X_2=0.5\Omega$, $R_1=0.4\Omega$, $R_2=0.1\Omega$.
 Resistance of equivalent exciting circuit referred to primary $R_0=1500\Omega$,
 Reactance of equivalent exciting circuit referred to primary $X_0=750\Omega$.
 What would be the reading of the instrument when the transformer is
 connected for the O.C. & S.C. tests?

OR

- Q-1 (a) Discuss voltage regulation of transformer. (04)
 (b) Answer the following: (04)
 (i) Why transformer rating is in kVA?
 (ii) Derive the condition for maximum efficiency of transformer.
 (c) A 600kVA, 1- Φ transformer has an efficiency of 92% both at full load (04)
 and half load at unity power factor. Determine its efficiency at 60% of
 full load at 0.8 p.f. lag.
- Q-2 (a) Discuss Torque-slip characteristic of 3-phase induction motor. (04)
 (b) Explain construction of 3- Φ induction motor. (04)
 (c) A 400V, 50Hz, 6-pole, delta connected, 3- Φ induction motor consumes (03)
 75kW with a line current of 75A and runs at a slip of 2.5%. If stator iron
 loss is 2kW, windage and friction loss is 1.2kW and resistance between
 two stator terminals is 0.32Ω . Calculate (i) Power supplied to the rotor
 P_2 (ii) rotor cu. Loss (iii) power supplied to load P_{out} (iv) efficiency and
 (v) shaft torque developed.

OR

- Q-2 (a) Discuss how we can make 1- Φ induction motor self starting? (04)
 (b) What is the requirement of starter in induction motor? Explain (04)
 autotransformer starter in detail.
 (c) A 3- Φ induction motor having a star connected rotor has an induced (03)
 emf of 80V between slip rings at standstill on open circuit. The rotor has
 a resistance and reactance per phase of 1Ω and 4Ω respectively.
 Calculate current/phase and p.f. when (a) slip rings are short circuited
 (b) slip rings are connected to a star connected rheostat of 3Ω per phase.

Q-3**Attempt any three:**

- (a) Prove that for induction motor the ratio of rotor cu. Loss to rotor input is equal to slip. (12)
- (b) Speed control of 3- Φ induction motor.
- (c) Types of 1- Φ induction motor.
- (d) Theory of ideal transformer.

SEAT NO: _____

SECTION: II

- Q-4 (a) Explain types of generators and derive the equation of generated emf for the same. (04)
- (b) Discuss the characteristics of DC compound generator. (04)
- (c) A 4-pole, 240V, wave connected shunt motor gives 1119kW when running at 1000 rpm and drawing armature and field currents of 50A and 1A respectively. It has 540 conductors. Its resistance is 0.1Ω . Assuming a drop of 1V per brush, find (a) total torque (b) useful torque (c) useful flux/pole (d) rotational losses and (e) efficiency. (04)

OR

- Q-4 (a) State and explain the methods of speed control for DC Shunt motor. (04)
- (b) Explain the armature reaction for DC generator. (04)
- (c) A long shunt dynamo running at 1000 rpm supplies 22kW at a terminal voltage of 220V. The resistance of armature, shunt field and the series field are 0.05 , 110 and 0.06Ω respectively. The overall efficiency of the above load is 88%. Find (a) cu. Losses (b) iron and friction losses (c) the torque exerted by the prime mover. (04)
- Q-5 (a) Derive the equation of induced emf for alternator. (04)
- (b) What is voltage regulation of alternator? And explain Synchronous Impedance method to obtain it. (04)
- (c) Discuss "V-curve" for synchronous motor. (03)

OR

- Q-5 (a) Discuss the effect of variable excitation on operation of synchronous motor at constant load. (04)
- (b) Explain Pitch factor and its effect on alternator. (04)
- (c) A 60kVA, 220V, 50Hz, 1- Φ alternator has effective resistance of 0.016Ω and an armature reactance of 0.07Ω . Compute the voltage induced in the armature when the alternator is delivering rated current at a load p.f. of (a) unity (b) 0.7 lagging and (c) 0.7 leading. (03)
- Q-6 **Attempt any three:** (12)
- (a) Compare Group Drives with Individual Drives.
- (b) Discuss (i) Damper winding (ii) Back emf.
- (c) Characteristics of DC series motor.
- (d) Synchronous reactance and vector diagrams of a loaded alternator.

END OF PAPER

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