

B. Tech Degree III Semester Examination in Marine Engineering, November 2009

MRE 302 ELECTRICAL TECHNOLOGY

Time : 3 Hours

Maximum Marks : 100

- I. a. Draw a complete phasor diagram for a transformer when the load *pf* is lagging.
b. A single phase 50 Hz transformer has 80 turns on the primary winding and 280 turns on the secondary winding. The voltage across the primary winding is 240V at 50Hz. Calculate (i) the maximum flux density in the core and (ii) induced *emf* in secondary. The net cross sectional area of the core be taken 200 cm^2 .

OR

- II. a. Derive an expression for the amount of copper saved in an auto transformer.
b. Obtain the equivalent circuit of a 10 KVA, 200/400 V, 50 Hz, Single phase transformer as referred to *lv* winding from the following test data.

OC test: 200V, 1.3A, 120W (on *lv* side)SC test: 22V , 30A, 200W (on *lv* side)

- III. a. How do the various losses occurring in a dc machine vary with the load?
b. A 110V dc shunt generator delivers a load current of 50A. The armature resistance is 0.2Ω and the field circuit resistance is 55Ω . The generator, rotating at a speed of 1800 rpm, has 6 poles, lap wound and a total of 360 conductors. Calculate (i) the no-load voltage at the armature and (ii) the flux per pole.

OR

- IV. a. Explain the different methods of speed control of dc shunt motors.
b. Two shunt wound generators running in parallel have each an armature resistance of 0.02Ω and a field resistance of 50Ω . The combined external load current is 5000A. The fields are excited so that the *emf* induced in one machine is 600V and in the second machine is 610 V. Calculate the bus bar voltage and the output of each machine.

- V. a. Draw and explain the torque – slip characteristics of a 3 phase induction motor.
b. A 3 phase, 50 Hz induction motor has a starting torque which is 1.25 times full load torque and a maximum torque which is 2.5 times full load torque. Neglecting stator resistance and rotational losses and assuming constant rotor resistance, find the slip at full load.

OR

- VI. a. Explain the various methods of starting of a 3 phase induction motor.
b. Draw the circle diagram of a 3.73 KW, 200V, 50Hz, 4 pole, 3d star connected induction motor from the following test data:

No – load : line voltage 200V, line current 5A, total input 350 W

Blocked rotor : line voltage 100V, line current 26A, total input 1700 W

(Turn over)

Estimate from the diagram for full load condition, the line current, power factor and also the maximum torque in terms of the full load torque. The rotor cu loss at stand still is half the total cu loss.

- VII. a. Derive the *emf* equation of an alternator. Explain distribution factor and pitch factor.
b. A 3 phase, 8 pole, 750 rpm star-connected alternator has 72 slots on the armature. Each slot has 12 conductors and winding is short – chorded by two slots. Find the induced *emf* between lines, given flux per pole is 0.06 wb.

OR

- VIII. a. Explain armature reaction on synchronous motor.
b. A 3 phase 50 Hz star connected 2000 KVA, 2300 V alternator gives a short circuit current of 600A for a certain field excitation. With the same excitation, the open circuit voltage was 900 V. The effective armature resistance is 0.06Ω . Find full load regulation at 0.8 pf lagging.

- IX. a. Compare the volume of copper used for 3 phase, 4 wire distribution with that of 2 wire d.c. distribution system. State the assumptions made.
b. What is the percentage saving in feeder copper if the line voltage in a two-wire d.c. system be raised from 220 V to 500 V for the same power transmitted over the same distance and having the same power loss?

OR

- X. Write notes on :
(i) Ring main distributor
(ii) Fuses and its materials
(iii) Air circuit breakers.
