B.Tech. Degree III Semester Examination in Marine Engineering December 2013

MRE 302 ELECTRICAL TECHNOLOGY

Time : 3 Hours Maximum Marks : 100

I. (a) Explain the principle of operation of a single-phase transformer. Derive the emf equations. (10)

(b) A single-phase transformer is connected to a 230V, 50Hz supply. The net cross sectional area of the core is 60cm^2. The number of turns in the primary is 500 and in the secondary 100. Determine (i) Transformation ratio (ii) EMF induced in secondary winding (iii) maximum value of flux density in the core. (10)

OR

II. (a) A 4KVA, 400/200V, 50Hz single phase transformer has the following test data: (10)
OC Test (l.v.side) 200V, 1A, 64W
SC Test (h.v.side) 15 V, 10A, 80W
Determine equivalent circuit referred to low voltage side.

(b) Derive an expression for saving in Cu in an autotransformer as compared to an equivalent two winding transformer. (10)

III. (a) Explain the effect of armature reaction? How is it compensated? (10)

(b) A 220V shunt generator supplies a load current of 120k at the rated speed of 800 rpm. The armature and shunt field resistances are 0.02 Ω and 110 Ω respectively. If the overall efficiency of the machine at this load is 88%, Determine: (10)
(i) Armature and shunt field copper losses
(ii) Stray losses

OR

IV. (a) Draw and explain different characteristics of a dc series motor. (8)

(b) The armature and field resistances of a 250V DC shunt motor are 0.5 Ω and 250 Ω respectively. When driving a load of constant torque at 600rpm, the armature current is 20A. If it is desired to raise the speed from 600 to 800 rpm, what resistance should be inserted in the shunt filed circuit. (12)

V. (a) Draw and explain the torque step characteristics of an induction motor. (8)

(b) A 6 pole, 50Hz, 3 phase induction motor running on full load with 3% slip develops a torque of 160N-m at its pulley rim. The friction and windage losses are 210W and stator copper and iron losses equal 1640W calculate: (12)
(i) Rotor output
(ii) Rotor Cu loss
(iii) Efficiency at full load.

OR

VI. (a) A 3 phase, 400V induction motor gave the following test readings: (12)
No-load test : 400V, 1250W, 9A
Short circuit test : 150V, 4KW, 38A.
Draw the circle diagram. If the normal rating is 14.91KW, find from the circle diagram, the full load values of current, pf and step.

(b) Explain, using double field revolving theory why the single phase induction motor is not self starting. (8)

(P.T.O.)

VII. (a) Derive emf equation for an alternator. Explain the effect of distribution factor and coil span factor on the emf generated (10)

(b) A 3 phase star connected, 1000KWÁ, 11,000V alternator has rated current of 52.5A. The resistance of the winding per phase is 0.45 Ω . The test results are given below: OC.Test : Field current 12.5A, voltage between lines = 422 V
S.C. Test : Field current 12.5A, live current = 525.5A
Determine the full load voltage regulator of the alternator at (i) 0.8 Pδ lagging (ii) 0.8 Pδ leading. (10)

OR

VIII. (a) What are the advantages of connecting alternators in parallel? State the requirements for paralleling alternators. (10)

(b) Describe the methods employed for the starting of a synchronous motor. (10)

IX. (a) State the advantages and disadvantages of a 3-wire DC distribution system over a 2-wire DC distribution system. (10)

(b) Give the comparison between DC and AC systems of transmission. (10)

OR

X. Write short notes on the following: (20)

(i) Radial and ring main distribution.
(ii) Fuses and its materials
(iii) Air circuit breakers.

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