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***B.Tech. Degree III Semester Examination in
Marine Engineering December 2018***

**MRE 1302 ELECTRICAL TECHNOLOGY
(2013 Scheme)**

Time: 3 Hours

Maximum Marks: 100

(5 × 20 = 100)

- I. (a) Draw and explain the phasor diagram of a transformer on load (i) unity power factor (ii) lagging power factor (iii) leading power factor (10)
- (b) A 20 kVA, 250/2,500 V, 50 Hz, 1-phase transformer gave the following test results. (10)
- OC(LV Side) : 250 V, 1.2 A, 105 W
SC(HV Side) : 120 V, 8.2 A, 320 W. Find the parameters and draw the equivalent circuit of 1-phase transformer as referred to: (i) Low voltage side (ii) High voltage side.
- OR**
- II. (a) What are the various tests that give the complete parameters of the equivalent circuit of the transformer? Explain in detail. (10)
- (b) State and prove the condition for maximum efficiency in a transformer. (5)
- (c) A 200/50 V, 50 Hz 1-phase transformer is connected to a 200 V, 50 Hz supply with secondary winding open. Primary winding has 400 turns. (i) What is the maximum flux through the core, if the primary winding has 400 turns? (ii) What is the peak value of flux, if the primary voltage is 200 V, 25 Hz? (5)
- III. (a) What are the materials used for the following parts of a DC machine, explain their functions? (i) Rotor core (ii) Commutator bars (iii) Yoke (iv) Brushes (v) Pole Shoes. (10)
- (b) A 4-pole lap connected armature of a dc shunt generator is required to supply the loads connected in parallel: (10)
- (i) 4 kW geyser at 230 V (ii) 3.5 kW lighting loads also at 230 V. The generator has an armature resistance of 0.3 Ω and a field resistance of 250 Ω. The armature has 120 conductors in the slot and runs at 1000 rpm. Allowing 1 V per brush for contact drops, find (i) flux per pole (ii) armature current per parallel path.
- OR**
- IV. (a) What would happen if a DC motor is directly switched on to the supply without any starter? Sketch a three point starter with proper label and explain. (10)
- (b) A shunt generator gives full load output of 30 kW at terminal voltage of 200 V. The armature and field resistances are 0.05 Ω and 50 Ω respectively. The iron and frictional losses are 1000 W. Calculate: (i) generated emf (ii) copper losses (iii) efficiency. (10)

(P.T.O.)

- V. (a) Draw the circle diagram of a 20 Hp, 400 V, 50 Hz 3-phase star connected induction motor from the following test data (line values). (14)
 No load: 400 V, 9 A, pf 0.2.
 Blocked Rotor: 200 V, 50 A, pf 0.4.
 From circle diagram find (i) line current (ii) pf (iii) slip (iv) efficiency at full load (v) max output (vi) maximum torque in synchronous watts.
- (b) Sketch the torque-slip characteristics of an induction motor and explain. (6)
- OR**
- VI. (a) Develop an expression for the frequency of rotor current in an induction motor. (5)
- (b) Explain the power flow diagram of an induction motor with a diagram. (5)
- (c) A squirrel cage induction motor is rated 25 kV, 440 V, 3-phase, 50 Hz. On full load it draws 28 kW with line current 50 A and runs at 720 rpm. Calculate (i) slip (ii) slip speed (iii) power factor (iv) efficiency. (10)
- VII. (a) Derive the emf equation of an alternator. (6)
- (b) What are the advantages of rotating field over rotating armature in an alternator? (4)
- (c) A 3.3 kV, 3-phase star connected alternator has full load current of 100 A. Under short circuit condition, it takes 5 A field current to produce full load short circuit current. The emf on open circuit for the same excitation is 900 V (line to line). The armature resistance is $0.9 \Omega/\text{phase}$. Determine the synchronous reactance per phase and voltage regulation for (i) 0.8 pf lagging (ii) 0.8 pf leading. (10)
- OR**
- VIII. (a) Calculate the speed and open circuit line and phase voltage of a 4 pole, three phase, 50 Hz star connected alternator with 30 conductors per slot. The flux per pole is 0.05 wb sinusoidally distributed. (Assume coil to be full pitched). (10)
- (b) What is hunting in synchronous machines? (5)
- (c) Explain any one method of starting synchronous motor. (5)
- IX. (a) Explain the layout of a typical AC power supply scheme with single line diagram. (10)
- (b) Differentiate fuse and circuit breaker. (5)
- (c) Explain the following system of distribution. (5)
 (i) ring main system (ii) interconnected system
- OR**
- X. (a) What are the advantages of DC transmission over AC transmission? (10)
- (b) Write short notes on (i) feeder (ii) distributor (iii) service mains. (10)