# B.Tech. Degree III Semester Supplementary Examination in Marine Engineering December 2015

## MRE 302 ELECTRICAL TECHNOLOGY

Time : 3 Hours

Maximum Marks : 100

$(5 \times 20 = 100)$

I.   (a)   Derive the emf equation of single phase transformer and explain voltage transformation ratio.   (10)

(b)   A 3000/200 V, 50 Hz single phase transformer is built on a core having an effective cross section area of 150 cm$^2$ and has 80 turns in low voltage winding.  Calculate (i) the value of maximum flux density in the core (ii) number of turns in high voltage winding.   (10)

**OR**

II.   (a)   Define the voltage regulation of a transformer.  Deduce the expression for the voltage regulation.   (10)

(b)   A 15 KVA 2300/230 V, 50 HZ single phase transformer gave the following test data:   (10)
Open circuit test : 2300 V, 0.21 A, 50 W
Short circuit test : 47V, 6.0A, 160W
Find the equivalent circuit referred to high voltage side.

III.   (a)   How is the voltage  build up in a dc shunt generator?  Sketch the magnetization characteristic of a dc shunt generator.   (10)

(b)   A 4 pole long shunt lap wound generator supplies 25 KW at a terminal voltage of 500 V.  The armature resistance is 0.03 $\Omega$. Series field resistance is 0.04 $\Omega$. Shunt field resistance is 200 $\Omega$. The brush drop may be taken as 1 V.  Determine the emf generated.   (10)

**OR**

IV.   (a)   Explain the methods of speed control of dc shunt motors.   (10)

(b)   A shunt generator delivers 195 A at terminal pd of 250 V.  The armature resistance and shunt field resistance are 0.02 $\Omega$ and 50 $\Omega$ respectively. The iron and friction losses equals 950 W.  Find (i) emf generated  (ii) copper losses  (iii) output of the prime mover.   (10)

V. (a) Explain the working principle of a 3 phase induction motor. (10)

(b) A 6 pole 50 hz 3 phase slip ring induction motor has resistance and reactance of 0.5 Ω and 5 Ω respectively. Calculate (i) at what speed the torque is maximum (ii) the ratio of maximum torque/starting torque. What must be the external resistance per phase so that the starting torque is half of the maximum torque? (10)

**OR**

VI. (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 value) (10)

No load : 400 V 9 A pf 0.2

Block rotor : 200 V 50 A pf 0.4

From the circle diagram find (i) line current and power factor at full load (ii) maximum power output.

(b) Explain why a single phase induction motor does not self start. Discuss its operation based on double revolving field theory. (10)

VII. (a) Derive emf equation of alternator. State the advantages and disadvantages of using short pitched winding and distributed winding in alternator. (10)

(b) A 100 KVA, 3000 V, 50 HZ 3 phase star connected alternator has effective armature resistance of 0.2 Ω. The field current of 40 A produces a short current of 200 A and an open circuit emf of 1040 (line value). Calculate the full load voltage regulation of 0.8 pf lagging and 0.8 pf leading. (10)

**OR**

VIII. (a) What are the advantages of connecting alternators in parallel? What conditions are required to be fulfilled for the successful parallel operation of alternators? (10)

(b) Describe the phenomenon of hunting in a synchronous machine. How is it remedied? (10)

IX. (a) Compare the 3-wire and 2-wire systems of DC distribution in respect of weight of copper conductors, all other conditions being the same. (10)

(b) Explain 3 phase 4 wire system of distributing electrical power. (10)

**OR**

X. Write short notes on the following. (20)
    (i) Ring main distributor.
    (ii) Fuses and its material.
    (iii) DC air circuit breaker.