INDIAN MARITIME UNIVERSITY
(A Central University, Govt. of India)

B.Tech. (Marine Engineering) - Semester III
December 2015 End Semester Examinations

Electrical Machines - I
Subject Code: UG11T2306/UG11T1306

Time: 3 hrs | Max Marks: 100
Date: 28.12.2015 | Pass Marks: 50

Part - A (3×10 = 30 Marks)

Compulsory Questions

1) (a) What is the function of a commutator?
   (b) What do you mean by back emf of a DC motor?
   (c) What are the important characteristics of a DC generator?
   (d) A eight pole lap-wound DC motor having 760 conductors and a useful flux of 35 mWb/pole is driven at 500 rpm. Calculate the back emf of motor.
(e) What are advantages of three-phase transformer?
   (f) In transformer open-circuit test, why are the ohmic losses negligible?
   (g) Explain why transformer rating is expressed in kVA or VA.
   (h) Why is low voltage windings placed near the core of a transformer?
   (i) Define voltage regulation of a transformer.
   (j) What are the functions of a starter for DC motor?

Part - B (5×14 = 70 Marks)

Answer Any Five of the following

2) (a) Draw a neat sketch of a DC Machine. State the functions of major parts. (3+ 5 = 8)
   (b) Derive the emf equation of a DC machine by using *Blv* concept. (6)

3) (a) A 6-pole wave connected DC shunt generator has 350 conductors and flux 0.02 Wb/pole is driven at 1000 rpm. The resistances of armature, shunt field and load are 0.8 Ω, 120 Ω and 12 Ω respectively. Calculate the power absorbed by the load. (7)
   (b) A separately excited DC generator having constant excitation supplies power to a constant resistance load. It delivers 150 A at 400 V at a speed of 1000 rpm . If current is reduced to 100 A, determine the speed. Total contact drop of brush is 2 V. Neglect the armature reaction. Armature resistance of the generator is 0.12 Ω. (7)

4) (a) Explain the working principle of a three-point starter for a DC shunt motor. (7)

(b) A 240 V DC shunt motor takes a current of 4 A from 240 V supply mains while running at no-load. The resistances of armature and shunt field are 0.2 Ω and 240 Ω respectively. Determine (i) the efficiency of the motor when it draws 20 A from the supply mains and (ii) the armature current during maximum efficiency. (7)

5) (a) Describe briefly different types of DC distributors. (7)

(b) A 4-pole, 220 V, lap-connected DC series motor has 200 slots with six conductors per slot. The armature current is 40 A and flux/pole is 16 mWb. The armature and field resistances are 0.46 Ω and 0.26 Ω respectively. The iron and friction losses are 700 W. Calculate the useful torque. (7)

6) (a) Give the concept of single-phase ideal transformer. Draw the phasor diagram of a single-phase transformer under lagging power-factor load. (4+6=10)

(b) In a transformer if the load current is kept constant, find the power factor at which the maximum efficiency occurs. (4)

7) (a) Derive an expression for the per unit voltage regulation of a transformer for lagging power factors. (7)

(b) Consider a 20kVA, 2200/220V, 50 Hz transformer. The open-circuit and short-circuit test results are as follows:

Open-circuit (on low voltage side) - 220V, 4.2A, 148 watts.

Short-circuit (on high voltage side) - 86V, 10.5A, 360 watts.

Calculate: (i) The voltage regulation at 0.8 p.f. lagging at full load. (ii) What is the p.f. on short-circuit test? (7)

8) (a) State the essential conditions which should be satisfied before two single-phase transformers operating parallel. (4)

(b) A 15 kVA, 2000/200V transformer has an iron loss of 250W and full-load copper loss 350W. During the day it is loaded as follows:

No. of hours	Load	Power factor
9	¼ load	0.6
7	full-load	0.8
6	¾ load	1.0
2	no-load	---

Calculate the all-day efficiency. (10)

9) (a) Define an Auto-transformer. Discuss the relative merits and demerits of an Auto-transformer. Write down the applications of Auto-transformer. (2 + 4 + 2 = 8)

(b) Proof that copper saving in Auto-transformer is dependent on the turns ratio. (6)

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