

INDIAN MARITIME UNIVERSITY
(Central University, Government of India)

May/June 2016 End Semester Examinations
B.Tech. (Marine Engineering)

Third Semester – Electrical Machines- I (UG112306/UG11T1306)

Date : 29.06.2016

Time: 3 Hrs

Max. Marks: 100

Pass Marks:50

Part- A

(3 X10 = 30 Marks)

Answer all the Questions

- 1) a) What is the difference between the short-shunt and long shunt compound generators?
- b) How is the DC motor reversed?
- c) Define the term "all day efficiency" for a transformer.
- d) Write down the conditions for the satisfactory parallel operation of transformers.
- e) What are the various types of circuit breakers?
- f) Enumerate the three most important characteristics of DC generators
- g) A 230V DC shunt motor takes 32A at full load. Find the back emf on full load if the resistances of motor armature and shunt field windings are 0.2 ohm and 115 ohm respectively
- h) Define the double ring distributor.
- i) 3300/300V single-phase 300kVA transformer has 1100 primary turns. Find the transformation ratio and secondary turns.
- j) What useful information is obtained from the short circuit test of a transformer?

Part-B

(5 x 14 = 70 Marks)

Answer Any Five of the following

- 2 (a) Describe briefly various parts of a DC machine. (9 Marks)
- (b) A 80 kW, 500V, 4-pole wave wound DC machine has 640 armature conductors. The brushes are given an actual lead of electrical 16° at full load. Calculate the cross-magnetizing and demagnetizing ampere-turns per pole. (5 Marks)

- 3) The open-circuit characteristic (OCC) of a DC generator running at 750 rpm is as follows:

Field current (A) :	0.5	1.0	1.5	2.0	2.5
Generated emf (V) :	50	84	105	120	131

- (i) If the machine is run as shunt generator at 750 rpm to what voltage will it excite with shunt field resistance equal to (a) $70\ \Omega$ (b) $55\ \Omega$? (ii) What is the critical value of the shunt field resistance? (iii) What is the critical speed when the shunt field resistance is $70\ \Omega$? (iv) With the shunt field resistance equal to $55\ \Omega$, what reduction in speed must be made to make the open-circuit voltage equal to 100 V? (14 Marks)

4) (a) Why is a starter necessary for DC motor? Explain the working of a three-point starter with the help of a neat diagram. (2+ 6 = 8 Marks)

(b) A wave connected, 250V, 4-pole DC shunt motor with 500 conductors. The armature resistance is 0.25Ω , field resistance is 125Ω and flux per pole is 0.02 wb. Armature reaction is neglected. If the motor draws 14 A from the mains, then compute, (i) speed and electromagnetic torque developed. (ii) The shaft power, shaft torque and efficiency with rotational losses equal to 300 watts. (6 Marks)

5) (a) Discuss the advantages and disadvantages of an auto-transformer as compared to a two-winding transformer. (4 Marks)

(b) A 20KVA, 2400V/240V, 50Hz, single phase transformer gave the following test results:

Open circuit (on low voltage side) - 240V, 1.2A, 100 watts.

Short circuit (on high voltage side) - 100V, 8A, 300 watts.

Compute parameters of the approximate equivalent circuit referred to low voltage and high voltage sides and draw the approx equivalent circuit. (10 Marks)

6) (a) Define voltage regulation of a transformer. Also find the condition for maximum voltage regulation at lagging power factor. (2 + 6 = 8 Marks)

(b) The maximum efficiency of a 500KVA, 3300/500V, 50Hz, single phase transformer is 97% and occurs at 75% full-load, unity power factor. If the impedance is 105, calculate the regulation at full-load, power factor 0.8 lagging. (6 Marks)

7) (a) Show that speed of DC motor is directly proportional to back emf and inversely proportional to the flux. (4 Marks)

(b) A 240V DC series motor run at 800 rpm to gives a total torque of 110 N-m. The current taken by the motor at this torque is 90A. If the total resistance of the motor is 0.6 ohm find the torque developed when motor runs at 1200rpm. Assume that flux is proportional to current. (10 Marks)

8) (a) Draw the phasor diagram of a single-phase transformer supplying a lagging power factor load. (4)

(b) A 5KVA, 400V/200V, 50Hz, single phase transformer gave the following test results:

Open circuit (on low voltage side) - 200V, 1.25A, 150 watts.

Short circuit (on high voltage side) - 20V, 12.5A, 175 watts.

Compute parameters of the approximate equivalent circuit referred to low voltage and high voltage sides and draw the approx equivalent circuit. (10 Marks)
