INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

END SEMESTER EXAMINATIONS –DECEMBER 2018

B. Tech (Marine Engineering)

Semester -III

ELECTRICAL MACHINES I (UG11T3306)

Date: 09.01.2019 Max Marks: 100

Time: 3Hrs Pass Marks: 50

Note:

1. **Question 1 is Compulsory**, 3x10 = 30 Marks.
2. Answer any 5 questions from question nos. 2 to 8.

(10 x 3 = 30 Marks)

Q1. a) What are the functions of pole shoes in DC machine?

b) What are the conditions for voltage building up of a self-excited shunt generator?

c) What are the functions of a starter for D.C motor?

d) A 6-pole, wave connected DC machine has 300 conductors and run at 100 rpm. The emf generated on open-circuit is 400 V. Find the useful flux per pole.

e) What is a booster?

f) What is the purpose of inter-connector in a DC ring main distributor?

g) Explain why core flux in a transformer is almost independent of load current?

h) Explain why leakage flux in a transformer is dependent on load current?

i) What is hysteresis loss?

j) Draw No-load Phasor of a transformer.

Q2. a) Derive the emf and torque equation of a DC machine. (7 Marks)

b) A 6 pole DC machine has 300 armature conductors where each conductor carry 80 A. The magnetic flux per pole is 0.015 *Wb* and machine is driven at 1800 rpm. Compute average emf generated, power developed and electromagnetic torque if the armature conductors are: (i) WAVE connected & (ii) LAP connected. (7Marks)

Q3. a) The open-circuit characteristic (OCC) of a DC shunt generator running at 375 rpm is as follows:

Field current (A) :	0	2	3	4	5	6	7
Generated emf (V):	9.4	115	165	202.5	228.8	248.8	265

(i) Plot the OCC for 375 rpm and determine the voltage to which the machine will excite if the field resistance is 40Ω. (ii) What additional resistance would have to be inserted in the field circuit to reduce the voltage to 200 V at 375 rpm. (7 Marks)

b) Draw a labeled diagram and describe the working of a three-point starter for a DC shunt motor. (7 Marks)

Q4. a) A 200V D.C. shunt motor takes 4A at no load and runs at 700 rpm. The armature resistance is 0.6 Ω and the shunt field resistance 100 Ω. Find (i) the efficiency, (ii) the speed and (iii) the torque developed when the motor input is 8 kw. (7 Marks)

b) Describe construction and operation of a three phase core type transformer at star –delta connection. (7 Marks)

Q5. a) A two-wire distributor 1200m long is loaded as shown in Figure 1, B is the mid-point. The power factors at the two load points refer to the voltage at C. The impedance of each line is (0.15+j0.2) Ω. Calculate the sending end voltage, current and power factor. The voltage at point C is 220V. (7 Marks)

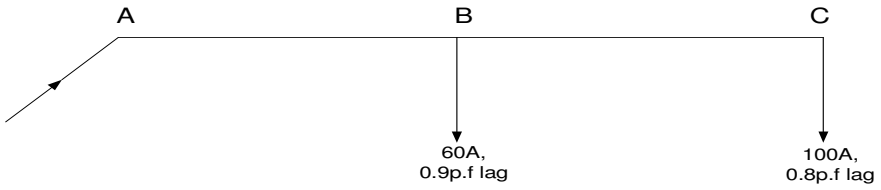

Figure 1: Two-wire distributor with 1200m long.

b) What is a circuit breaker? How does a circuit breaker different from switch? Write the consequences of short circuit**.** (7 Marks)

Q6. a) What is ideal transformer? Derive an expression for the e.m.f induced in a single-phase transformer windings. (7 Marks)

b) Explain how the primary current increases as the current on the secondary side of the transformer is increased and draw a lagging power factor load related phasor diagram. (7 Marks)

Q7. a) Develop approximate equivalent circuit with respect to primary side of a single-phase transformer. (7 Marks)

b) A 1000-VA 230/115-V transformer has been tested to determine its equivalent circuit. The results of the tests are shown below. (7 Marks)

Open-circuit test: V_{OC} = 230 V, I_{OC} = 0.45 A, P_{OC} = 30 W.

Short-circuit test: V_{SC} = 19.1 V, I_{SC} = 8.7 A, P_{SC} = 42.3 W.

All data given were taken from the high voltage side of the transformer. Find the approximate equivalent circuit of this transformer referred to the low-voltage side of the transformer.

Q8. a) A 15-kVA, 8000V/230V transformer has equivalent impedance referred to the primary of Z_{eq}= (80 + j300)Ω. The components of the excitation branch referred to the primary side are R_C = 350kΩ and X_M=70kΩ. If the primary voltage input is 7967V and the load impedance across secondary is Z_L = (3.2 + j1.5)Ω. What is the secondary voltage across load of the transformer? What is the voltage regulation of the transformer? (7 Marks)

b)Describe the conditions and tests necessary for paralleling of single-phase transformers. (7 Marks)

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