INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examination Dec 2019/Jan 2020

B.Tech (Marine Engineering)

Semester -III

UG11T3306- Electrical Machines I

Date: 21.12.2019 **Max Marks: 70**

Time: 3 Hours **Pass Marks: 35**

Part – A (compulsory)

Answer the following (10x2=20 Marks)

1. What is counter voltage of a DC motor?
2. Explain why the terminal voltage of a DC shunt generator falls as it is loaded.
3. Why is a starter needed to start the DC motor?
4. 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.
5. What is the purpose of inter-connector in a DC ring main distributor?
6. Explain why transformer rating is expressed in KVA or VA.
7. Why the low voltage winding of a transformer placed near the core.
8. 2200/200V single-phase 300kVA transformer has 1100 primary turns. Find the transformation ratio and secondary turns.
9. Write down the conditions for the satisfactory parallel operation of transformers.
10. In open circuit test the ohmic loss are negligible in compare with normal core loss, explain.

Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

11. a) Write down the working principle of DC generator with diagram. 5 marks

    b) A shunt generator delivers 40 kW at 240 V when running at 450 rpm. The armature and field resistances are 0.03Ω and 60Ω respectively. Calculate the speed of the machine running as a shunt motor and taking 40 kW input at 240 V. Allow 1 V per brush for contact drop. 5 marks

12. a) Discuss various conditions for the build-up voltage of a DC shunt generator. 5 marks

    b) A long-shunt DC dynamo having terminal voltage of 250 V at 1000 rpm supplies 25 kW. The resistances of armature, shunt field and series field are 0.04 Ω, 50 Ω and 0.05 Ω respectively. Calculate (i) Cu-losses, (ii) iron and friction losses and (iii) the torque exerted by the prime mover if it has efficiency 89% of the above load. 5 marks

13. a) Draw a labeled diagram and describe the working of a three-point starter for a DC shunt motor. 5 marks

b) A 500 V DC shunt motor running at 700 rpm takes an armature current of 50 A. Effective armature resistance is 0.4Ω. What resistance must be placed in series with the armature to reduce the speed to 600 rpm, the torque remaining constant? 5 marks

14. a) Find and expression for the maximum steady state power output of a DC shunt motor with an armature resistance r_a, if the applied voltage V_t and the shunt field current I_f are kept constant. Neglect rotational losses and assume that the theoretical maximum power output will not overload the motor. 5 marks

b) A 2-wire DC ring distributor is 300 m long and is fed at 240 V at point A. At point B, 150 m from A, a load of 120 amps is taken and at C, 100 m in the opposite direction, a load of 80 amps is taken. If the resistance per 100 m of single conductor is 0.03Ω, find : 5 marks

(i) Current in each section of distributor.

(ii) Voltage at points B and C.

15. a) Draw the phasor diagram of a single-phase transformer supplying a leading power factor load. 5 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. 5 marks

16. a) In a transformer if the load current is kept constant, find the power factor at which the maximum efficiency occurs. 5 marks

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. 5 marks

17. a) Explain the advantages, disadvantages and applications of autotransformer. 5 marks

b) Two transformers *A* and *B* are connected in parallel to a load of $(2+j1.5)\Omega$. Their impedances in secondary terms are $Z_{eA}=(0.15+j0.5)\Omega$ and $Z_{eB}=(0.1+j0.6)\Omega$. Their no-load terminal voltages are $E_A=207\angle 0^0$ volt and $E_B=205\angle 0^0$ volt. Find the power output and power factor of each transformer. 5 marks