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

May/June 2015 End Semester Examinations

SEMESTER – III, B.TECH (MARINE ENGINEERING)

ELECTRICAL MACHINES - I (T 2306 / T 1306)

Date:24.06.2015 **Max.Marks:100**
Time:-3 Hrs **Pass Marks:50**

PART – A (3 x10 = 30 Marks)
(Compulsory Questions)

1. a) Explain why the emf generated in the armature of a DC motor is called "back emf".

   b) Why is a starter needed to start the DC motor?

   c) Explain why transformer rating is expressed in KVA or VA.

   d) In open-circuit test of a transformer, the ohmic loss is negligible in compare with normal core loss, explain.

   e) What useful information are obtained from the short-circuit test of a transformer?

   f) Discuss the advantages and disadvantages of an auto-transformer as compared to a two winding transformer.

   g)A 4-pole, lap-wound armature has 800 conductors and flux per pole of 0.012 Wb. Calculate the emf generated, when the machine is running at 800 rpm.

   h) If the transformer core is made by wood then what will happen.

   i) What do you mean by demagnetizing and cross-magnetizing effects of armature reaction in a DC machine?

   j) Discuss the difference between AC distributor and DC distributor.

PART – B (5 x14 = 70 Marks)
(Answer any five of the following)

2. a) Describe briefly various parts of a DC machine. **(7)**

   b) A 4-pole, DC shunt generator with a shunt field resistance of $100\,\Omega$ and an armature resistance of $1\,\Omega$, has 378 wave-connected conductors in its armature. The flux per pole is 0.02 Wb. If a load resistance of $10\ \Omega$ is connected across the armature terminals and the generator is driven at 1000 rpm, calculate power absorbed by load. **(7)**

3. a) Enumerate the three most important characteristics of DC generators. Write down the reasons for failure of self-excited shunt generator to build-up voltage. **(3+4 = 7)**

   b) A 4-pole 500V shunt motor takes 7A on no-load, the no-load speed being 750 rpm. It has a shunt field current of 2A. Calculate the full-load speed of the motor if it takes 122A at full load. Armature resistance is $0.2\,\Omega$. Contact drop per brush is 1 Volt. Armature reaction weakens the field by 4% on full load. **(7)**

4. 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. **(7)**

   b) A 250V D.C. shunt motor takes 4A at no load and runs at 800 rpm. The armature resistances is 0.3 Ω and the shunt field resistance 125 Ω. Find (i) the efficiency, (ii) the speed and (iii) the torque developed when the motor input is 9 kw. **(7)**

5. a) Describe briefly different types DC distributors. **(6)**

   b) 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. **(8)**

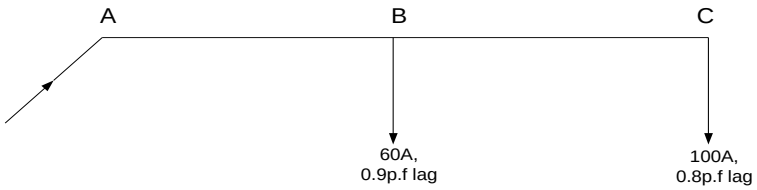

Figure 1: Two-wire distributor with 1200m long.

6. a) Draw and explain the phasor diagram of a single-phase transformer supplying a leading power factor load. **(7)**

   b) A 2200/220V, 50Hz, 1-ϕ transformer has exiting current of 0.6A and a core loss of 361 watts, when its H. V side is energized at rated voltage. Calculate the two components of exciting current. If the transformer supplies a load current of 60A at 0.8p.f lag on its L.V side then calculate the primary current and its power factor. Ignore leakage impedance drop. **(7)**

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

   b) Derive the condition for maximum voltage regulation of transformer. **(5)**

   c) The maximum efficiency of a 500KVA, 3300/500V, 50Hz, single phase transformer is 97% and occurs at 755 full-load, unity power factor. If the impedance is 105, calculate the regulation at full-load, power factor 0.8 lagging. **(4)**

8. a) Explain, the necessary conditions for parallel operation of single phase transformers. **(4)**

   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)**

9. a) Describe the working principle of a three-point starter for a DC shunt motor. **(6)**

   b) A 500 V DC shunt motor running at 700 rpm takes an armature current of 50 A. Effective armature resistance is $0.4\,\Omega$. What resistance must be placed in series with the armature to reduce the speed to 600 rpm, the torque remaining constant? **(8)**

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