



This exam measure ILOs (a1, a15, b2, b5, c3, c16, d5, d7)
Attempt to solve all questions (assume any missing data)

- Q1: (15 Marks)
- a) Write a short note on equalizer rings. [5Marks]
- b) Draw a developed diagram of a simple 2-layer lap-winding for a 4-pole generator with 16 coils. Hence, point out the characteristics of a lap-winding. [10 Marks]

- Q2: (15 Marks)
- a) Give the constructional features and working principle of a D.C. generator. Draw a cross-sectional view of a 4 pole D.C. generator and label there on all parts. Also sketch the shapes of magnetic distribution. [5 Marks]
- b) A d.c. shunt generator has an induced voltage on open-circuit of 127 volts. When the machine is on load, the terminal voltage is 120 volts. Find the load current if the field circuit resistance is 15 ohms and the armature-resistance is 0.02 ohm. Ignore armature reaction. [10 Marks]

- Q3: (15 Marks)
- a) How are D.C. generators classified? [5 Marks]
- b) A 90 kW, 450 V, 4-pole dc shunt generator has a wave wound armature of 640 conductors. If the brushes are given an actual lead of 8° , determine the demagnetizing ampere-turns per pole. Also calculate its distorting ampere-turns per pole. Assume the resistance of the shunt winding to be 45 Ω . [10 Marks]

- Q4: (20 Marks)
- a) Explain the process of commutation in d.c. generator? [10 Marks]
- b) A 230 V dc machine has an emf constant $K=212.21 \text{ V} \cdot \text{s/Wb} \cdot \text{rad}$ and $R_a=0.278 \Omega$. The field is separately excited and produces 0.01 Wb per pole. $I_a=36 \text{ A}$ for all parts of the problem. (a) At what speed does the machine operate as a dc generator with rated terminal voltage? (b) At what speed does the machine operate as a dc motor with rated terminal voltage? (c) If an external resistance $R_x=1 \Omega$ is added in series with the armature circuit, at what speed does the machine operate as a dc motor with rated terminal voltage? (d) If the motor of part (b) is known to be supplying 10 HP to a coupled mechanical load, determine the rotational losses at the point of operation. [10 Marks]

- Q5: (15 Marks)



Exam Date: 12/1/2020

- a) What is the difference between three point starter and four point starters? What are the additional features incorporated in a four point starter. [5 Marks]
- b) Assume that a separately excited shunt motor operating at 1000 rev/min has a load current of 100 A and a terminal voltage of 240 V. If the armature winding resistance is 0.1 Ω , determine the following:
- (i) The developed torque
- (ii) The shaft speed and the load current if the torque is doubled at the same excitation [10 Marks]
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Q6:

(10 Marks)

For a preliminary design of a 1500kW, 275V, 300rpm, dc shunt generator determine the number of poles, armature diameter and core length, number of slots and number of conductors per slot. Assume: Average flux density over the pole arc as 0.85T, Output coefficient 276, Efficiency 0.91. Slot loading should not exceed 1500A. [10 Marks]

With my best wishes
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