Kafrelsheikh University — Final Exam of 1st semester-2020-2021
Faculty of Engineering — Department of Electrical Engineering
Subject: **Electrical Machine 1 (DCM)** — Course code: EPM3106 — Full Mark: 90 Marks
Year: Third Electrical Power (R.2007) — Number of pages: 2 — Time allowed: 3 hours
Exam Date: 3/3/2021

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) What is meant by reactance voltage? [5 Marks]

b) Calculate the magnetising force and flux density at a distance of 5 cm from a long straight circular conductor carrying a current of 250 A and placed in air. Draw a curve showing the variation of B from the conductor surface outwards if its diameter is 2 mm. [10 Marks]

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Q2: (15 Marks)

a) Why do we use starter for dc machine? What are the types of starters used for starting of D.c motors? [5 Marks]

b) A shunt generator delivers 195 A at terminal p.d. of 250 V. The armature resistance and shunt field resistance are 0.02 Ω and 50 Ω respectively. The iron and friction losses equal 950 W. Find

(a) E.M.F. generated (b) Cu losses (c) output of the prime motor

(d) commercial, mechanical and electrical efficiencies. [10 Marks]

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Q3: (15 Marks)

a) Draw and explain the deferent form of air gap flux in a 4-pole dc generator. [5 Marks]

b) A 250 kW, 400 V, 6-pole dc generator has 720 lap wound conductors. It is given a brush lead of 2.5 angular degrees (mech) from the geometric neutral. Calculate the cross and demagnetizing turns per pole. Neglect the shunt field current. [5 Marks]

c) A 440 V, 4-pole, 25 kW, dc generator has a wave-connected armature winding with 846 conductors. The mean flux density in the air-gap under the interpoles is 0.5 Wb/m2 on full load and the radial gap length is 0.3 cm. Calculate the number of turns required on each interpole. [5 Marks]

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Q4: (20 Marks)

a- Explain the commutation process of dc generator, what are the main causes and how can the commutation of a DC generator is improved? [7 Marks]

b- The following OC test data was recorded for a separately dc generator:

$I_f(A)$	0	0.2	0.4	0.6	0.8	1	1.2	1.4
$V_{oc}(V)$	10	52	124	184	220	244	264	276

Its load test data is as , I_a (fl) = 50 A, V = 240 V and I_f = 1.4 A
The armature resistance inclusive of the brush voltage drop is R_a = 0.3 Ω
Estimate at full load
(a) The internal induced emf
(b) The voltage drop caused by armature reaction
(c) The field current equivalent of armature reaction demagnetization [13 Marks]

Q5: (15 Marks)

a- What are the conditions to be satisfied for parallel operation of DC generators? [5 Marks]

b- 20 kW, 250 V dc shunt motor has a full-load armature current of 85 A at 1100 rpm. The armature resistance is 0.18 Ω. Determine:

(a) the internal electromagnetic torque developed;
(b) the internal torque if the field current is suddenly reduced to 80% of its original value;
(c) The steady motor speed in part (b) assuming the load torque to have remained constant.
Assume: magnetic circuit to be linear. [10 Marks]

Q6: (10 Marks)

What are Design aspects of shunt field winding for DC MACHINES? [10 Marks]

With my best wishes
Associate. Prof./Mohamed I. Abd EL_Wanis