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Kafrelshikh University
Faculty of Engineering
Electrical Engineering Department
Final 1st Term Exam 2015-2016.

3rd Year

Subj: Electrical machines 1
Time Allowed: 3 hours
Examiner: Dr.S.Gharib
Date: 24 / 1 / 2016

Q1

a) Explain how a sinusoidal wave form could be created when a single turn rotate in a magnetic field.

b) What is meant by:

Fractional pitch coil-simplex wave winding-resultant pitch.

c) A 4 pole dc machine is connected as wave winding, the armature has 24 slot, each slot has 4 side coil the armature speed is 500 rpm and flux per pole is 30mwb, Find the induced voltage.

Q2

a) Classify the losses in dc generator then describe the criteria when the efficiency is maximum in dc shunt machine.

b) A 240-V, short-shunt, compound generator supply the load with 100 A. The shunt field current is 3 A. It has an armature resistance of 50 m Ω , a series field resistance of 10 m Ω , and a rotational loss of 2 kW. The *When the* generator is supplying the full load at the rated voltage, determine its efficiency.

Q3

a) On the open circuit characteristics of dc generator show the critical values of both field resistance and speed then explain the influence of these critical values on machine operation .

b) An armature voltage 230 V dc machine has an emf constant $K = 212.21 \text{ V} \cdot \text{s} / \text{Wb} \cdot \text{rad}$ and $R_a = 0.278 \Omega$. The field is separately excited and produces 0.01 Wb per pole.
 $I_a = 36 \text{ A}$

- (i) At what speed does the machine operate as a dc generator with rated terminal voltage.
 - (ii) At what speed does the machine operate as a dc motor with rated supply voltage 230V.
 - (iii) 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 the same rated supply voltage.
 - (iv) If the motor in problem (ii) is known to be supplying 10 HP to a coupled mechanical load, determine the rotational losses at the point of operation.
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Q4

- a) Explain how you can start the dc motor.
- b) Choose the correct answer:
The d.c. series motor should never be switched on at no load because
 - (i) the field current is zero.
 - (ii) The machine does not pick up
 - (iii) The speed becomes dangerously high
 - (iv) It will take too long to accelerate.
- c) A series DC motor has combined armature and field resistance of $R_a + R_s = 1.2 \Omega$. When connected to a supply of $V_T = 48V$ at standstill, the motor develops a torque of 1500Nm.
 - i) Calculate the armature current at standstill and the motor constant k , assume constant field.
 - ii) Calculate the torque when the speed is 500 rpm.
 - iii) Calculate the output power and efficiency when operating at 500 rpm (neglect mechanical losses)