Code No: RR210205 **Set No.1**

II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTRO MECHANICS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the torque produced by reluctance motor.
   (b) Define energy and co-energy in a linear magnetic system.
2. Design a lap winding for 32 conductor, 4 pole d. c. machine. Show also the brush positions.
3. A 4-pole lap wound d. c. generator delivers a full load current of 400 A. It has shunt field current of 12 A and 123 commutator segments in the commutator ring of the machine. If the brushes are advanced by 3 commutator segments on full load, find
   (a) The demagnetizing AT/pole;
   (b) The cross-magnetizing AT/pole.
4. Two d.c. compound generators, A and B with an equilising bar, supply a total load of 500A. The data relating to the machine are as follows.
   Armature resistance, $R_A = 0.05$ ohm, $R_B = 0.03$ ohm
   Series field winding $R_{SA} = 0.02$ ohm, $R_{SB} = 0.01$ ohm
   Generated emf EA = 463V, EB = 470X.
   Calculate
   (a) The current in each armature.
   (b) The current in each series winding.
   (c) The current in the equilising bar and
   (d) The bus-bar voltage.

   Neglect the shunt currents and state the necessary assumptions made, if any.
5. (a) Explain the principle of operation of a DC motor. Derive the equation for the torque developed by a DC motor.
   (b) Determine the torque developed when a current of 30A passes through the armature of a motor with lap winding of 310 conductors, 4-Pole, pole shoes 16.2cm long subtending an angle of 60^0 at the center, bore radius 16.2cm, flux density in air gap 0.7 tesla.
6. (a) What is the power flow diagram of DC motor? And explain about losses involved in each stage?

(b) A 4-pole 120KW, 240V, 800rpm wave wound generator has shunt field current of 4A at rated voltage. The generator has the following data.
Armature winding single turn coils
Length of conductors (including over hang) = 0.48 m
Number of conductors = 480 : Voltage drop/brush = 1 volt
Cross sectional area of conductors = 25 mm^2
Full load temperature = 60^0C : Commutator diameter = 0.6 m
Specific resistance of copper at 20^0C = 1.725×10^{-2} Ω/m/mm^2 Find

i. Full - load armature copper loss
ii. Shunt field copper loss, and
iii. Brush contact loss

7. (a) Explain with a neat circuit diagram swinburns test on DC shunt motor to find the efficiency of DC machine when if runs as motor and generator? Mention the advantages and disadvantages of this method?

(b) The following readings are obtained when doing a load test on D.C. Shunt Motor using a brake-Drum
Spring Balance reading: 10 kg & 35 kg.
Diameter of Drum 40 cm.
Speed of the Motor:950 R.P.M.
Applied Voltage 200 V
Line Current 30 A.
Calculate the output power and efficiency.

8. (a) Describe a suitable method for determining the efficiency of a DC compound motor?

(b) In a retardation test on DC separately excited motor the induced e.m.f in the armature falls from 220V to 190V in 30 seconds disconnecting the armature from the supply. The same fall takes place in 20 seconds if immediately after disconnection armature is connected to a resistance which takes 10A (average) during this fall. Find the stray losses of motor.

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Code No: RR210205 **Set No.2**

II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTRO MECHANICS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the significances of energy and co-energy of Energy conversion system?
   (b) Derive expression for the magnetic force developed in linear electromagnetic system.
2. Design a lap winding for 32 conductor, 4 pole d. c. machine. Show also the brush positions.
3. Explain the importance of series field, interpole and compensating windings in d. c. compound machine.
4. Two d.c. compound generators, A and B with an equilising bar, supply a total load of 500A. The data relating to the machine are as follows.
   Armature resistance, $R_A = 0.05$ ohm, $R_B = 0.03$ ohm
   Series field winding $R_{SA} = 0.02$ ohm, $R_{SB} = 0.01$ ohm
   Generated emf EA = 463V, EB = 470X.
   Calculate
   (a) The current in each armature.
   (b) The current in each series winding.
   (c) The current in the equilising bar and
   (d) The bus-bar voltage.

   Neglect the shunt currents and state the necessary assumptions made, if any.
5. (a) Distinguish between generator and motor action. Derive the equation for the back emf of a DC motor.
   (b) What are the different types of DC motors and give their applications.
6. (a) What is the power flow diagram of DC motor? And explain about losses involved in each stage?
   (b) A 4-pole 120KW, 240V, 800rpm wave wound generator has shunt field current of 4A at rated voltage. The generator has the following data.
   Armature winding single turn coils
   Length of conductors (including over hang) = 0.48 m
   Number of conductors = 480 : Voltage drop/brush = 1 volt
   Cross sectional area of conductors = 25 mm^2
   Full load temperature = 60^0C : Commutator diameter = 0.6 m
   Specific resistance of copper at 20^0C = 1.725×10^{-2} Ω/m/mm^2 Find

i. Full - load armature copper loss
ii. Shunt field copper loss, and
iii. Brush contact loss

7. (a) Why is a starter necessary for a DC motor? Explain the working of a 3-point starter with the help of a neat diagram.

   (b) Develop the general expression for the speed of a motor in terms of supply voltage, armature resistance and flux per pole.

8. (a) Describe a suitable method for determining the efficiency of series motor?

   (b) A test on two coupled similar tramway motors, with their fields connected in series, gave the following results when one machine acted as motor and the other as a generator.
   Motor : armature current = 56 A, armature voltage = 590 V, voltage drop across field winding = 40 V.
   Generator : armature current = 44 A, armature voltage = 400 V, field voltage drop = 40 V, resistance of each armature = 0.3 Ω.
   Calculate the efficiency of the motor and generator at this load.

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Code No: RR210205 **Set No.3**

II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTRO MECHANICS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the principle of energy conversion of electromechanical system.
   (b) Derive an expression for the energy stored in a magnetic field system.
2. A 4-pole wave connected armature has 51 slots. Draw a developed winding diagram and show the brush positions. Assume any other data required.
3. (a) Explain the effects of armature reaction in a d. c. generator and discuss briefly the methods to minimize these effects.
   (b) With a neat sketch explain the function of commutator in a d.c. mechine.
4. Two d.c. compound generators, A and B with an equilising bar, supply a total load of 500A. The data relating to the machine are as follows.
   Armature resistance, $R_A = 0.05$ ohm, $R_B = 0.03$ ohm
   Series field winding $R_{SA} = 0.02$ ohm, $R_{SB} = 0.01$ ohm
   Generated emf EA = 463V, EB = 470X.
   Calculate
   (a) The current in each armature.
   (b) The current in each series winding.
   (c) The current in the equilising bar and
   (d) The bus-bar voltage.

   Neglect the shunt currents and state the necessary assumptions made, if any.
5. (a) Distinguish between generator and motor action. Derive the equation for the back emf of a DC motor.
   (b) What are the different types of DC motors and give their applications.
6. (a) What is the power flow diagram of DC motor? And explain about losses involved in each stage?
   (b) A 4-pole 120KW, 240V, 800rpm wave wound generator has shunt field current of 4A at rated voltage. The generator has the following data.
   Armature winding single turn coils
   Length of conductors (including over hang) = 0.48 m
   Number of conductors = 480 : Voltage drop/brush = 1 volt
   Cross sectional area of conductors = 25 mm^2
   Full load temperature = 60^0C : Commutator diameter = 0.6 m
   Specific resistance of copper at 20^0C = 1.725×10^{-2} Ω/m/mm^2 Find

i. Full - load armature copper loss
ii. Shunt field copper loss, and
iii. Brush contact loss

7. (a) Explain why Swinburne's test cannot be used to determine the efficiency of d.c. series machines.

   (b) Explain how a swinburne's test can be used to predetermine the efficiency of a d.c. machine, when used as
   i. a generator &
   ii. as a motor

   (c) Write a note on Constant and Variable losses.

8. (a) Explain how the efficiency of d.c. series motors can be determined, by conducting field's test, with a neat circuit diagram.

   (b) A test on two coupled similar tramway motors, with their fields connected in series, gave the following results when one machine acted as a motor and the other as a generator. Calculate the efficiency of motor and generator.

Motor :	Armature Current	: 56 A
	Armature Voltage	: 590 V
	Voltage drop a cross field winding	: 40 V
Generator:		
	Armature Current	: 44 A
	Armature Voltage	: 400 V
	Field Voltage drop	: 40 V
	Resistance of each armature	: 0.3 Ω

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Code No: RR210205 **Set No.4**

II B.Tech. I Semester Supplementary Examinations, May -2005
ELECTRO MECHANICS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Describe singly excited magnetic field systems.
   (b) The magnetic flux density on the surface of an iron face is 1.6 T, which is a typical saturation level value for ferromagnetic material. Find the force density on the iron face. Derive the formula used.

2. The armature core of a 4-pole d. c. machine has 31 slots each designed to accommodate 4 coil sides of a simplex wave winding. The winding has total of 496 conductors. Find
   (a) Total number of coils
   (b) Turns per coil
   (c) Commutator pitch
   (d) Back, front and total pitches and
   (e) Number of commutator segments.

3. (a) Explain the effects of armature reaction in a d. c. generator.
   (b) What are the causes of sparking in a d. c. machine? Explain how commutation is improved by use of interpoles.

4. Two d.c. compound generators, A and B with an equilising bar, supply a total load of 500A. The data relating to the machine are as follows.
   Armature resistance, $R_A = 0.05$ ohm, $R_B = 0.03$ ohm
   Series field winding $R_{SA} = 0.02$ ohm, $R_{SB} = 0.01$ ohm
   Generated emf EA = 463V, EB = 470X.
   Calculate
   (a) The current in each armature.
   (b) The current in each series winding.
   (c) The current in the equilising bar and
   (d) The bus-bar voltage.

   Neglect the shunt currents and state the necessary assumptions made, if any.

5. A 4-pole 250V DC shunt motor has lap connected 960 conductors. The flux per pole is 20mWb. Determine the torque developed by the armature and the useful torque in Nm when current drawn by the motor is 32A. The armature resistance is 0.1Ω and shunt field resistance is 125Ω. The rotational losses of the machine amount to 825W. Derive the formula used.

6. (a) A 220V shunt motor takes 60A when running at 800rpm. It has an armature resistance of 0.1Ω. Find the speed and armature current if the magnetic flux is weakened by 20%, contact drop per brush = 1V. Total torque developed remains constant.

   (b) A 220V series motor runs at 800 rpm, when taking a current of 15A. The motor has $R_a = 0.3\Omega$ and $R_f = 0.2\Omega$. Find the resistance to be connected in series with armature if it has to take the same current at the same voltage at 600 rpm. Assume flux is proportional to current.

7. (a) What do you mean by back-to-back test in case of DC shunt machines? What are the limitations of this test?

   (b) A 220V, 12KW, DC shunt motor has a maximum efficiency of 90% and a speed of 800 rpm. When delivering 80% of its rated output. The resistance of its shunt field is 80 Ω. Determine the efficiency, speed when the motor draws a current of 70A from mains.

8. (a) Describe a suitable method for determining the efficiency of a DC compound motor?

   (b) In a retardation test on DC separately excited motor the induced e.m.f in the armature falls from 220V to 190V in 30 seconds disconnecting the armature from the supply. The same fall takes place in 20 seconds if immediately after disconnection armature is connected to a resistance which takes 10A (average) during this fall. Find the stray losses of motor.

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