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

II B.Tech I Semester Regular Examinations, November 2005
ELECTRO MECHANICS-I
(Electrical & Electronics 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.

   [6+10]

2. Give lay out (winding table) of a simplex lap progressive winding used for a 44 slot, 4-pole d. c. armature with 44 commutator segments. [16]

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.

   [8+8]

4. (a) How do you determine the critical resistance and critical speed in the laboratory.
   (b) How do you determine the internal and external characteristics of D.C component generators.

   [8+8]

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. [10+6]

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.

[8+8]

7. (a) In case of Hopkinson's test the efficiency of the two identical machines are not same, why?

   (b) In a test on a DC shunt generator, whose full load output is 200KW at 250V, the following figure were obtained.

      i. With the machine at rest, a potential difference of 8volts produced on a armature current of 400A.

      ii. With the motor running at no load and at rated speed the line current was 36A, the field current 12A and the supply voltage 250V.

   Obtain the generator efficiency at full load and half full load.

[6+10]

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.

[8+8]

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

II B.Tech I Semester Regular Examinations, November 2005
ELECTRO MECHANICS-I
(Electrical & Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Describe the principle of energy conversion. From the consideration of various energies included, develop the model of an electromechanical energy conversion device. [16]

2. Explain with neat sketches, the difference between progressive and retrogressive winding of a d. c. machine. [16]

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.

   [8+8]

4. (a) What is critical speed? How do you calculate the critical speed in the laboratory?
   (b) What are the conditions to build up of emf in a shunt generator?

   [8+8]

5. (a) Derive an expression for the torque of a DC motor.
   (b) Explain the armature reaction in dc motors.

   [8+8]

6. (a) A 6 pole, 500 V, wave connected shunt motor has 1200 armature conductors and useful flux/pole of 20 mwb. The armature and field resistances are 0.5Ω and 250Ω respectively. What will be the speed and torque developed by the motor when it draws 20 A from the supply mains?
   Neglect armature reaction. If magnetic and mechanical losses amount to 900 W, find
      i. useful torque
      ii. output in KW &
      iii. efficiency at this load.
   (b) A 230V, 10 H.P. shunt motor takes a full load line current of 40A. The armature and the field resistances are 0.25Ω and 230Ω respectively. The total brush drop is 2V, and the core and friction losses are 380W, Calculate the efficiency of the motor. Assume that the stray load loss is 1% of the rated output.

   [8+8]

7. (a) What is the effect of excitation, speed and load on the losses of a DC machine?

   (b) A 230V, DC shunt motor is taking 5A when running light (i.e at no load). The armature resistance (including brushes) is 0.2Ω and field circuit resistance is 115Ω. For an input current of 72A, calculate the shaft output and efficiency. Also calculate the armature current at which the efficiency is maximum.

   [6+10]

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.

   [8+8]

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

II B.Tech I Semester Regular Examinations, November 2005
ELECTRO MECHANICS-I
(Electrical & Electronics 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 advantages of analyzing energy conversion devices by field energy concept?
   (b) For linear magnitude circuit, derive the following relations for the stored magnetic energy (w_{fld}) and coenergy (w'_{fld}).
   $W_{fld} = W_{fld} = \frac{1}{2}F\phi = \frac{1}{2}\psi i$

   [6+10]

2. Explain with neat sketches, the difference between progressive and retrogressive winding of a d. c. machine. [16]

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.

   [8+8]

4. (a) Explain the procedure of parallel operation of generators.
   (b) Two separately-excited d.c generators are connected in parallel and supply a load of 200A. The machines have armature circuit resistances of 0.05 ohm and 0.1 ohm and induced emfs of 425V and 440V respectively. Determine the terminal voltage, current and power output of each machine. The effect of armature reaction is to be neglected.

   [8+8]

5. (a) Discuss armature reaction and commutation in a dc motor.
   (b) A 230V DC shunt motor takes 32A at full load. Find the back emf on full load if $R_a = 0.2\Omega$ and $R_f = 115\Omega$ respectively.

   [8+8]

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

[6+10]

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+8]

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.

[8+8]

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

II B.Tech I Semester Regular Examinations, November 2005
ELECTRO MECHANICS-I
(Electrical & Electronics Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the force in a singly excited relay in the linear magnetic system..
   (b) In a rectangular electromagnetic relay excited from a voltage source, the current and flux linkages are related as i = λ (λ + 2 (1 x)^2); x < 1. Find force on the armature as a function of λ.

   [8+8]

2. Design a lap winding for 32 conductor, 4 pole d. c. machine. Show also the brush positions. [12+4]

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.

   [6+4]

4. What is parallel operation? How do you connect the two shunt generators in parallel.Explain briefly? [4+4+8]

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.

   [8+8]

6. (a) How can you control the speed of D.C. Shunt Motor by using Ward-Leonard system.
   (b) A 220V series motor runs at 800 rpm when taking a current of 15A. The motor has an armature resistance of 0.3Ω and series field resistance of 0.2Ω. Find the resistance to be connected in series with the armature if it has to take the same current at the same voltage at 600 rpm. Assume flux is proportional to current.

   [8+8]

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+8]

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.

   [6+10]

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