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

II B.Tech I Semester Supplementary Examinations, November 2006
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) State and briefly explain the various phenomenon useful for the electromechanical energy conversion in rotating mechanisms.
   (b) Energy conversion devices make use of the magnetic field as a coupling medium rather than an electric field. Discuss. [8+8]

2. Explain with sketches, the difference between a progressive and retrogressive winding. Also, explain why progressive windings are used with lap windings. [10+6]

3. (a) With relevant diagrams, explain the phenomena of commutations in a d.c. machine.
   (b) Explain what is meant by 'straight line commutation,' 'Accelerated' & 'Retarded commutation'. Discuss the role of interpoles in improving commutation. [8+8]

4. The load characteristics of two shunt generators are as follows:

Machine: IArmature current In amperes	0	283	566	850
Machine: IIArmature current In amperes	0	200	400	600
Terminal voltage	500	490	480	470

   If the above machine works in parallel to supply a total load of 400 KW, determine
   (a) The load taken by each machine and
   (b) The amount by which the open circuit emf of the machine must be raised by field regulation so that the two machines share the 400 KW load equally?

   [8+8]

5. (a) Develop the general expression for the speed of a motor in terms of supply voltage, armature resistance and flux per pole.
   (b) Discuss the applications of series motors and compound motors. [8+8]

6. (a) Discuss about ward-Leonard system method of Speed Control of D.C. machines in detail.
   (b) In a shunt machine, running at 500 rpm, the hysteresis and eddy current losses are 250W and 150W respectively. Find the speed at which the total core losses are reduced by 30%. [8+8]

7. (a) Derive the condition for maximum efficiency of DC machine?

(b) A 50 KW, 250 V, 1200 rpm DC motor when tested on no-load at 250V draws an armature current of 13.24A, while its speed is 1215 rpm. Upon conducting other tests it is found that $R_a = 0.06\ \Omega$ and $R_f = 50\ \Omega$ while V_b(Brush voltage drop) = 2V. Calculate the motor efficiency at a shaft load of 50 KW at rated voltage with a speed of 1195 rpm. Assume that the stray loss is 1% of the output.
What would be the load for motor to have maximum efficiency and what would be its value? [6+10]

8. (a) Outline the steps to estimate the efficiency of given two d.c. machines by conducting Hopkinson's test. Draw schematic diagram to illustrate the method.

(b) In a Hopkinson's test on a pair of 500V, 100KW, shunt generators, the following data was obtained. Auxiliary supply 30A at 500V
Generator output Current 200 A
Field currents 3.5 A and 1.8A
Armature circuit resistances of each machine 0.075 Ω
Voltage drop at brushes (each machine) : 2 V
Calculate the efficiency of each machine acting as a generator. [8+8]

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

II B.Tech I Semester Supplementary Examinations, November 2006
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. [6+10]

2. Determine a suitable winding scheme for a 2-circuit, 4-pole winding of a D. C. machine. The armature slots are 17 and the commutator bars are 51. Give the winding table and use retrogressive type winding. [12+4]

3. Explain the importance of series field, interpole and compensating windings in d. c. compound machine. [16]

4. The load characteristics of two shunt generators are as follows:

Machine: IArmature current In amperes	0	283	566	850
Machine: IIArmature current In amperes	0	200	400	600
Terminal voltage	500	490	480	470

   If the above machine works in parallel to supply a total load of 400 KW, determine
   (a) The load taken by each machine and
   (b) The amount by which the open circuit emf of the machine must be raised by field regulation so that the two machines share the 400 KW load equally?

   [8+8]

5. (a) Develop the general expression for the speed of a motor in terms of supply voltage, armature resistance and flux per pole.
   (b) Discuss the applications of series motors and compound motors. [8+8]

6. (a) What are the different methods of speed control of DC motor? Explain.
   (b) A 220V DC shunt motor draws a no load armature current of 2.5A when running at 1400rpm. Determine its speed when taking an armature current of 60A if armature reaction weakens the flux by 3%. (Assume $R_a = 0.2\Omega$) [8+8]

7. (a) Explain with neat circuit diagram how can you find the efficiency of small DC motor with brake test?

(b) The Hopkenson's test on two shunt machines gave the following results for full load. The supply current was 15 A at 200 V. The generator output current was 85A. The field currents for motor and generator were 2.5 A and 3 A respectively. The armature resistance of each machine was 0.05 Ω. Find the efficiency of each of the machines under the above loading conditions. [6+10]

8. (a) How are large series machines tested, explain?

(b) The Hopkinson's test on two DC shunt machines gave the following results for full load. Line voltage 250V, line current 45A excluding field currents; motor armature current 385A; field current 5A and 4A. Calculate the efficiency of each machine. Armature resistance of each machine is 0.015 Ω. [8+8]

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

II B.Tech I Semester Supplementary Examinations, November 2006
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) State and briefly explain the various phenomenon useful for the electromechanical energy conversion in rotating mechanisms.
   (b) Energy conversion devices make use of the magnetic field as a coupling medium rather than an electric field. Discuss. [8+8]

2. Draw the winding diagram in radial form for a 4-pole 13-slot simplex wave connected d. c. generator with commutator having 13 segments. The no.of coil sides per slot is 2. Indicate the position of brushes. [12+4]

3. Explain the importance of series field, interpole and compensating windings in d. c. compound machine. [16]

4. (a) How do you classify the compound generators.
   (b) What are the various characteristics of compound generators. Explain them briefly? [6+10]

5. (a) Derive an expression for the torque of a DC motor.
   (b) Explain the armature reaction in dc motors. [8+8]

6. (a) Write a note on series-parallel Speed Control method of D.C. Series Motors.
   (b) A 4 pole, 250V, d.c. series motor has a wave wound armature with 496 conductors. Calculate:
      i. The gross torque
      ii. The speed
      iii. The output torque
      iv. The efficiency, if the motor current is 50A
      v. The value of flux per pole under these conditions is 22 mwb and the corresponding iron, friction and vintage losses totaling 810 w. Armature resistane = 0.19Ω field resistance = 0.14Ω [8+8]

7. (a) Explain with neat circuit diagram how can you find the efficiency of small DC motor with brake test?
   (b) The Hopkenson's test on two shunt machines gave the following results for full load. The supply current was 15 A at 200 V. The generator output current was 85A. The field currents for motor and generator were 2.5 A and 3 A respectively. The armature resistance of each machine was 0.05 Ω. Find the efficiency of each of the machines under the above loading conditions. [6+10]

8. (a) Outline the steps to estimate the efficiency of given two d.c. machines by conducting Hopkinson's test. Draw schematic diagram to illustrate the method.

   (b) In a Hopkinson's test on a pair of 500V, 100KW, shunt generators, the following data was obtained. Auxiliary supply 30A at 500V
   Generator output Current 200 A
   Field currents 3.5 A and 1.8A
   Armature circuit resistances of each machine 0.075 Ω
   Voltage drop at brushes (each machine) : 2 V
   Calculate the efficiency of each machine acting as a generator. [8+8]

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

II B.Tech I Semester Supplementary Examinations, November 2006
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) 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 simplex wave winding for a 35 slot, 4-pole d. c. machine with 35 Commutator bars. Give the brush positions and the winding scheme. [16]

3. (a) With relevant diagrams, explain the phenomena of commutations in a d.c. machine.
   (b) Explain what is meant by 'straight line commutation,' 'Accelerated' & 'Retarded commutation'. Discuss the role of interpoles in improving commutation. [8+8]

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

5. (a) How does a DC motor automatically adjust input to match the mechanical load on the motor?
   (b) Explain the armature reaction in D.C shunt motors, indicating also a few remedies to its adverse effects. [8+8]

6. (a) Derive the standard torque equation of a D.C motor from first principles.
   (b) A 200V DC shunt motor with a constant main field drives a load, the torque of which varies as the square of the speed. When running at 600 rpm it takes 30A. Find the speed at which it will run and the current it will draw if a 20Ω resistor is connected in series with armature. Neglect motor losses. [8+8]

7. A 10KW, 250V, DC shunt motor with an armature resistance of 0.8 Ω and a field resistance of 275 Ω takes 3.91 A, when running light at rated voltage and rated speed.
   (a) What conclusions can you draw from the above data regarding machine losses.
   (b) Calculate the machine efficiency as a generator when delivering an output of 10KW at rated voltage and speed and as a motor drawing an input of 10KW. What assumption if any do you have to make in this computation. [6+10]

8. (a) Outline the steps to estimate the efficiency of given two d.c. machines by conducting Hopkinson's test. Draw schematic diagram to illustrate the method.

(b) In a Hopkinson's test on a pair of 500V, 100KW, shunt generators, the following data was obtained. Auxiliary supply 30A at 500V
Generator output Current 200 A
Field currents 3.5 A and 1.8A
Armature circuit resistances of each machine 0.075 Ω
Voltage drop at brushes (each machine) : 2 V
Calculate the efficiency of each machine acting as a generator. [8+8]

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