Code No: 07A30201 **Set No. 1**

II B.Tech I Semester Regular Examinations, November 2008
ELECTRICAL MACHINES-I
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. In a rectangular electro magnetic relay, he exciting coil has 1200 turns. Cross sectional are of the core is A = 6 cm × 6 cm. neglect the reluctance of he magnetic circuit and fringing effects. With coil current kept constant at 2A, derive expression for force on armature as a function of air gap of length x. Find the work done by the magnetic field when x decreases from 1 cm to 0.5 cm by integrating the force. [16]

2. (a) Deduce an expression for the voltage induced in a DC generator.
   (b) The lap wound armature of a 4 - pole generator armature has 51 slots. Each slot contains 20 conductors. What will be the e.m.f generated in machine when driven at 1500 r.p.m. If useful flux per pole is 0.01Wb? [8+8]

3. (a) Explain the armature reaction in a D.C generator on no-load. Enumerate and explain the method to overcome the adverse effects of the armature reaction.
   (b) A 4-pole 50 KW, 250v wave wound, shunt generator has 400 armature conductors. Brushes are given a lead of 4 commutator segments. Calculate the demagnetizing ampere turns/pole if shunt field resistance is 50 ohms. Also calculate extra shunt filed turns/pole to neutralize the demagnetization.[8+8]

4. (a) How do you determine the magnetization characteristics of a DC generator.
   (b) A separately excited generator when running at 1200 rpm supplies a current of 200A at 125 V to circuit of constant resistance. What will be the current when the speed drops to 1000 rpm if the field current is unaltered? Armature resistance is 0.04 ohm and the total voltage drop at the brushes is 2V. Ignore the change in armature reaction. [8+8]

5. (a) Explain the drooping charectoristics of a D.C shunt generator
   (b) A d.c series generator having an reternal charectristics which is a straight line through zero to 50V at 200A is connected as a booster between a station busbar and a seeder of 0.3Ω resistance. Calculate the voltage different between the station busbar and the far end Ω the seeder at a curent of
      i. 1200A and
      ii. 50A. [6+10]

6. A 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 ohm.
   Determine:

(a) the initial torque developed;

(b) the internal torque of the field current is suddenly reduced to 80% of its original value;

(c) The steady motor speed in part

i. assuming the load torque to have remained constant. [16]

7. The speed of a 50 h.p series motor working on 500V supply is 750 rpm at full load and at 90 % efficiency. If the load torque is made 350Nm and a 5Ω resistance is connected in series with the machine, calculate the speed at which the machine will run. Assume the magnetic circuit to be unsaturated and the armature and field resistance to be 0.5Ω. [16]

8. The Hopkinson's test on two similar machines gave the following full load results.
Line current =48A
Line voltage =110V
Motor armature current=230A
The field currents are 3A an 3.5A. Armature resistance of each machine is 0.035 ohms.Calculate the efficiency of each machine assuming a brush contact drop of 1V per brush. [16]

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Code No: 07A30201 **Set No. 2**

II B.Tech I Semester Regular Examinations, November 2008
ELECTRICAL MACHINES-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 the principle of energy conversion. From a consideration of the various energies involved, develop the model of an electro mechanical conversion device.
   (b) Show that the torque developed in a doubly excited magnetic system is equal to the rate of increase of field energy with respect to the displacement at constant currents . [8+8]

2. (a) Distinguish between lap and wave windings.
   (b) The armature of a 2 pole, 200V generator has 400 conductors and runs at 300 rpm. Calculate the useful flux or pole. If the number of turns in each field coil is 1200, what is the average value of the emf induced in each coil on breaking the field, if the flux dies away completely in 0.1s. [8+8]

3. (a) How are demagnetizing and cross magnetizing ampere-turns/pole in a D.C Machines calculated?
   (b) Determine AT/pole for each interpole of a 4 pole generator with 88 slots each containing 900 amp - conductors. The interpole air gap is 0.01 m and flux density in the interpole air gap is 0.3 T . The effects of iron parts of iron parts of the circuits and leakage may neglected. [8+8]

4. (a) How are the series and shunt windings arranged on the pole of a dc compound machine?
   (b) How will you distinguish between series and shunt windings of a dc compound machine? [8+8]

5. Two short-shunt compound generators A and B running in parallel supply a load current of 140A at a terminal voltage 100 V. An equalizig bar connects the two machines. The data regarding the machines are:
   Generator A: Ra=0.02 ohm; Rsh=80ohm; Rse=0.02 ohm.
   Generator B: Ra=0.05 ohm; Rsh=100 ohm; Rse=0.05 ohm; e.m.f generator B, 105 V.
   Calculate:
   (a) current in series windings
   (b) armature currents
   (c) current in equalizer
   (d) e.m.f generated by generator A. [4+4+4+4]

6. (a) Explain the basic performance equations for a dc motor.
   (b) A 4-pole, 250 V series motor has a wave-connected armature with 1254 conductors. The flux per pole is 22 mWb when the motor is taking 50 A. Iron and friction losses amount to 1.0 Kw. Armature resistance is 0.2 ohm and series field resistance is 0.2 ohm. Calculate:
      i. the speed
      ii. the BHP
      iii. the shaft torque and
      iv. the efficiency at this load. [8+8]

7. (a) Draw and explain the speed-torque characteristics and torque charectristics of dc shunt motor.
   (b) A 240V, 50A,800 rpm dc shunt motor has armature circuit resistance of 0.2Ω. If load torque is reduced to 60% of its full-load value and a resistance of 2Ω is inserted in series with armature circuit, find the motor speed. Armature reaction weakens the field flux by 4% at full load and by 2% at 60% of full load. [8+8]

8. A 10kW 900 rpm, 400V dc shunt motor has armature circuit resistance (including brushes) of 1Ω and shunt field resistance of 400Ω. If efficiency at rated load is 85%, then calculate:
   (a) The no-laoad armature current,
   (b) The speed when motor draws 20A from the mains and
   (c) The armature, eurrent, when the total(or internal) torque developed is 98.5 Nm.
   Assume the flux remain constant. [16]

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Code No: 07A30201 **Set No. 3**

II B.Tech I Semester Regular Examinations, November 2008
ELECTRICAL MACHINES-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) Prove that energy and coenergy in a linear magnetic system are given by identical expressions.
   (b) A 10 KW, 1500rpm d.c shunt generator has a time constant L_f/R_f of 0.5 sec for its field winding. Under normal operating conditions, the $I_f^2 r_f$ loss in the filed winding is 600 watts. Compute the energy stored in the magnetic field produced by the field winding, under normal operating conditions. [8+8]

2. What are the ordinary types of armature winding for dc machine? Explain the essential difference between them and give relative merits and the applications of the two types windings. [16]

3. (a) How demagnetizing and cross magnetizing ampere turns per pole are calculated in a DC machine?
   (b) Determine per pole, the number of
      i. across magnetizing ampere turns
      ii. demagnetising ampere turns
      iii. series field turns to balance the back ampere turns in the case of a dc generator having the following data
      6000 conductors, total current 100A, 6 pole wave wound, angle of lead is 10^0 , leakage coefficient = 1.3 [8+8]

4. (a) List the conditions for building up of a dc shunt generator.
   (b) A d.c. shunt generator is supplying load connected to a bus - bar voltage of 220 V. It has an armature resistance of 0.025 Ω and field resistance of 110 Ω. Calculate the value of load current and load power when it generates an emf of 230 V. Neglect the effect of armature reaction. Draw circuit diagram.[8+8]

5. (a) What are the reasons for failure of voltage build up in a self excited D.C generator
   (b) A shunt generator is to be converted into a level compounded generator by the addition of a series field winding. From a test on the machine with shunt excitation only, it to give 400V on no-load and 4.8A to give the same voltage when the machine is supplying its full load of 200A. the shunt winding has 1200 turns/pole. find the noos series turns required per pole. [10+6]

6. (a) Draw and explain the dc Series motor characterstics.

(b) The magnetization characteristic of a 4-pole dc series motor may be taken as proportional to current over a part of the working range; on this basis the flux per pole is 4.5 mwb/A. The load requires a gross torque proportional to the square of the speed equal to 30 Nm at 1000 rev/min. The armature is wave-wound and has 492 active conductors. Determine the speed at which the motor will run and the current it will draw when connected to a 220 V supply, the total resistance of the motor being 2.0 ohm. [8+8]

7. A 250V dc series motor has armature and series field resistance of 0.25 and 0.15ohms respectively.

   (a) Calculate the current for developing a torque of 80Nm at 1200 rpm.

   (b) Calculate the percentage reduction in flux when the motor runs at 1800 rpm at half the current obtained in part (a). [8+8]

8. A 50 Kw, 440 V shunt generator having an armature circuit resistance including inter-pole winding of 0.15 ohm at normal working temperature was run as a shunt motor on no-load at rated voltage and speed. The total current drawn by the motor was 5 A including shunt field current of 1.5 A. Calculate the efficiency of the shunt generator at $3/4^{th}$ full-load. [16]

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Code No: 07A30201 **Set No. 4**

II B.Tech I Semester Regular Examinations, November 2008
ELECTRICAL MACHINES-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) Prove that energy and coenergy in a linear magnetic system are given by identical expressions.
   (b) A 10 KW, 1500rpm d.c shunt generator has a time constant L_f/R_f of 0.5 sec for its field winding. Under normal operating conditions, the $I_f^2 r_f$ loss in the filed winding is 600 watts. Compute the energy stored in the magnetic field produced by the field winding, under normal operating conditions. [8+8]

2. (a) With neat diagram give the constructional features of dc machine.
   (b) An 6 pole lap wound generator armature has 720 conductors, a flux of 30 mwb and a speed of 600 r.p.m. Calculate the e.m.f generated on open circuit. If the same armature is wave wound, at what speed it be driven to generate 600 volts? [8+8]

3. A 4-pole generator supplies a current of 143A. It has 492 armature conductors
   (a) wave wound
   (b) lap wound connected. When delivering full load, the brushes are given an actual lead of 10^0.

   Calculate the demagnetizing ampere turns/pole. This field winding is shunt connected and takes 10A. Find the number of extra shunt filed turns necessary to neutralize this demagnetization. [8+8]

4. (a) Draw OCC of a dc shunt generator and define critical speed and critical resistance.
   (b) A dc shunt generator has the following open circuit magnetization curve at its rated speed

Field current (A) :	0.5	1.0	1.5	2	3	4
EMF (V) :	180	340	450	500	550	570

   The resistance of the field circuit is 200 Ω. The generator is driven at its rated speed. Find the terminal voltage on open circuit. (Use graph paper) [8+8]

5. (a) Explain how critical resistale and critical speed of a D.C. generator can be obtained.
   (b) Draw the load charectristics of all the D.C generators. [8+8]

6. A 250v 4 pole shunt motor has two circuit armature winding with 500 conductors.The armature circuit resistance is 0.25 ohms field resstance is 125 ohm and the flux per pole is 0.02wb.neglect armature reaction.find the sped and torque developed if the motor draws 14 A from the mains. [16]

7. (a) What are the factors effecting the speed of dc motors.
   (b) State one advantage and one disadvantage in the application of each of the three basic types of dc motors. [8+8]

8. A 200V shunt motor has Ra=0.1Ω, Rf=240Ω and rotational loss=236W. On full load the line current is 9.8A with the motor running at 1450 rpm. Determine:
   (a) the mechanical power developed
   (b) the power output
   (c) the load torque
   (d) the full load efficiency. [4+4+4+4]

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