Code No: A109210206 **R09** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
ELECTRICAL MACHINES-I
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. A 480V, 20 kW shunt motor took 2.5A when running light. For an armature resistance to be 0.6Ω field resistance of 800Ω and brush drop of 2V. Find the full load efficiency. [15]

2. (a) Describe the methods for speed control of dc series motors.
   (b) A dc series motor, running a fan at 1000 r.p.m., takes 50A from 250V mains. The armature plus field resistance is 0.6Ω. If an additional resistance of 4.4 Ω is inserted in series with the armature circuit, find the motor speed in case the field flux is proportional to the armature current. [7+8]

3. (a) What are the factors on which the choice of type of armature winding of a dc machine will depend?
   (b) A 4 pole dc machine armature with lap connected coils has 72 slots and 6 coil sides per slots. Determine the winding pitches and connections to 9 equally spaced equalizer rings. [7+8]

4. (a) Explain the action of compensating windings in certain dc machines. Show schematically how they are connected .
   (b) A 500 V, wave wound, 750 rpm dc shunt generator supplies a load of 195 A. The armature has 720 conductors and shunt field resistances is 100 ohms .Find the demagnetising ampere turns/pole if the brushes are advanced through 3 commutator segments at this load. Also calculate the extra field turns required to neutralize this demagnetization. [7+8]

5. Draw the connection diagrams for the shunt , series and compound generators and Discuss their load characterstics. [15]

6. (a) Explain the various possible causes for the failure of build up of voltage in dc generators.
   (b) A 6 pole lap wound shunt generator supplies to 100 lamps of 100 watts, 200V each. The field and armature resistances are 500 ohms and 0.2 ohm respectively. Allowing a brush drop of 1V each brush, calculate the following
      i. armature current
      ii. current per path
      iii. generated emf
      iv. power output of D.C generator [7+8]

7. (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. [7+8]

8. Two windings, one on stator and the other on rotor, has the following parameters $R_s = 2.5\ \Omega$ $r_r = 3\Omega$ $L_s = 0.03$H $L_r = 0.12$ H $M_{sr} = 0.06\cos\theta_r$
Where θ_r is the space angle between stator and rotor winding axes. The two windings are connected in parallel and the rotor is locked at $\theta_r = 90^0$. With the currents initially zero, the windings are switched on to a voltage source of 30 volt d.c at time t = 0

(a) Find i_s, i_r as functions of time.

(b) Find an expression for magnetic torque as a function of time. [15]

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Code No: A109210206 **R09** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
ELECTRICAL MACHINES-I
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. A 600V dc motor drives a 60 kW load at 900 rpm. The shunt field resistance is 100Ω and the armature resistance is 0.16Ω . If the motor efficiency is 85%, determine:
   (a) the speed at no-load and the sped regulation.
   (b) the rotational loss. [7+8]
2. (a) Explain the construction and working of an elementary generator.
   (b) An 8 pole wave connected DC generator has 900 armature conductors and flux/pole of 0.04 wb. At what speed it must be driven to generate 500V.[7+8]
3. Why is a dc series motor used to start heavy loads?
   A 250 V dc series motor runs at 500 rpm. The shaft torque is 130 N-m and the efficiency at this load is 88%. Find the current taken by the motor. [15]
4. (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. [7+8]
5. (a) Define field energy and co - energy. Give the significance of coenergy in the derivation of torque or force in an electro mechanical energy conversion device.
   (b) All practical energy conversion devices use magnetic field as a coupling medium rather than electrical field. Discuss? [8+7]
6. (a) In a model of a dc machine, the field winding and its armature circuit are always drawn at 90^0 with respect to each other. Why ?
   (b) The resistance of the field circuit of a dc shunt generator is 200 Ω. When the output of the generator is 100 KW, the terminal voltage is 500 V and the generated emf is 525 V. Calculate
      i. The armature resistance and
      ii. The value of the generated emf when the output is 60 KW and terminal voltage is 520 V. [7+8]
7. (a) What are renewable and non-renewable resources? Give examples.
   (b) What are the direct and indirect benefits from forest? Explain? [7+8]

8. 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+3]

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Code No: A109210206 **R09** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
ELECTRICAL MACHINES-I
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain with neat sketches, the difference between progressive and retrogressive windings of a d.c machine. [15]

2. (a) Explain the methods of improving commutation with relevant figures.
   (b) A commutator segment having a diameter of 0.7 m rotates at 600 rpm. Determine the approximate time of commutation. The brush width is 15mm. [7+8]

3. (a) How O.C.C charecteristics of a series generator can be obtained
   (b) Draw the load charecteristics of a cumulative compound D.C. generator (flat, under excited and over excited). [7+8]

4. (a) How will you distinguish between series and shunt windings of a dc compound machine.
   (b) A short shunt compound generator delivers a load current of 30 A at 220 V and has armature, series field and shunt field resistance of 0.05, 0.03, and 200 Ω respectively. Calculate the induced emf and the armature current. Allow 1.0 V per brush contact drop. [8+7]

5. (a) Explain the operating characteristics of dc compound motors?
   (b) A 250 V dc Series motor has a linear open charactersitc curve with a slope of 12V/A at 1220 rpm. Find its speed when developing a torque of 40 N-m if R_a+R_f=0.6 ohms. [7+8]

6. Two windings, one on stator and the other on rotor, has the following parameters $R_s = 3.5\ \Omega$ $r_r = 4\ \Omega$ $L_s = 0.06$H $L_r = 0.25$ H $M_{sr} = 0.08\cos\theta_r$
   Where θ_r is the space angle between stator and rotor winding axes. The two windings are connected in parallel and the rotor is locked at $\theta_r = 90^0$. With the currents initially zero, the windings are switched on to a voltage source of 60 volt d.c at time t=0
   (a) Find i_s, i_r as functions of time
   (b) Find an expression for magnetic torque as a function of time [15]

7. A dc shunt motor, with armature circuit resistance of 0.1Ω, runs at 1600 rpm while taking an armature current of 100A from 230V dc source. The friction and windage loss is 300W, no-load core losses are 1200W and the total I^2R loss is 2500W. Stray loss equals 1% of the output.
   Find the shaft torque of the motor and its efficiency. [7+8]

8. A dc series motor drives a fan at 800 rpm and takes 20A. When fed from rated voltage of 230V. The motor resistance is 0.4 Ω. The motor speed is to be raised to 1000 rpm by voltage control. Find the voltage and current in case magnetic circuit is:

   (a) saturated and

   (b) unsaturated. [7+8]

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Code No: A109210206 **R09** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
ELECTRICAL MACHINES-I
Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the condition for maximum efficiency in D.C motors.
   (b) A 500V dc shunt machine draws 4A as a motor on no load. If Ra=0.2 ohms and Rf=500 ohms find:
      i. the constant losses
      ii. efficiency when running as a generator supplying a 50A load at 500V. [7+8]

2. (a) Explain the voltage regulationof a D.C generator
   (b) A 25 kw, 250V shunt generator delivers rated current at rated voltage on removal of load the terminal voltage rises to 275 V. Determine the voltage regulation. [7+8]

3. (a) With the help of neat sketches, explain the effect of armature reaction on the air gap flux in a D.C. generator.
   (b) A 300 KW, 500V,6 - pole lap wound DC generator has 70 slots with 12 conductors/slot. The brushes are advanced through 3.33 mechanical degrees. Find the number of demagnetizing and cross magnetizing AT/pole. Ignore shunt filed current. [7+8]

4. Explain the following:
   (a) How can induced emf in the armature conductors of a dc generator be made unidirectional
   (b) Do we use laminations for all iron parts of electrical machines? If not why?
   (c) Why are the carbon or graphite brushes preferred over copper brushes for use in dc machines?
   (d) What is dummy coil and where and why it is used? [15]

5. A 10 KW, 250 V, dc shunt motor has an armature resistance of 0.5 ohm and a field resistance of 200 ohm. At no load and rated voltage, the speed is 1200 rpm and the armature current is 3 A. At full load and rated voltage, the line current is 47 A and because of armature reaction, the flux is 4% less than its no-load value:
   (a) What is its full-load speed?
   (b) What is the developed torque at full load? [15]

6. (a) Derive an expression for the energy stored in a magnetic field.

(b) Show that the reaction of coupling magnetic field on the electrical or mechanical system is essential for the electro mechanical energy conversion process. [7+8]

7. (a) Explain the applications of different types of dc generators.

(b) A long shunt generator supplies a load current of 180A at a terminal voltage of 400V. The series field, shunt field and armature resistances are 0.03 Ω, 200 Ω and 0.04 Ω respectively. Contact drop per brush = 1V. Armature reaction may be ignored. Determine the EMF generated. [7+8]

8. Shunt motor connected to a constant d.c. voltage source, drives a load requiring constant electromagnetic torque. Prove that, if counter e.m.f. Ea $> (1/2)V_t$, the speed decreases with an increase in flux (or vice-versa) and if $E_a < (1/2)V_t$ the speed increases with an increase in flux. Here Vt is the armature terminal voltage. [15]

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