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

**II B.Tech I Semester Examinations,MAY 2011**
**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) Give the materials and functions of the following parts of a DC machine:
   i. Field poles
   ii. Yoke
   iii. Commutator
   iv. Commutating poles
   v. Armature
   (b) The armature of a 6 - pole generator has a wave winding containing 664 conductors. Calculate the generated e.m.f when flux per pole is 60 mWb and the speed is 250 rpm. Find the speed at which the armature must be driven to generate an e.m.f. of 550 V if the flux per pole is reduced to 58 mWb. [7+8]

2. (a) For a linear magnetic circuit, show that the magnetic stored energy density is given by $\frac{1}{2}$ B$^2$/ $\mu$ joules/m$^3$.
   (b) A 10 KW, 1440 rpm d.c shunt generator has a time constant $L_f/R_f$ of 0.2 sec for its field winding. Under normal operating conditions, the $I_f{}^2 r_f$ loss in the filed winding is 400 watts. Compute the energy stored in the magnetic field produced by the field winding, under normal operating conditions. [7+8]

3. (a) Give reason why a shunt generator may fail to build up.
   (b) Compute the emf generated in 8 - pole dc shunt generator having a lap wound armature with 120 slots and 8 conductors per slot. The flux per pole is 0.05 Wb and the speed of rotation is 200 rpm. The above generator supplies 40 no's of 60W lamps, a terminal voltage of 160 V if the armature and field resistances are 0.25 Ω and 160 Ω respectively, and the voltage drop at each brush is 2 V. Find the new speed at which the machine must run. Neglect armature reaction. [7+8]

4. Derive an expression for the emf generated in a dc motor?
   The counter emf of a shunt motor is 227 V, the field resistance is 160 ohm and field current is 1.5A. If the line current is 39.5 A, find the armature resistance. Also find the armature current when the motor is stationary. [15]

5. (a) What do you understand by armature reaction? Explain the concept of demagnetizing and cross magnetizing armature ampere turns?
   (b) A 4 pole dc generator supplies a current of 148A. It has 492 armature conductors lap connected. The brushes are given lead of $10^0$ when the machines delivers full load. Calculate the demagnetising ATs per pole. If the shunt field

winding takes 6 A. Determine the number of extra shunt field turns necessary to neutralize this demagnetization. [7+8]

6. The following data apply to dc shunt motor.
Supply voltage=460V, armature current=28A, speed=1000 rpm, armature resistance=0.72Ω.
Calculate:

   (a) the armature current

   (b) the speed when the flux per pole is increased to 120% of the initial value, given that the total torque developed by the armature is unchanged. [15]

7. (a) Explain with neat diagram how field's test can be conducted on pair of identical series machines.

   (b) A field's test on two identical machines gave the following data:
   Motor armature current=60A, Motor armature voltage=500V, Motor field voltage=40V,
   Generator armature current=46A, Generator terminal voltage=450V, Generator field voltage=40V.
   Armature resistance including brushes is 0.25 ohm for each machine. Find the efficiency of the machines. [7+8]

8. In a 110 V compound generator, the resistance of the armature, shunt and series windings are 0.06, 25, and 0.04 ohms respectively. The load consists of 200 lamps each rated at 55 w, 110 V. Find the e.m.f generated and armature current when the machine is connected:

   (a) long shunt

   (b) short shunt

   (c) How will the ampere-turns of series winding be changed if in (a), a diverter of resistance 0.1 ohm be connected in parallel with the series winding? Ignore armature reaction and brush contact drop. [15]

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

**II B.Tech I Semester Examinations,MAY 2011**
**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. The armature winding of a 4-pole. 250V dc shunt motor is lap connected. There are 120 slots, each slot containing 8 conductors. The flux per pole is 20mWb and current taken by the motor is 25A. The resistance of armature and field circuit is 0.1Ω and 125Ω respectively. If the rotational losses amount to be 810W find.
   (a) gross torque
   (b) usefull torque and
   (c) efficiency. [15]

2. (a) What are the similarities and dissimilarities between lap and wave windings in a D.C machine
   (b) A 4 pole lap wound dc armature has a bore diameter of 0.7 metre. It has 560 conductors and the ratio of pole arc/pole pitch is 0.63. if the armature is running at 600 rpm and the flux density in the air gap is 1.2 Wb/$m^2$. Determine the induced emf in the armature if effective length of the armature conductor is 20cm. [7+8]

3. (a) What are the significances of energy and co - energy of energy conversion system?
   (b) Show how mechanical energy output can be determined in the multiple excited nonlinear systems. [7+8]

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

5. (a) A separately excited generator when running at 1200 rpm supplies a current of 150A at 125 V to circuit of constant resistance. What will be the current when the speed drops to 800 rpm if the field current is unaltered? Armature resistance is 0.05 ohm and the total voltage drop at the brushes is 2V. Ignore the change in armature reaction.
   (b) A short shunt compound generator delivers a load current of 20 A at 220 V and has armature, series field and shunt field resistance of 0.03, 0.01, and 250 Ω respectively. Calculate the induced emf and the armature current. Allow 1.0 V per brush contact drop. [7+8]

6. A 230V, 1000 rpm dc shunt motor has field resistance of 115Ω and armature circuit resistance of 0.5Ω. At no load, the motor runs at 1000 rpm with armature current of 4A and with full field flux.:

(a) For a load requiring 80Nm, compute armature current and speed of the motor

(b) If it is desired that motor develops 8kW at 1250 rpm determine the value of external resistance that must be inserted in series with the field winding. Saturation and armature reaction are neglected. [7+8]

7. (a) What is the function of inter poles in DC machines.

(b) A 6-pole 120 kW, 500v DC shunt generator has 756 armature conductors wave wound. The shunt field resistance is 50 ohms. When delivering full load the brushes are displaced from the geometrical neutral axis by 24 electrical degrees. Find the demagnetizing ampere turns/pole and cross magnetizing ampere turns/pole. Also find the number of additional shunt field turns required to neutralize the magnetizing effect. [7+8]

8. (a) Compare the speed-torque characteristics of dc shunt, series and compound motors.

(b) A 200 V dc shunt motor with armature resistance 0.1 ohm runs at 1000 rpm taking an armature current of 50A. If the flux is suddenly reduced by 10% obtain maximum current at this instant and the corresponding torque.[5+10]

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

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

**Answer any FIVE Questions**
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1. (a) What are the advantages and disadvantages of different types of speed control methods of DC motors?
   (b) A 500V shunt motor runs at its normal speed of 250rpm. When the armature current is 200A, the resistance of armature is 0.12Ω. Calculate the speed when a resistance is inserted in the field reducing the shunt field to 80% of normal value and the armature current is 100A. [5+10]
2. What features of a dc series generator distinguish it from other types of dc generators explain. [15]
3. (a) Draw and explain fully the general block diagram representation of an electro mechanical energy conversion device.
   (b) For a singly excited magnetic system, derive the relation for the magnetic stored energy in terms of reluctance. [7+8]
4. (a) What is the difference between resistance commutation and E.M.F commutation?
   (b) A 2000 kw, 500 V, 16 - pole generator has a lap wound armature with 2360 conductor. Calculate the number of pole face conductors in each of the compensating winding. Assume that pole faces cover 66 percent of the entire circumstances. [7+8]
5. A 10 kW, 250V dc shunt generator has total no load rotational loss of 400W. The armature circuit (including brushes) and shunt field resistance are 0.5Ω and 250Ω respectively. Calculate the shaft power input and the efficiency at rated loa. Also calculate the maximum efficiency and the corresponding power output. [15]
6. 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]
7. (a) Explain the operating characteristics of dc series motors?

(b) A250 V shunt motor has an armature current of 20A when running at 1000 rpm against full-load torque. The armature resistance is 0.5 ohm. What resistance must be inserted in series with the armature to reduce the speed to 500 rpm at the same torque, and what would be the speed if the load torque is halved with this resistance in the circuit. Assume the flux to remain constant throughout and neglect brush contact drop. [5+10]

8. (a) How will you distinguish between series and shunt windings of a dc compound machine?

(b) 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? [7+8]

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

**II B.Tech I Semester Examinations,MAY 2011**
**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) Explain the effects of armature reaction.
   (b) A 4 pole series motor has 944 wave connected armature conductors. At a certain load, the flux per pole is 34.6 mwb and the total mechanical torque developed is 209 NM. Calculate the line current taken by the motor and the speed at which it will run when the voltage of 500V is applied. Total motor resistance is 3Ω. [5+10]

2. Explain the importance of series field, interpole and compensating windings in dc machine. [15]

3. (a) Describe singly excited magnetic field systems.
   (b) The magnetic flux density on the surface of an iron face is 1.6T which is typical saturation level value for ferromagnetic material. Find the force density on the iron face. Derive the formula used. [8+7]

4. Design a lap winding for 32 conductors, 4 pole d.c machine. Show also the brush position. [15]

5. Write short notes on the following:
   (a) Parallel operation of DC generators
   (b) Cross connection of field windings. [8+7]

6. A 7.46 kW, 250V shunt motor takes a line current of 5A when running light. Calculate the efficiency as a motor when delivering full load output, if the armature and field resistance are 0.5Ω and 250Ω respectively. At what output power will the efficiency be maximum? Is it possible to obtain this output from these machine? [15]

7. (a) How are the series and shunt windings arranged on the pole of a dc compound machine.
   (b) The magnetization curve of a dc shunt generator running at 1000 rpm is as follows:

| Field amperes : | 0.25 | 0.5 | 1.0 | 1.5 | 2 | 2.5 | 3 |
|---|---|---|---|---|---|---|---|
| EMF ( V ) : | 36 | 72 | 138 | 188 | 225 | 250 | 270 |

   Find
      i. The value of field resistance to give 240 volts on load .
      ii. The speed at which generator fails to build up. [7+8]

8. A 200V d.c shunt motor, with an armature resistance of 0.1Ω, is running at 1000 r.p.m. and takes an armature current of 50A. If the field flux is suddenly reduced by 10% obtain:

   (a) the maximum value of current at this instant and the corresponding torque and

   (b) ultimate speed and armature current after the transients are over. Assume constant load torque and negligible armature inductance. [7+8]

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