Code No: R050210202 **Set No. 1**

**II B.Tech I Semester Regular Examinations, November 2006**
**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) What is field energy? What is the relation of mechanical energy and field energy? Relate them in a linear system.
   (b) The magnetic flux density on the surface of an iron face is 1.45 T, find the force density on the iron face. [8+8]

2. (a) What is an equalizer connection? What is necessity of equalizer connection?
   (b) An 8 pole DC generator has per pole flux of 40mWb and winding is connected in lap with 960 conductors. Calculate the generated EMF on open circuit when it runs at 400 rpm. If the armature is wave wound at what speed must the machine be driven to generate the same voltage. [8+8]

3. (a) Explain the effects of armature reaction in a d. c. generator.
   (b) Determine per pole the number
      i. of cross-magnetizing ampere-turns
      ii. of back ampere-turns and
      iii. of series turns to balance the back ampere-turns in the case of a.d.c. generator having the following data
      500 conductors, total current 100A, 4 poles, 2-circuit wave winding, angle of lead = $10^0$, leakage coefficient = 1.3. [8+8]

4. What is critical speed? How do you calculate the critical speed in laboratory. [16]

5. Six DC generators are running in parallel, each having an armature resistance of 0.15 ohm, running at the same speed and excited to give equal induce e.m.f(s). All generators share load equally at a terminal voltage of 500V. The total load is 360KW. If the field current of one generator is raised by 5% and the speed remains constant, Calculate
   (a) New Terminal Voltage
   (b) Output of each machine. [16]

6. (a) Discuss armature reaction and commutation in DC motors.
   (b) A 220v DC Shunt Motor takes 22A at rated voltage and runs at 1000 rpm. Its field and armature circuit resistances are 110 ohms and 0.1 ohm respectively. Compute the value of additional resistance required in the armature circuit to reduce the speed to 800 rpm when the load torque is proportional to speed. [6+10]

7. (a) Explain the 'above normal speed', speed control of DC motor. How this control is achieved? Explain why speed is above normal?

   (b) A 220 V series motor runs at 700 RPM when operating at full load current of 20 Amp. The motor resistance is 0.5 Ω. Assume magnetic path is un-saturable. What will be the speed if:

   i. Load torque is increased by 44%

   ii. Motor current = 10 Amp. [6+10]

8. (a) Explain the various losses taking place in DC machines. With the help of these losses draw the power flow diagram for a DC Motor.

   (b) A 440 V DC shunt motor takes a current of 3 A. at no-load. The armature resistance including brushes is 0.3 Ω and the field current is 1 A. Calculate the output and efficiency when the input current is 20 A. [8+8]

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Code No: R050210202 **Set No. 2**

**II B.Tech I Semester Regular Examinations, November 2006**
**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) What is field energy? What is the relation of mechanical energy and field energy? Relate them in a linear system.
   (b) The magnetic flux density on the surface of an iron face is 1.45 T, find the force density on the iron face. [8+8]

2. The armature of a DC generator is wave wound with 6 poles. There are 56 slots on the armature surface and 6 turns per coil. The armature winding is double layer winding. The current carrying capacity of each conductor is 45 Amp, find the power developed by the armature, if flux per pole is 45mwb and generator is rotated at 350 rpm. Find the resistance of armature, if resistance of each conductor is 3 milliohm and hence find the output power and electrical efficiency of machine. Repeat the calculation for lap winding. Compare the out put power and comment on result. [16]

3. (a) What are the causes of sparking in a d. c. machine? Explain how commutation is improved by use of inter poles.
   (b) A 22.38 kW, 400-V, 2-pole wave-wound d.c., shunt motor has 840 armature conductors and 140 commutator segments. Its full-load efficiency is 88% and the shunt field current is 1.57A. If brushes are shifted backward through 1.5 segments from the geometrical neutral axis, find the demagnetizing and distorting amp-turn /pole. [8+8]

4. What is critical speed? How do you calculate the critical speed in laboratory. [16]

5. (a) Explain clearly why an equilizer connection makes it possible for two compound generators to operate in parallel in stable equilibrium.
   (b) Discuss the necessity for parallel operation of generators. Explain the parallel operation of DC Series generators. [8+8]

6. (a) Differentiate between generator action and motor action of a DC machine.
   (b) Explain the applications of DC shunt and series motors with the help of their characteristics and equations. [8+8]

7. Deduce the expression for the number of steps, No. of studs, and resistance for each step of a 3-point starter. [16]

8. (a) A DC motor is fed from a constant voltage supply runs at 900 RPM. At this speed hysteresis loss is 70 W and eddy current loss is 40 W. If the motor speed is increased to 1000 RPM by reducing the flux, calculate the new core loss. Take Steinmitz's constant as 1.6 and neglect armature circuit resistance.

   (b) Explain different iron losses. How these losses can be reduced. [10+6]

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Code No: R050210202 **Set No. 3**

**II B.Tech I Semester Regular Examinations, November 2006**
**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. With the help of neat diagram obtain the expression for the energy stored in a magnetic system for a simple attracted armature type relay. Explain the operation of system. [16]

2. (a) What is an equalizer connection? What is necessity of equalizer connection?
   (b) An 8 pole DC generator has per pole flux of 40mWb and winding is connected in lap with 960 conductors. Calculate the generated EMF on open circuit when it runs at 400 rpm. If the armature is wave wound at what speed must the machine be driven to generate the same voltage. [8+8]

3. (a) Explain about demagnetizing Ampere turn per pole and Cross magnetizing Ampere Turn per pole.
   (b) What is the purpose of compensating winding? Explain in detail. [8+8]

4. (a) Explain experimental determination of critical field resistance for a self excited generator?
   (b) What are the causes and indication of over load generator. [8+8]

5. (a) Sketch and explain the load characteristics of DC generators. Also give their fields of application.
   (b) A separately excited generator with constant excitation is connected to a constant load. When the speed is 1200 rpm, it delivers 120A at 500V. At what speed will the current be reduced to 60A ? Armature resistance is 0.1 ohm. Armature reaction may be ignored. [8+8]

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

7. (a) With Neat diagram Explain the construction and working of 3-point starter
   (b) A 2 ? pole lap wound DC shunt motor with 360 conductors operates at a constant flux level of 50mWb. The motor armature has a resistance of 0.12 Ω and is designed to operate at 240 V, taking a current of 60 A at full load.
      i. Determine the value of external resistance to be inserted in the armature circuit so that armature current does not exceed twice its full load value at starting.

ii. The external resistance is completely cut out when the motor reaches its finale speed, with the armature current at the full load value. Calculate the motor speed under these conditions. [8+8]

8. (a) Explain the testing method for traction motors.

(b) A retardation test is made on a separately excited DC machine as a motor. The induced EMF falls from 250 V to 175 V in 48 Seconds on opening the armature circuits and 6 Seconds on suddenly changing armature connection from supply to a load resistance taking average current of 11A. Find the stray losses and efficiency of the machine when running as a motor & taking a current of 28 A on a supply of 250V. The resistance of its armature is 0.48 Ω and that of its field winding is 300 Ω. [8+8]

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Code No: R050210202 **Set No. 4**

**II B.Tech I Semester Regular Examinations, November 2006**
**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. With the help of neat diagram obtain the expression for the energy stored in a magnetic system for a simple attracted armature type relay. Explain the operation of system. [16]

2. (a) What is an equalizer connection? What is necessity of equalizer connection?
   (b) An 8 pole DC generator has per pole flux of 40mWb and winding is connected in lap with 960 conductors. Calculate the generated EMF on open circuit when it runs at 400 rpm. If the armature is wave wound at what speed must the machine be driven to generate the same voltage. [8+8]

3. (a) Explain about demagnetizing Ampere turn per pole and Cross magnetizing Ampere Turn per pole.
   (b) What is the purpose of compensating winding? Explain in detail. [8+8]

4. (a) Explain magnetization characteristic of a DC generator?
   (b) What are the advantages and disadvantages of separately excited generators? [10+6]

5. (a) Distinguish between:
      i. DC shunt generator and
      ii. DC compound generator.

      Show and explain the nature of external characteristic of each of them. Also give applications of each of them.
   (b) Eight DC Shunt Generators are running in parallel. Each generator supplies a load current o f 400A at 210V. The shunt field current of each generator is 4A and the armature resistance of each generator is 0.04 ohm. If one generator is suddenly switched off, determine the % change in terminal voltage, the total load current being kept unchanged. [8+8]

6. (a) Distinguish between motor and generator action. Derive the equation for the back e.m.f induced in a DC motor.
   (b) A 6-pole DC motor has a wave connected armature with 87 slots, each slot containing 6 conductors. The flux per pole is 20 m.wb and the armature has a resistance of 0.13 ohm when the motor is connected to 240V supply and the armature draws a current of 80A driving a load of 16KW. Calculate
      i. Speed

ii. Armature Torque and
iii. shaft Torque. [10+6]

7. (a) With neat diagram explain the construction of mechanical starter used for starting of DC shunt motor.
   (b) A 4 kW DC series motor has four field coils. The motor runs at 900 RPM and takes 20 Amp from a 230 V DC source, when field coils are in series under normal operation. Estimate the speed and current taken by the motor, if field coils are reconnected in two parallel groups of two in series. [8+8]

8. (a) How the rotational losses can be computed by retardation test.
   (b) A retardation test is made on a separately excited DC machine as a motor. The induced EMF falls from 240 V to 175 V in 45 Seconds on opening the armature circuits and 5 Seconds on suddenly changing armature connection from supply to a load resistance taking an average current of 10A. Find the efficiency of the machine when running as a motor & taking a current of 25 Amp on a supply of 240V. The resistance of armature is 0.4 Ω & that of its field winding is 300 Ω. [8+8]

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