2008-PUNJAB TECHNICAL UNIVERSITY

B.TECH I SEMESTER REGULAR EXAMINATION

ELECTRICAL MACHINES-I

(ELECTRICAL AND ELECTRONICS ENGINEERING)

TIME-3HOUR
MARKS-80

ANSWER ANY FIVE QUESTIONS ALL QUESTIONS CARRY EQUAL MARKS

MARKS [16*5=80]

1. (a) Obtain the expression for the mechanical energy developed in electromechan- ical energy conversion devices (Single excited system).

(b) In a electromechanical relay excited from a voltage source, the current and flux linkages are related as i = (1.2?)2+3.8?(10.2x2); x < 1, find the force on the armature as a function of ?.

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.

3. (a) Discuss armature reaction and commutation in a dc motor.

(b) A 2-pole lap connected motor armature has 880 conductors and delivers 120A. The brushes have been displaced through 4 angular degrees from the geomet- rical axis. Calculate

i. demagnetizing amp-turns/pole

ii. cross-magnetising amp-turns/pole

(c) the additional field current for neutralizing the demagnetization of the field winding has 1100 turns/pole.

4. What is critical field resistance? How do you draw the open circuit characteristic in laboratory.

5. (a) Discuss in detail the characteristics and applications of DC Shunt, series and compound generators

(b) Explain the conditions necessary for the parallel operation of DC generators.

6. (a) Define torque. Derive the expression for torque developed by a D.C. motor from fundamentals.

(b) Determine the torque developed when a current of 30A passes through the armature of a motor with the following particulars: lap winding, 310 conduc- tors, 4-pole, pole-shoes 16.2 cm long subtending an angle of 600 at the centre, bore radius 16.2 cm, flux density in air gap 0.7 tesla.

7. (a) Why we need to control the speed of D.C. Motor? Explain the torque-speed relation of DC Motor.

(b) A 230 V DC series motor has resistance of 0.2 . At a speed of 1800 rpm, it takes a current of 40 A. Find the resistance to be added to limit the speed to 3600 RPM, when the current is 10 Amp. Assume that flux is linear to current between 10 Amps to 40 Amps.

8. (a) With neat diagram explain the Back to Back test conducted on two DC machines? Give all calculations assuming equal constant losses.

(b) A Hopkinson's test on two identical shunt machines gave the following results: Input voltage 500 V, Input current 15 A, output current of generator 120 A, Field current of generator 4A, field current of motor 3 A. Armature resistance of each machine 0.06 . find efficiency of motor and generator.