

II B.Tech I Semester Supplementary Examinations, May 2005
ELECTRO MECHANICS-I
(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 70

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is the torque produced by reluctance motor.
 (b) Define energy and co-energy in a linear magnetic system.
2. A 4-pole wave connected armature has 51 slots. Draw a developed winding diagram and show the brush positions. Assume any other data required.
3. (a) Explain the purpose of laminating the armature core of a d. c. machine.
 (b) The diameter of a commutator ring of a lap wound d. c. motor is 25 cms. The brush width is 1.8 cm and width of mica insulation is 0.2 cm. If the speed of the motor is 200 rpm, determine the time of commutation.

4. Two d.c. compound generators, A and B with an equilibrising bar, supply a total load of 500A. The data relating to the machine are as follows.

Armature resistance, $R_A = 0.05$ ohm, $R_B = 0.03$ ohm

Series field winding $R_{SA} = 0.02$ ohm, $R_{SB} = 0.01$ ohm

Generated emf $E_A = 463$ V, $E_B = 470$ X.

Calculate

- (a) The current in each armature.
- (b) The current in each series winding.
- (c) The current in the equilibrising bar and
- (d) The bus-bar voltage.

Neglect the shunt currents and state the necessary assumptions made, if any.

5. (a) Distinguish between generator and motor action. Derive the equation for the back emf of a DC motor.
 (b) What are the different types of DC motors and give their applications.
6. (a) What is the power flow diagram of DC motor? And explain about losses involved in each stage?
 (b) A 4-pole 120KW, 240V, 800rpm wave wound generator has shunt field current of 4A at rated voltage. The generator has the following data.
 Armature winding single turn coils
 Length of conductors (including over hang) = 0.48 m
 Number of conductors = 480 : Voltage drop/brush = 1 volt
 Cross sectional area of conductors = 25 mm²
 Full load temperature = 60°C : Commutator diameter = 0.6 m
 Specific resistance of copper at 20°C = $1.725 \times 10^{-2} \Omega/\text{m}/\text{mm}^2$ Find

- i. Full - load armature copper loss
 - ii. Shunt field copper loss, and
 - iii. Brush contact loss
- 7. (a) A 250V DC shunt motor has a rated current of 120A and an armature resistance of 0.08Ω . It is to accelerate a load whose torque is constant and of rated value. The peak current is not to exceed twice the rated value. Calculate the value of starting resistance and the manner in which it is divided among several sections.
- (b) Explain the design of a starter for a dc shunt motor.
- 8. (a) With a help of neat circuit diagram, explain how a retardation test is useful in determining the losses? Also state its limitations.
- (b) A running down test is carried out on a 100 rpm d.c. machine. The time taken for the speed to fall from 1030 rpm to 970 rpm is
 - i. 36 seconds with no excitation
 - ii. 15 seconds with full excitation
 - iii. 09 seconds with full excitation and the armature supplying an extra load of 10 A at 219 V.

Calculate

- i. the moment of inertia of the armature in $\text{kg} - \text{m}^2$
- ii. iron losses and
- iii. mechanical losses at the mean speed of 1000 rpm.
