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Code No: 123BZ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, November/December - 2016
ELECTRICAL MACHINES-I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART-A

(25 Marks)

1.a) Write the expression for the mechanical force developed by the magnetic field for a non-linear case. [2]
b) Why energy storing capacity of magnetic field is much larger than that of electric field. [3]
c) State the salient features of simplex winding. [2]
d) What is the action of commutator and brushes of a d.c machine. [3]
e) Define critical field and critical speed of a d.c Generator. [2]
f) Write the conditions necessary for the voltage build-up in a DC generator. [3]
g) A d.c shunt motor is connected to a 3-point starter. Explain what would happen if the field circuit becomes open circuit with the motor running at no-load. [2]
h) Draw the circuit model for Ward-Leonard system of speed control. [3]
i) State with reason whether field test on two identical dc series machines is regenerative method? [2]
j) Write the expressions for core losses and remedial measures to reduce them in a dc machine. [3]

PART-B

(50 Marks)

2.a) What is meant by singly-excited and doubly-excited electromechanical energy conversion? Give two examples for each.
b) The self and mutual inductances of the two exciting coils of a multiply-excited translator system are:

$L_{11} = L_{12} = 3.6/(1+2x)$

$L_{12} = L_{21} = 1.8/(1+2x)$

Calculate the time average force and coil currents at x=0.3m when both the coils are connected in parallel across a voltage source of 100cos314t. [5+5]

OR

3.a) With one example derive the co-energy of a multi excited magnetic field system.
b) What are the causes for irrecoverable energy loss when the flux in the magnetic circuit undergoes a cycle? [6+4]

4. Explain the effect of armature reaction in a DC shunt generator. How is its demagnetizing and cross-magnetizing ampere turns calculated? [10]

OR

5.a) Draw the sketches for different methods of excitation of DC generators and write the respective generated emf equations.

b) A d.c. machine has 8 poles, lap connected armature with 960 conductors and flux per pole is 40 mWb. It is driven at 400 r.p.m. Calculate the generated e.m.f. If now lap connected armature is replaced by wave connected, calculate the speed at which it should be driven to generate 400V. [5+5]

6. Discuss the constructional details and working principle of 2-pole and 4-pole D.C machines. Also discuss the performance characteristics of d.c generators. [10]

OR

7.a) State the applications of various types of generators according to their characteristics.

b) Two DC shunt generators are connected in parallel to supply a load of 5000 A. Each machine has an armature resistance of 0.03 Ω and field resistance of 60 Ω but the emf of one machine is 600V and that of the other machine is 640 V. What power does each machine supply? [4+6]

8. What is the necessity of starter in a DC motor? Explain the working principle of 3-point starter with a neat sketch. Also explain about protective measures in the starter. [10]

OR

9.a) Enumerate the factors on which speed of a D.C motor depends. Explain briefly about speed control methods of a DC motor.

b) A d.c motor takes an armature current of 74 A when flux is 10mWb. It develops a torque of 120 N-m. If armature current is changed to 45 A keeping the flux constant, determine the new torque developed. With the same flux, if entire load on the motor is removed, armature current is observed to be 6.8 A. Determine the torque required to overcome stray losses. [5+5]

10. With the help of neat circuit diagram, explain Swinburne's test and derive the relations for efficiency (both for generator and motor) also state the merits and demerits of this method. [10]

OR

11. With the help of neat circuit diagram, explain Hopkinson's test and derive the relations for efficiency (both for generator and motor) also state the merits and demerits of this method. [10]

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