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Code No: 123BZ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, March - 2017

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) Give an expression for force in a single excited machine. [2]
b) Differentiate between electric and magnetic circuit. [3]
c) Give the functions of Yoke and pole core in a D.C. Machine. [2]
d) Differentiate between Lap and Wave windings in a D.C. Machine. [3]
e) Define critical speed in D.C. Generators. Give its significance. [2]
f) Define critical resistance in D.C. Generators. Give its significance. [3]
g) Give the merits and demerits of Ward-Leonard speed control method. [2]
h) Give the importance of OLR and NVC in 3-point starter. [3]
i) Give the condition for maximum efficiency in a D.C. Motor. [2]
j) Enumerate the various losses in a D.C. Machine. [3]

PART – B

(50 Marks)

2.a) A steel ring has a mean diameter of 20cm, a cross section of $25cm^2$ and a radial air gap of 0.8mm cut across it. When excited by a current of 1A through a coil of 1000 turns wound on the ring core, it produces an air gap flux of 1mWb. Neglecting leakage and fringing, calculate
(i) relative permeability of steel and
(ii) total reluctance of the magnetic circuit.

b) State and explain the two kinds of power losses that occur when a magnetic material undergoes cyclic magnetization. [5+5]

OR

3.a) A straight conductor of 1.5m length carries a current of 40A.It is lying at right angles to a uniform magnetic flux density of 0.8T.
Find (i) the force developed on the conductor (ii) The power required to derive the conductor at a uniform speed of 25m/sec and (iii) the emf induced in the conductor.

b) Derive an expression for torque produced by doubly excited system. [5+5]

4.a) Derive the e.m.f. equation of a D.C. generator.

b) What is armature reaction? Explain with neat diagrams. [5+5]

OR

5.a) A separately excited dc generator running at 1000 rpm supplied 110A at 220V to a resistive load. If the load resistance remains constant, what will be the load current if the speed is reduced to 800 rpm? Armature resistance is 0.02Ω. Field current is unaltered. Assume a voltage drop of 1Vper brush. Ignore the effect of armature reaction.

b) Explain different methods to improve commutation in a d.c machine. [5+5]

6.a) Explain the procedure to obtain magnetization, external and internal characteristics of a series generator.

b) Explain the procedure to connect two series generators to share load in proportion. [5+5]

OR

7.a) Classify DC machines according to forms of excitation and draw its circuit diagram.

b) The relation between excitation current and emf generated by a DC shunt wound generator running on open circuit at 850 rpm is as follows:

Excitation (Amperes):	2	3	4	5	6
EMF (Volts):	68	87	100	109	112

The shunt field resistance is 22.2Ω. Find the voltage at the terminals of the machine when it runs at 850 rpm self excited. [5+5]

8.a) Explain the constructional details of a d.c motor with a neat sketch.

b) A DC motor takes an armature current of 110A at 480V. The armature circuit resistance is 0.2Ω.The machine has 6 poles and the armature is lap connected with 864 conductors. The flux per pole is 0.05Wb. Calculate (i) speed (ii) Torque developed in the armature. [5+5]

OR

9.a) Explain the working of a 4 point starter.

b) Discuss different methods of speed control of a DC Motor. [5+5]

10.a) Explain the Swinburne's test with the help of a neat diagram to find out the efficiency of a DC machine. What are the main advantages and disadvantages of this test?

b) A 230V, 10 HP shunt motor takes a full load line current of 40 A. The armature and field resistances are 0.25Ω and 230Ω respectively. The total brush contact drop is 2V, and the core and the friction losses are 380W. Calculate the efficiency of the motor. Assume that the stray load loss is 1% of the rated output. [5+5]

OR

11.a) A field's test on two mechanically coupled DC series motors (with their field windings connected in series) gave the following test data: **Motor**: Armature current = 50A; Armature voltage = 500V; Field winding voltage drop = 38 V. **Generator:** Armature current = 38A; Armature voltage = 400V; Field winding voltage drop=36V. Resistance of each armature is 0.2 ohms. Calculate the efficiency of each machine at this load.

b) With a neat circuit diagram explain the Hopkinson's test. [5+5]

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