

Code No: 123BZ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, August/September - 2022

ELECTRICAL MACHINES - I

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

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. [15]
2. Derive expressions of field energy, co-energy and magnetic force in a singly excited electromechanical unit. [15]
- 3.a) What is meant by armature reaction? Show that the effect of armature mmf on the main field is entirely cross magnetizing? Also explain the bad effects of armature reaction?  
b) The wave-connected armature of a 6-pole d.c generator is required to generate an emf of 520 V when driven at 660 rpm. Calculate the flux per pole required if the armature has 144 slots with 2 coil-sides per slot, each coil consisting of 3 turns. [8+7]
- 4.a) Briefly explain different methods to improving commutation in DC generators.  
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+7]
- 5.a) Sketch the internal and external characteristics of DC shunt and series generators. What are their fields of application?  
b) A separately excited generator, when running at 1000 rpm supplied 200 A at 125 V. What will be the load current when the speed drops to 800 rpm. If field current is unchanged? Given the armature resistance =  $0.04\Omega$  and brush drop = 2V. [8+7]
- 6.a) Explain the process of voltage build up in a dc shunt generator. What is critical field resistance?  
b) A D.C shunt generator has following open circuit magnetizing curve at its rated speed.

Field current(A)	0.5	1.0	1.5	2.	3	4
EMF(V)	180	340	450	500	550	570

The resistance of the field circuit is 200ohms. The generator is driven at its rated speed. Find the terminal voltage on open circuit. [8+7]
- 7.a) Derive the torque equation of a DC motor.  
b) A 4 pole dc series motor has wave connected winding with 600 conductors. Total resistance of the motor is  $0.8\Omega$ . When fed from 250 V source, dc motor supplies a load of 10 kW and takes 50 A with a flux per pole of 3 mWb. For these operating conditions, calculate the developed torque and the shaft torque. [8+7]
8. Explain the Swinburne's test to determine no-load losses of DC machine. What are the limitations of this test? [15]

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