

Code No: 53012

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, October - 2020

ELECTRICAL MACHINES - I

(Electrical and Electronics Engineering)

Time: 2 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

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1. a) Self and mutual inductances in henries of two coupled coils are  
 $L_1 = 3 + \frac{1}{2x}$ ,  $L_2 = 2 + \frac{1}{2x}$ ,  $M_{12} = M_{21} = \frac{1}{2x}$   
 over a certain displacement  $x$  in meters. The coil resistances are negligible. For constant currents of  $I_1 = 10$  A and  $I_2 = -5$  A, Compute: (i) the mechanical work done in increasing  $x$  from 0.5 to 1 m, (ii) the energy supplied by each electrical source in part (i).
- b) Find an expression for the magnetic force developed in a singly excited magnetic system. [8+7]
2. From the fundamentals, derive the emf expression for a d.c. Generator. [15]
3. What is armature reaction? What are the effects of armature reaction? How the armature reaction minimized? [15]
4. a) Explain the reasons for failure of building up of emf in a d.c shunt generator. Suggest the remedies for it.
- b) The open circuit characteristics of a d.c shunt generator at 800 r.p.m are given by the following data:

$I_f$ (A)	0	0.2	0.4	0.7	1.2	1.8	3.2	5.4
$E_a$ (V)	12	45	85	125	165	210	250	270

Determine the critical field resistance at 800 r.p.m.

[7+8]

5. a) Draw the load characteristics of d.c compound and shunt generator.
- b) What is the need for parallel operation of d.c generators? Explain the conditions to be satisfied for successful parallel operation of d.c generators. [5+10]
6. a) Derive the speed-current characteristics of dc shunt, series and cumulative compound motors. Sketch these characteristics in one figure on the assumptions of (i) same speed at no load and (ii) rated speed at rated current. Comment on the nature of these characteristics.
- b) Derive an expression for the electromagnetic torque produced by d.c motor. [8+7]
7. Explain the principle of Ward- Leonard speed control of d.c motor. State its advantages and disadvantages. [15]
8. a) Explain the advantages and drawbacks of Hopkinson's test.
- b) Hopkinson's test on two similar dc shunt machines gave the following data:  
 Line voltage 230 V; Line current, excluding both the field currents, 40 A; motor armature current 350 A; field current 5 A and 4.2 A. Calculate the efficiency of each machine. Armature resistance of each machine is 0.02  $\Omega$ . [7+8]

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