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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; Sep. / Oct. - 2023

DC and Synchronous Machines

Time: 3 hrs   Max. Marks: 100

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of basic electrical laws to study the operating principle of DC & Synchronous machines.

CO2: Analyze the performance characteristics of DC & Synchronous machines.

CO3: Apply the different testing methods to examine the desired parameters of DC & Synchronous machines.

CO4: Compute numerical problems on DC & Synchronous machines.

<u>*Note*</u>*: I) PART - A is compulsory. **Two** marks for each question.*

    *II) PART - B: Answer any <u>**Two**</u> sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
1 a.	State the various effects of armature section.	2	L1	CO2	PO2
b.	State and explain voltage equation of DC motor.	2	L1	CO2	PO2
c.	Mention the disadvantages of Swin burne or No load test.	2	L1	CO3	PO1
d.	What is synchronous speed of an alternator?	2	L1	CO2	PO2
e.	List the necessary conditions for synchronization ant alternator.	2	L1	CO2	PO2
	II : PART - B	**90**			
	UNIT - I	**18**			
2 a.	Derive an expression for calculating demagnetizing and cross magnetizing Amp-Turns.	9	L3	CO2	PO2
b.	Explain the process of commutation in a DC machine and explain any one method of improving commutation.	9	L2	CO2	PO2
c.	A 4 pole DC shunt generator has 386 wave connected conductors. The armature and shunt field resistances are1 Ω and 100 Ω respectively. The flux per pole is 25 mwb and the speed is 1000 rpm. If the load resistance is 40 Ω, calculate the armature current and output power.	9	L4	CO1,4	PO1
	UNIT - II	**18**			
3 a.	A 14.92 kW, 230 V, 1150 rpm, 4-pole DC shunt motor has a total 620 conductors arranged in two parallel paths and the armature circuit resistance is 0.2 Ω. When it delivers rated power at rated speed, it draws a line current of 74.8 amp and a field current of 3 amp. Calculate; i) Flux per pole ii) The torque developed in armature iii) The rotational losses iv) The total losses expressed as a percentage of power of input	9	L4	CO1,4	PO1

b.	Discuss the following method to control the speed of DC shunt motor: i) Flux control method ii) Voltage control method	9	L2	CO2	PO2
c.	Explain the operation of a three point starter with a neat sketch.	9	L2	CO2	PO2

UNIT - III — **18**

4 a.	A 500 V, DC shunt motor when running on no load taken 5 Armature resistance is 0.5 Ω and shunt field resistance is 250 Ω. Find the output in kW and efficiency of the motor when running on full load and taking a current of 50 A.	9	L4	CO1,4	PO1
b.	The Hopkinson's test in two DC shunt machines gave the following results on full load. Line voltage = 220 V, line current excluding field currents = 15 Amps. Motor armature current 72 Amps. The field currents are 1.5 Amps and 1.0 Amp for generator and motor respectively. The armature resistance of each machine is 0.2 Ω. Calculate efficiency of each machine.	9	L4	CO1,4	PO1
c.	Explain how you will obtain the efficiency of a DC series machine by conducting the field test.	9	L4	CO3	PO1

UNIT - IV — **18**

5 a.	With neat sketches, explain the constructional feature of smooth cylindrical rotor and salient pole rotor of an alternator.	9	L2	CO2	PO2
b.	A 3- phase 8-pole, star connected alternator has the armature coils short chorded by one slot. The coil span is 165° electrical. The alternator is driven at the speed of 750 rpm. If there are 12 conductors per slot and flux per pole is 50 mwb, calculate the value of induced *emf* across the terminals.	9	L3	CO1,4	PO1
c.	Define voltage regulation. Explain the synchronous impedance method of determination of voltage regulation of an alternator.	9	L3	CO2	PO2

UNIT - V — **18**

6 a.	State the methods of starting synchronous motor. Explain any two in detail.	9	L2	CO2	PO2
b.	Discuss *v*-curves and inverted *v*-curves of synchronous motor with diagrams.	9	L2	CO2	PO2
c.	A 6.6 kV 3-phase star connected synchronous motor takes a line current of 50 A. The effective resistance and synchronous reactance per phase are 1.5 Ω and 8 Ω respectively. Find; i) The power supplied to the motor ii) The induced *emf* for a p.f of 0.8 lag and lead.	9	L4	CO1,4	PO1

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