U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**
Course Code: 22EE5PCDSM **Max Marks: 100**
Course: DC & Synchronous Machines

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Classify the motor according to their field winding connections with a neat circuit diagram & necessary equation	*CO1*	*PO1*	**06**
	b)	A 22.38kW, 440V, 4 pole wave wound D.C shunt motor has 840 armature conductors & 140 commutator segments. Its full load efficiency is 88% & shunt field current is 1.8A. if brushes are shifted backward through 2 segments from GNA. Find the demagnetizing & cross magnetizing ampere turns per pole	*CO1*	*PO1*	**08**
	c)	Mention the applications of the DC motor based on the field winding connection.	*CO1*	*PO1*	**06**
		OR			
2	a)	Classify the method of speed control of a DC shunt motor and explain any one method with neat diagram	*CO1*	*PO1*	**06**
	b)	A DC shunt motor drives a centrifugal pump whose torque varies as the square of the speed. The motor is fed from a 200V supply and take 50A when running at 1000 rpm. What resistance must be inserted in the armature circuit in order to reduce the speed to 800 rpm? The armature and field resistances of the motor are 0.1 ohm and 100 ohm respectively.	CO1	PO1	**08**
	c)	With neat block diagram explain the power flow in a motor and generator. Also classify & explain different types of losses in detail with necessary equations	*CO1*	*PO2*	**06**
		UNIT - II			
3	a)	List the relative merits and demerits of Swinburne's test	*CO2*	*PO1*	**04**
	b)	The Hopkinson's test on two similar shunt machines give the following full load data:	*CO2*	*PO2*	**08**

			Line voltage is110 V, field currents are 3 A and 3.5 A, line current 48 A, armature resistance of each machine is 0.035 Ω, motor armature current is 230 A. Calculate the efficiency of each machine assuming a brush contact drop of 1 V per brush.			
		c)	A test on two identical motors with their filed winding connected in series gave the following data when one machine acted as a motor other as a generator. **Motor**: Armature current= 56A, Armature Voltage= 590V & voltage drop across the field winding is 40V **Generator**: Armature current= 44A, Armature Voltage= 400V & voltage drop across the field winding is 40V Assume the armature resistance of each machine as 0.3 ohm. Calculate the efficiency of the motor and generator at this load	*CO2*	*PO2*	**08**
			OR			
	4	a)	Discuss about retardation test on a DC Motor. Also explain how stray loss component and moment of inertia are determined using this test.	*CO2*	*PO2*	**10**
		b)	Two identical DC shunt machines, when tested by Hopkinson's method, gave the following data: Line voltage=250V Line current excluding the field current= 35A Motor armature current=240A Field current is 5A and 4.5A respectively. The armature resistance of each machine is 0.03Ω. Evaluate the efficiency of both the machines.	*CO2*	*PO2*	**10**
			UNIT - III			
	5	a)	List the advantages of rotating field construction in alternator.	*CO3*	*PO1*	**04**
		b)	Derive an expression for induced EMF in an alternator after deriving an expression for synchronous speed.	*CO3*	*PO1*	**08**
		c)	A 3-phase, 8 pole, 50 Hz star connected alternator has 96 slots with 4 conductors/slot. The coil span is 10 slots and the flux per pole is 0.06wb. Determine the line emf generated. If each phase is capable of carrying 650 amps, What is the kVA rating of the machine.	*CO3*	*PO2*	**08**
			OR			
	6	a)	Explain the phenomenon of armature reaction in alternator while supplying lagging, and leading pf loads.	*CO3*	*PO1*	**10**
		b)	A 400 V, 50 Hz, delta connected alternator has $X_d = 0.1\ \Omega$ and $X_q = 0.07\ \Omega$ and Ra is negligible. The alternator is supplying 1000 A at 0.8 p.f. lagging. (i) Find the excitation emf by neglecting saliency & assuming $X_d = X_s$. (ii) Find the excitation emf taking into account of saliency.	*CO3*	*PO2*	**10**

			UNIT - IV			
	7	a)	Define synchronous impedance? What is meant by load angle of an alternator?	*CO3*	*PO1*	**04**
		b)	With phasor diagrams, explain the effect of operation at constant load with variable excitation of a synchronous motor	*CO3*	*PO2*	**06**
		c)	A 3 phase, 6000V alternator has the following OCC at normal speed: I_f(A) | 14 | 18 | 23 | 30 | 43 E_L(V) | 4000 | 5000 | 6000 | 7000 | 8000 With armature short circuited and full load current flowing the field current is 17A and when the machines is supplying full load of 2000 kVA at zero power factor, the field current is 42.5A and the terminal voltage is 6000V. Determine the field current required when the machine is supplying the full load at 0.8 pf lagging	*CO4*	*PO2*	**10**
			OR			
	8	a)	Explain the slip test for the determination of direct axis and quadrature axis reactances with necessary diagram and equation	*CO3*	*PO1*	**10**
		b)	A 415 V, 30 kVA, 50 Hz, 3 phase star connected alternator has the following O.C test data: I_f(A) | 6 | 12 | 18 | 24 | 28 E_L(V) | 282 | 408 | 435 | 459 | 474 An excitation of 8A produced full load current in the armature on short circuit. If $R_a = 0.5\Omega$/phase, Determine the voltage regulation at full load, 0.707 pf lagging by a) EMF method b) MMF method	*CO3*	*PO1*	**10**
			UNIT - V			
	9	a)	Derive an equation for Power Developed in non-salient-Pole Synchronous Generator with the help of phasor diagram.	*CO4*	*PO1*	**10**
		b)	Discuss the effect of change in excitation with constant load on a synchronous machine connected to busbars in both generating and motoring modes.	*CO4*	*PO1*	**10**
			OR			
	10	a)	Derive the expressions for active and reactive power exchange between busbar and synchronous generator considering and neglecting the armature resistance. Also mention the condition at which maximum power occurs.	*CO4*	*PO1*	**10**
		b)	With necessary diagram explain the concept of Power angle characteristics.	*CO4*	*PO1*	**10**

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