	U.S.N						
P.E.S. College of Engineering, Mandya - 571 401 (An Autonomous Institution affiliated to VTU, Belagavi)							
Fifth Semester, B.E Electrical and Electronics Engineering							
Semester End Examination; February / March - 2022 Electrical Machines - II							
Time: 3		ax. Mari	ks: 100				
	Course Outcomes						
	lents will be able to: how about basic operation and construction of different types of DC Gen.						
CO2: To	b know about basic operation and construction of different types of DC Motors.						
	nalysis of various tests to be conducted on DC Machines. In study about voltage regulation of synchronous generators.						
	<i>learn about principle of operation and the effect of load variation in synchronous motor</i> <b>PART - A</b> <i>is compulsory.</i> <b>Two</b> <i>marks for each question.</i>	<i>S</i> .					
	<b>PART - B</b> : Answer any <u>Two</u> sub questions (from a, b, c) for Maximum of <b>18 marks</b> from	each unit	•				
Q. No.	Questions		<b>BLs COs</b>				
I a.	<b>I : PART - A</b> What is critical field resistance of a DC shunt generator? What is its	10					
	significance?	2	L2 CO1				
b.	Explain the necessity of a starter for a DC shunt motor.	2	L2 CO1				
с.	Mention the applications of permanent magnet DC motor.	2	L1 CO3				
d.	List out the factors influencing the induced emf of an alternator.	2	L1 CO4				
e.	What are the necessary conditions for parallel operation of alternators?	2	L1 CO5				
	II : PART - B	90					
1 a.	<b>UNIT - I</b> What is armature reaction? What are its effects? Mention the methods to	18					
1 u.	reduce those effects and explain any one of them.	9	L2 CO1				
b.	What is the cause for sparking in the process of commutation in a DC						
	machine? Mention the methods available for minimizing / eliminating	9	L2 CO1				
	sparking. Explain any one of them.						
с.	The brushes of 4 pole, 50 kW, 250 V wave connected DC generator are given						
	a lead of 4 commutator segments. If the generator has 400 conductors, shunt						
	field resistance of 50 $\boldsymbol{\Omega}$ and delivers full load current, find; demagnetizing	9	L3 CO1				
	ampere-turns /pole and calculate extra shunt field turns/ pole to neutralize the						
	demagnetization.						
2	UNIT - II	18					
2 a.	With relevant fundamental relations, deduce the characteristics of DC series	9	L2 CO2				
h	motor. Mention the applications of DC shunt motor.						
b.	Two series motor run at a speed of 500 rpm and 550 rpm respectively, when						
	taking 50 A at 500 V. The terminal resistance of each motor is 0.5 $\Omega$ . Calculate	9	L3 CO2				
	the speed of the combination when connected in series and coupled						
	mechanically. The combination is taking 50 A on 500 V supply.						

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<ul> <li>c. A DC series motor drives a load, the torque of which varies as the square of the speed. Assuming the magnetic circuit to remain unsaturated and the motor resistance to be negligible, estimate the percentage reduction in the motor full voltage, which will reduce the motor speed to half the value it has on full voltage. What is then the percentage fall in motor current?</li> <li>INIT - III</li> <li>3 a. Explain Swinburne's test to predetermine the efficiency of a DC shum machine as both generator and motor.</li> <li>b. It is required to determine the efficiency of two coupled DC series motors. Which test would you recommend and explain the same with circuit diagram.</li> <li>c. The Hopkinson test on 2 similar shunt machines gave the following full load data; Line voltage = 240 V; field currents are 2 A and 3 A; line current excluding field currents = 16 A; armature resistance of each machine is 0.2 Ω; motor armature current = 71 A. Calculate the efficiency of each machine is 0.2 Ω; motor armature current = 71 A. Calculate the efficiency of a determator.</li> <li>b. A 30 star connected alternator is rated at 1600 kVA, 13500 V. The armature resistance and synchronous section for a load of 1280 kW at a PF of; i) 0.8 lag ii) 0.8 lead.</li> <li>c. Define voltage regulation of an alternator. With relevant circuit diagrams, explain EMF method of determining the voltage regulation of cylindrical rotor alternator.</li> <li>b. With respect to synchronous generator and there from deduce the power development in a salient pole synchronous motor, explain briefly; i) Starting torque ii) Running torque iii) Running torque iii) Pull-int torque iv) Pull-out torque</li> <li>9 L2 CO3</li> <li>9 L2 CO4</li> </ul>	P18EE54		Page No 2	
resistance to be negligible, estimate the percentage reduction in the motor terminal voltage, which will reduce the motor speed to half the value it has on full voltage. What is then the percentage fall in motor current?       9       L3       CO2         UNT - II       18         3 a.       Explain Swinburne's test to predetermine the efficiency of a DC shut machine as both generator and motor.       9       L2       CO3         b. It is required to determine the efficiency of two coupled DC series motors. Which test would you recommend and explain the same with circuit diagram.       9       L2       CO3         c. The Hopkinson test on 2 similar shunt machines gave the following full load data; Line voltage = 240 V; field currents are 2 A and 3 A; line current excluding field currents = 16 A; armature resistance of each machine is 0.2 Ω; motor armature current = 71 A. Calculate the efficiency of each machine.       9       L2       CO3         UNT - IV       18         4 a.       1) Compare; (i) Full pitch winding and fractional pitch winding. (ii) Concentrated winding and distributed winding. (ii) Concentrated winding and of 1280 kW at a PF of; i) 0.8 lag       9       L4       CO4         UNT - V       18         4       5 a.       USIR a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power development in a salient pole synchronous generator and there from deduce the power developed in a cylindrical rotor alternator.       9	с.	A DC series motor drives a load, the torque of which varies as the square of		
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UNIT - HI     18       3 a. Explain Swinburne's test to predetermine the efficiency of a DC shunt machine as both generator and motor.     9     L2 CO3       b. It is required to determine the efficiency of two coupled DC series motors. Which test would you recommend and explain the same with circuit diagram.     9     L2 CO3       c. The Hopkinson test on 2 similar shunt machines gave the following full load data; Line voltage = 240 V; field currents are 2 A and 3 A; line current excluding field currents = 16 A; armature resistance of each machine is 0.2 Ω; motor armature current = 71 A. Calculate the efficiency of each machine.     9     L2 CO3       4 a. 1) Compare; (i) Full pitch winding and fractional pitch winding. (ii) Concentrated winding and distributed winding. (ii) Concentrated winding and distributed winding. (ii) Concentrated winding and 30 Ω respectively/phase. Calculate the percentage regulation for a load of 1280 kW at a PF of; i) 0.8 lag ii) 0.8 lead.     9     L2 CO4       c. Define voltage regulation of an alternator. With relevant circuit diagrams, explain EMF method of determining the voltage regulation of cylindrical rotor alternator.     9     L2 CO5       s. 4. Using a suitable vector diagram, derive the expression for power development in a salient pole synchronous motor, explain briefly; i) Starting torque ii) Pull-iout torque Mention the applications of synchronous motor.     9     L2 CO5       b. With respect to synchronous motor, explain briefly; i) Starting torque ii) Pull-out torque Mention the applications of synchronous motor.     9     L2 CO5		terminal voltage, which will reduce the motor speed to half the value it has on		
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machine as both generator and motor.9L2 CO3b. It is required to determine the efficiency of two coupled DC series motors. Which test would you recommend and explain the same with circuit diagram.9L2 CO3c. The Hopkinson test on 2 similar shunt machines gave the following full load data; Line voltage = 240 V; field currents are 2 A and 3 A; line current excluding field currents = 16 A; armature resistance of each machine is $0.2 \Omega$ ; motor armature current = 71 A. Calculate the efficiency of each machine. UNIT - IV9L3 CO34 a. 1) Compare; (i) Full pitch winding and fractional pitch winding. (ii) Concentrated winding and distributed winding. (ii) Concentrated winding and distributed winding. (ii) Concentrated winding and distributed winding. (ii) Concentrated winding and of 1280 kW at a PF of; (i) 0.8 lag ii) 0.8 lead.9L4 CO4c. Define voltage regulation of an alternator.9L2 CO3b. A: using a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power developed in a cylindrical rotor alternator.9L2 CO5b. With respect to synchronous motor, explain briefly; (i) Starting torque (ii) Pull-in torque (iii) Pull-in torque (iii) Pull-out torque (iiii) Pull-in torque (iii) Pull-out torque (iii) Pull-in torque (iii) Pull-out torque9L2 CO5dention the applications of synchronous motor.9L2 CO5L2 CO5		UNIT - III	18	
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UNIT - IV       18         4 a.       1) Compare; (i) Full pitch winding and fractional pitch winding. (ii) Concentrated winding and distributed winding.       9       1.2 CO4         1) State at least two advantages of revolving field type of alternator.       9       1.2 CO4         b.       A 3\$ star connected alternator is rated at 1600 kVA, 13500 V. The armature resistance and synchronous resistance are 1.5 Ω and 30 Ω respectively/phase. Calculate the percentage regulation for a load of 1280 kW at a PF of; i) 0.8 lag ii) 0.8 lead.       9       1.4 CO4         c.       Define voltage regulation of an alternator. With relevant circuit diagrams, explain EMF method of determining the voltage regulation of cylindrical rotor alternator.       9       1.2 CO4         5 a.       Using a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power developed in a cylindrical rotor alternator.       9       1.2 CO5         b.       With respect to synchronous motor, explain briefly; i) Starting torque iv) Pull-out torque       9       1.2 CO5         iii) Pull-in torque iv) Pull-out torque       Wention the applications of synchronous motor.       9       1.2 CO5         c.       With suitable diagrams, discuss the effect of variation of excitation of a       9       1.2 CO5	c.	data; Line voltage = 240 V; field currents are 2 A and 3 A; line current	9	L3 CO3
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<ul> <li>(ii) Concentrated winding and distributed winding.</li> <li>9 L2 CO4</li> <li>II) State at least two advantages of revolving field type of alternator.</li> <li>b. A 3φ star connected alternator is rated at 1600 kVA, 13500 V. The armature resistance and synchronous resistance are 1.5 Ω and 30 Ω respectively/phase. Calculate the percentage regulation for a load of 1280 kW at a PF of; <ul> <li>i) 0.8 lag</li> <li>ii) 0.8 lag</li> <li>ii) 0.8 lead.</li> </ul> </li> <li>c. Define voltage regulation of an alternator. With relevant circuit diagrams, explain EMF method of determining the voltage regulation of cylindrical rotor alternator.</li> <li>UNIT - V</li> <li>18</li> <li>5 a. Using a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power development in a cylindrical rotor alternator.</li> <li>b. With respect to synchronous motor, explain briefly; <ul> <li>i) Starting torque</li> <li>ii) Running torque</li> <li>iii) Pull-in torque</li> <li>iv) Pull-out torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a</li> </ul> </li> </ul>		UNIT - IV	18	
<ul> <li>I) State at least two advantages of revolving field type of alternator.</li> <li>b. A 3φ star connected alternator is rated at 1600 kVA, 13500 V. The armature resistance and synchronous resistance are 1.5 Ω and 30 Ω respectively/phase. Calculate the percentage regulation for a load of 1280 kW at a PF of; <ul> <li>i) 0.8 lag</li> <li>ii) 0.8 lag</li> <li>ii) 0.8 lead.</li> </ul> </li> <li>c. Define voltage regulation of an alternator. With relevant circuit diagrams, explain EMF method of determining the voltage regulation of cylindrical rotor alternator.</li> <li><b>UNIT - V</b></li> <li>18</li> <li>5 a. Using a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power developed in a cylindrical rotor alternator.</li> <li>b. With respect to synchronous motor, explain briefly; <ul> <li>i) Starting torque</li> <li>ii) Running torque</li> <li>iii) Pull-in torque</li> <li>iv) Pull-out torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a 20 L2 CO5</li> </ul> </li> </ul>	4 a.	I) Compare; (i) Full pitch winding and fractional pitch winding.		
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<ul> <li>resistance and synchronous resistance are 1.5 Ω and 30 Ω respectively/phase. Calculate the percentage regulation for a load of 1280 kW at a PF of; i) 0.8 lag ii) 0.8 lead.</li> <li>c. Define voltage regulation of an alternator. With relevant circuit diagrams, explain EMF method of determining the voltage regulation of cylindrical rotor alternator.</li> <li>UNIT - V</li> <li>18</li> <li>5 a. Using a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power developed in a cylindrical rotor alternator.</li> <li>b. With respect to synchronous motor, explain briefly;</li> <li>i) Starting torque ii) Running torque iii) Running torque</li> <li>iii) Pull-in torque iv) Pull-out torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a</li> <li>9 L2 CO5</li> </ul>		II) State at least two advantages of revolving field type of alternator.		
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<ul> <li>i) 0.8 lag ii) 0.8 lead.</li> <li>c. Define voltage regulation of an alternator. With relevant circuit diagrams, explain EMF method of determining the voltage regulation of cylindrical rotor 9 L2 CO4 alternator.</li> <li>UNIT - V</li> <li>18</li> <li>5 a. Using a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power 9 L2 CO5 developed in a cylindrical rotor alternator.</li> <li>b. With respect to synchronous motor, explain briefly; <ul> <li>i) Starting torque</li> <li>ii) Running torque</li> <li>iii) Pull-in torque</li> <li>iv) Pull-out torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a</li> </ul> </li> </ul>		resistance and synchronous resistance are 1.5 $\Omega$ and 30 $\Omega$ respectively/phase.	9	L4 CO4
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alternator.       UNIT - V     18       5 a.     Using a suitable vector diagram, derive the expression for power development in a salient pole synchronous generator and there from deduce the power     9     L2     CO5       developed in a cylindrical rotor alternator.     9     L2     CO5       b.     With respect to synchronous motor, explain briefly; i) Starting torque     9     L2     CO5       iii) Pull-in torque     iv) Pull-out torque     9     L2     CO5       Mention the applications of synchronous motor.     9     L2     CO5	c.			
UNIT - V       18         5 a.       Using a suitable vector digram. derive the expression for power development in a salient pole synchrous generator and there from deduce the power developed in a cylindrical rotor alternator.       9       L2       CO5         b.       With respect to synchrous motor. explain briefly; i) Starting torque iii) Pull-in torque iii) Pull-out torque       9       L2       CO5         Mention the applications by chronous motor.       6       L2       CO5         CO5       L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L2       CO5       CO5         L3       CO5       CO5         L4			9	L2 CO4
<ul> <li>in a salient pole synchronous generator and there from deduce the power</li> <li>9 L2 CO5 developed in a cylindrical rotor alternator.</li> <li>b. With respect to synchronous motor, explain briefly;</li> <li>i) Starting torque</li> <li>ii) Running torque</li> <li>iii) Pull-in torque</li> <li>iv) Pull-out torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a</li> <li>9 L2 CO5</li> </ul>			18	
<ul> <li>developed in a cylindrical rotor alternator.</li> <li>b. With respect to synchronous motor, explain briefly; <ul> <li>i) Starting torque</li> <li>ii) Running torque</li> <li>iii) Pull-in torque</li> <li>iv) Pull-out torque</li> </ul> </li> <li>9 L2 CO5</li> </ul>	5 a.	Using a suitable vector diagram, derive the expression for power development		
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<ul> <li>i) Starting torque</li> <li>ii) Running torque</li> <li>iii) Pull-in torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a</li> <li>9 L2 CO5</li> </ul>		developed in a cylindrical rotor alternator.		
<ul> <li>9 L2 CO5</li> <li>iii) Pull-in torque iv) Pull-out torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a</li> <li>9 L2 CO5</li> </ul>	b.	With respect to synchronous motor, explain briefly;		
<ul> <li>iii) Pull-in torque iv) Pull-out torque</li> <li>Mention the applications of synchronous motor.</li> <li>c. With suitable diagrams, discuss the effect of variation of excitation of a 9 L2 CO5</li> </ul>		i) Starting torque ii) Running torque	0	12 005
c. With suitable diagrams, discuss the effect of variation of excitation of a 9 L2 CO5		iii) Pull-in torque iv) Pull-out torque	9	L2 C03
9 L2 CO5		Mention the applications of synchronous motor.		
-	c.	-	9	L2 CO5