Reg. No.



(A constituent unit of MAHE, Manipal)

REDR

## DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

## FIRST SEMESTER M.TECH. (ELECTRIC VEHICLE TECHNOLOGY) END SEMESTER EXAMINATIONS, DECEMBER 2023

## **ENERGY CONVERSION SYSTEMS [ELE 5118]**

REVISED CREDIT SYSTEM

Time:	3 Hours	Date: 07 December 2023	Max. Marks: 50
Instructions to Candidates:			
	✤ Answer ALL the questions	5.	
	<ul> <li>Missing data may be suita</li> </ul>	bly assumed.	
1A.	Design an inductor with a The inductor is a part o inductance of 10mH. A D Assume the wire used in	toroidal core with a relative permeability of an R-L circuit, the Resistance is $10\Omega$ , and C supply of 12V is connected across the inductor winding has a diameter of 2.588n	f 1000. and the circuit. nm. <b>(05)</b>
1B.	Develop a dynamic mode coils in the stator and two circuited.	el of a cylindrical rotating machine with two p-phase coils in the rotor. The rotor coils are	o-phase e short- <b>(05)</b>
2A.	A hoist is coupled to a m hoist must lift a weight diameter of 50mm. Assu motor has an inertia of 10 500rpm from 0 when app the power rating and sele	notor through a rope and pulley mechanis of 10kg at a speed of 1.5ms <sup>-1</sup> . The pulley me the transmission efficiency to be 95% Okg-m <sup>2</sup> , determine the time taken to accele lied with an accelerating torque of 10Nm. E ect a suitable motor for this application.	m. The y has a . If the erate to xamine <b>(05)</b>
2B.	A system has a three-pha the system can be mappe and power invariance.	se sinusoidally distributed excitation. Analy ed to a two-phase excitation with mmf inv	rze how ariance <b>(05)</b>
3A.	Develop a dynamic moo generalized two phase ma	del of a separately excited dc motor fro achine model. State the assumptions made	om the e. <b>(05)</b>
3B.	A 230V,40hp, 4 poles, 19 the speed needs to be available to supply is 400 motor to run at a con $0.05\Omega$ , $L_a = 6.5mH$ , $J = 25Kg$ 2.41A (Maintained constant) 50%.	500rpm dc motor is used in an application maintained constant at 1200 rpm. The IV DC. Design a suitable controller to facilit stant speed. The motor parameters are $gm^2, B = 0 Nms, M = 400.4mH$ , $T_l = 10Nm$ and $I_j$ ). Determine the torque if the duty ratio is	where source sate the e: $R_a =$ kept at (05)

- **4A.** A 220V, 1200rpm, 15A separately excited dc motor has armature resistance and inductance of 1.8W and 32mH respectively. The motor is controlled by a fully controlled full wave rectifier with an ac source voltage of 230V, 50Hz. Determine the torque developed when the firing angle is 60o and the speed of the motor is 1500rpm. Draw the relevant waveforms.
- **4B.** A three phase squirrel cage induction motor used in an EV is controlled using field oriented control. Derive the suitable dynamic model for the induction motor from the arbitrary reference frame model.
- **5A.** A 7.5hp, 173V, 3 phase, 60Hz, 4 pole star connected squirrel cage induction machine with the parameters  $R_s = 0.383\Omega$ ,  $L_s = 56.15mH$ ,  $L_r = 58.13mH$ ,  $R_r = 0.313\Omega$  and  $L_m = 50.1mH$ , runs at a speed of 1740 rpm. Evaluate its input power factor and efficiency.
- **5B.** A high-end electric car used for sports needs recommendations on the type of electrical motor used. Among the various motors available, evaluate the options and suggest a particular motor for the above-mentioned applications with proper justification.
- **5C.** Compare the construction of a BLDC motor and a permanent magnet synchronous machine for EV applications.

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