



# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

## DEPARTMENT OF MECHATRONICS

### VII SEMESTER B.TECH. (MECHATRONICS)

### END SEMESTER EXAMINATIONS, NOV-2023

### SUBJECT: MODELING OF ELECTRIC VEHICLES [MTE 4085]

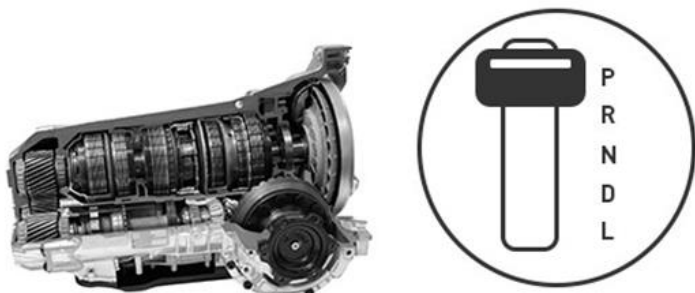
(30-11-2023)

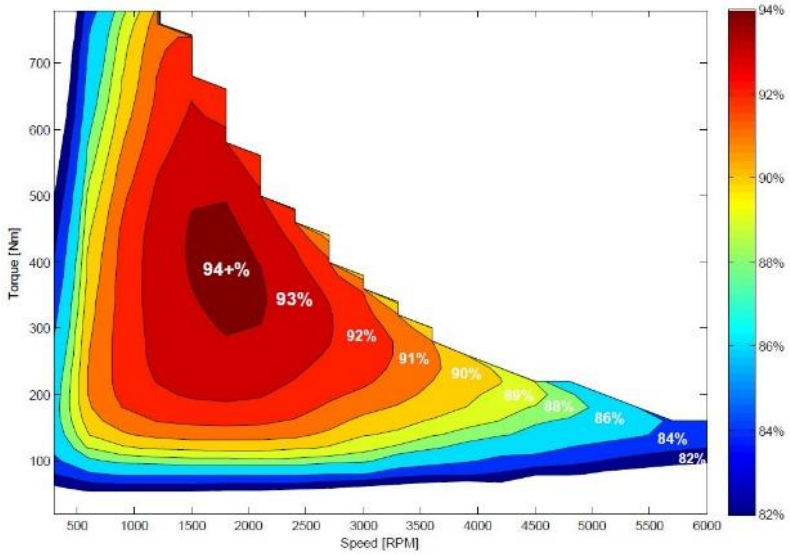
Time: 3 Hours

MAX. MARKS: 50

#### Instructions to Candidates:

- ❖ Answer **ALL** the questions.

Q. No		M	CO	PO	LO	BL
1A.	<p>Recognize the type of transmission shown in Fig. 1a and their issues in contrast to the electric vehicle counterpart.</p>  <p style="text-align: center;"><b>Fig. 1a</b></p>	3	1	1	1	3
1B.	Analyze the modeling approaches with suitable examples.	3	1	5	3	4
1C.	Identify the type of hybrid electric vehicle requiring bulk motor and recognize the pros and cons of the system.	4	1	1	1	3
2A.	Inspect the role of design consideration for dynamic equation in vehicles.	4	2	3	2	4
2B.	Compare the performance of materials used for electric vehicle body.	3	2	6	2	4
2C.	Examine the key consideration for shape of vehicles improving the aerodynamic performance with suitable commercial vehicles available.	3	2	2	2	4
3A.	Model the integro-differential equation of DC excited RLC circuit.	3	2	5	3	3
3B.	Identify the type of motor technology from the efficiency map as shown in Fig. 3b with justification.	2	2	1	1	3

	 <p>The figure is a contour plot titled 'Efficiency Map'. The vertical axis is 'Torque [Nm]' ranging from 100 to 700. The horizontal axis is 'Speed [RPM]' ranging from 500 to 6000. The plot shows efficiency contours in various colors, with a color bar on the right indicating efficiency percentages from 82% (dark blue) to 94% (dark red). The highest efficiency region (94%+) is a small area at approximately 1500 RPM and 400 Nm. Efficiency decreases as speed increases and torque decreases, reaching 82% at 6000 RPM and 100 Nm.</p> <p style="text-align: center;"><b>Fig 3b. Efficiency Map</b></p>					
<b>3C.</b>	Examine the impact of higher speed ratio of plant over the lower speed ratio with reference to ideal requirements.	<b>5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>4A.</b>	Compare the key advantages and disadvantages of reluctance based motors over induction machines and permanent magnet machines.	<b>4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>4B.</b>	Inspect the control of a 3HP, 1500RPM, separately excited DC Motor for EV. Given: Motor rated voltage is 230V and field voltage of 300V.	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>4C.</b>	Analyze the significance of vector control over scalar control with suitable case studies.	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>5A.</b>	Examine the driver model and significance of vehicle dynamic controller.	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>5B.</b>	Recognize the significance of advanced semiconductor technologies for battery charging systems.	<b>2</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>3</b>
<b>5C.</b>	Model the power sources for electric vehicle technology.	<b>5</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>3</b>