## RDRS SATEME

CTIT		Service Code
USN		18EE646
26	dr.y	Sixth Semester B.E. Degree Examination, June/July 2023
	The state of	Electric Vehicle Technologies
) Heli		hrs. Max Marks: 100
1 111	10.00	Max. Marks: 100
	N	ote: Answer any FIVE full questions, choosing ONE full question from each module.
		Wadula 1
1	a.	Explain the configuration of modern electric vehicle drive train with a neat functional
		diagram. (08 Marks)
	b.	Define a series hybrid electric vehicle and explain its configuration with a neat diagram
		incorporating various modes of operation. (12 Marks)
		OR
2	a.	Draw and explain various possible EV configurations based variations in electric propulsion
	h	characteristics and energy sources. (10 Marks)  Define a parallel hybrid electric vehicle and explain its configuration with a neat diagram.
	0.	(10 Marks)
3	a.	Module-2 List out and explain in detail, various requirements of energy storage devices used in
		automotive applications. (08 Marks)
	b.	Classify various fuel-cell technologies based on electrolyte used. Also explain the following
		fuel cell technologies in detail with relevant chemical reactions:  (i) PEMFC (ii) MCFC (iii) SOFC (12 Marks)
		(1) PEMFC (11) MCFC (111) SOFC (12 Marks)
,		OR
4	a.	Define and explain the following battery parameters:  (i) Battery coulometric capacity
		(ii) State-of-charge (SOC)
		(iii) Discharge rate
	h	(iv) Battery energy (08 Marks)
	D.	Develop a Fractional Depletion Model (FDM) of batteries using constant current discharge approach. (06 Marks)
	c.	Explain the basic principle of operation of a double layer ultra capacitor with a neat diagram.
		(06 Marks)
		Module-3
5	a.	Explain the operation of following DC drives with a neat circuit diagram and steady-state
		waveforms:  (i) Step-down chopper drive
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- - Step-down chopper drive (ii)
  - (iii) Class C chopper drive

(12 Marks)

- b. Explain the following control schemes of a BLDC motor drive with a relevant block diagram:

  - (i) Torque control scheme(ii) Speed control scheme

(08 Marks)

OR

a. Explain the constant v/f control of inductor motor for varying its torque-speed characteristics with relevant curves. Also depict the power electronic control for v/f control with the help of (12 Marks) block diagram.

b. Explain the operation of classic half bridge converter used in SRM drives with the help of a (08 Marks) circuit diagram.

Explain various configurations of electrical coupling device in the design of series hybrid electric drive trains. Also explain the operation of different bidirectional DC/DC converters (12 Marks) used in it.

b. Explain the engine power design of a torque coupled hybrid electric drive train with relevant (08 Marks) equations and curves.

a. Explain the following control strategies employed in a parallel hybrid electric drive train:

(i) Max. SOC-of-PPS control strategy with a neat flow chart and speed-traction characteristics.

(12 Marks) (ii) Engine on-off control strategy

Explain the power rating design of traction motor in a series hybrid electric drive with (08 Marks) relevant equations and curves.

## Module-5

List out and explain in detail various charging methods of battery used in EV and HEV.

Explain the following transformer less charger topology for battery with a neat circuit diagram:

Simple buck technology (i)

Neutral-point clamped topology

(08 Marks)

10 a. Explain the high frequency transformer based two-stage isolated charger topology for batteries used in EV and HEV with a neat circuit diagram. Also explain in detail about the (12 Marks) design of various components of it.

Explain in detail about the design of z-circuit capacitor and inductor with relevant equations. (08 Marks)