

2022 SCHEME

Basavarajeswari Group of Institutions
BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code

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Sixth Semester B.E. Degree Examinations, May/June 2026

ELECTRIC VEHICLE TECHNOLOGY

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO: PI)</u>
<u>Module-1</u>			
1.	a. With a neat block diagram, explain parallel hybrid EV and discuss about the modes of operation.	10	(2 :1: 1.4.1)
	b. Compare the differences between fixed gear and variable gear system in BEV configuration.	10	(2 :1: 1.4.1)
(OR)			
2.	a. Define tractive effort. Explain tractive effort on an electric vehicle and obtain the relation between speed, power and energy.	10	(2 :1: 1.4.1)
	b. Define aero dynamic drag. What are its components and explain in brief. An EV has drag coefficient of 0.25, frontal area of 3 m ² , air density of 1.3 kg/m ³ and speed of 130km/hr. What is the aerodynamic drag on EV if it is experiencing an opposing wind of 12 km/hr?	10	(2 :1: 1.4.1)
<u>Module-2</u>			
3.	a. With neat a flow diagram give the classification of DC electric motors used in electric vehicles, explain the principle and operation of DC motor drive.	10	(2 :2: 1.4.1)
	b. With a neat circuit diagram of explain the construction and operation of Switched Reluctance motor drive.	10	(2 :2: 1.4.1)
(OR)			
4.	a. With a neat circuit diagram explain the principle and basic operation of the Induction motor.	10	(2 :2: 1.4.1)
	b. With a neat block diagram explain the torque control of BLDC motor drives.	10	(2 :2: 1.4.1)
<u>Module-3</u>			
5.	a. With a neat circuit diagram explain the operation of a two quadrant chopper used for electric vehicle application.	10	(2 :3: 1.4.1)
	b. With a neat circuit diagram explain the operation of boost converter for the HEV applications.	10	(2 :3: 1.4.1)

(OR)

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI- Performance Indicator)

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| 6. | a. | With a neat circuit diagram explain the operation of non-Isolated bidirectional DC-DC converter for the HEV applications. | 10 | (2 :3: 1.4.1) |
| | b. | With a neat circuit diagram explain the operation of forward and fly back converter for the HEV applications. | 10 | (2 :3: 1.4.1) |

Module-4

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| 7. | a. | Compare various batteries based on the specific energy, specific power, cycle life, cost and safety parameters. Also, explain each in detail. | 10 | (2 :4: 1.4.1) |
| | b. | A NiMH battery has the following specifications:
168 cells (28 modules), 201.6 V nominal voltage, 6.5 Ah nominal capacity, 28 hp (21kW) output power, 1300 W/kg specific power and 46Wh/kg specific energy.
(i) Calculate the time taken by the battery to charge from current SoC of 40 % to 90 % at a maximum rate of 90 A.
(ii) If the battery has an internal resistance of 0.15 Ω , calculate the efficiency at maximum charge rate.
(iii) Calculate the time taken by the battery to self-discharge with a leakage current is 20 mA from 80 % SoC to 30 %. | 10 | (3 :4: 1.4.1) |

(OR)

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| 8. | a. | Discuss about the thermal management of HEV power electronics circuits. | 10 | (2 :4: 1.4.1) |
| | b. | A NiMH battery has the following specifications:
168 cells (28 modules), 201.6 V nominal voltage, 6.5 Ah nominal capacity, 28 hp (21kW) output power, 1300 W/kg specific power and 46Wh/kg specific energy.
(i) Calculate the time taken by the battery to discharge from current fully charged to 40 % at a maximum rate of 95 A.
(ii) If the battery has an internal resistance of 0.1 Ω , calculate the efficiency at maximum charge rate.
(iii) Calculate the voltage drop due to internal resistance of 0.12 Ω with a maximum current of is 90 A during charge and 0.1 Ω at maximum current of 95 A during discharge. | 10 | (3 :4: 1.4.1) |

Module-5

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| 9. | a. | Discuss the need of AC charging of electric vehicles and mention its advantages. | 10 | (2 :5: 1.4.1) |
| | b. | With a neat circuit diagram explain the process of wireless and wired charging technique in electric vehicles. | 10 | (2 :5: 1.4.1) |
| (OR) | | | | |
| 10. | a. | With a neat circuit diagram explain the solar generation integration with electric vehicles. | 10 | (2 :5: 1.4.1) |
| | b. | With a neat diagram explain about the integration of Smart grid integration for EV charging. | 10 | (2 :5: 1.4.1) |

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