

(Time -3 Hours)

[Max Marks: 80]

NB: 1. Q.1 is compulsory

2. Answer **any three** out of remaining **five** questions
3. Assumptions made should be clearly stated
4. Assume any suitable data wherever required but justify the same

Q.1 Answer the following (**Any four**)

(20)

- (i) Illustrate how evolution of Automotive Electrical & Electronics (E/E) architecture took place over the past few decades. What kind of advancement in features and challenges seen in the automotive E/E systems.
- (ii) Highlight the major automotive safety related advancement achieved through the automotive controllers and auxiliary systems over the past few decades.
- (iii) Illustrate the working 'Antilock Brake System (ABS)' and its implementation in vehicles.
- (iv) Describe the working of Steering System with Angle Sensor. Also draw the schematic of angle sensor's interface with automotive controller.
- (v) Explain the functioning of key-less entry system with the help of schematic clearly indicating the interface with Electronic Control Unit (ECU).

Q.2 (A) Describe the principle of 'Object Detection' in the context of automotive application. **(10)**

Also illustrate various sensor technologies which are used in the object detection in automotive systems. Compare their features and limitations.

(B) Illustrate the functioning of 'Advanced Driver Assistance System (ADAS)' with the help of suitable schematics/diagrams. List all the features of various levels of ADAS integration in automotive applications. **(10)**

Q.3 (A) Illustrate Vehicle Control Unit (VCU) role in EV Inverter control and Battery management with the help of schematic / block diagram. **(10)**

(B) List the major communication protocols used in In-Vehicle Communication Systems. Compare the performance and utility of these protocols. Describe any one of the protocol in detail. **(10)**

- Q.4 (A) Describe the functioning of Airbag Control Unit (ACU). List and describe various sensors, detectors and actuators which are incorporated in ACUs. Also show the positioning of these sensors in a four wheeler. (10)
- (B) Illustrate the schematic of High Voltage (HV) circuit in EV. Clearly show the various cut-outs which are used for safety. In case of crash or any other mishap, how the HV connection is isolated in the vehicular? (10)
- Q.5 (A) Describe the principle and working of following automotive systems in automotive applications: (i) Tyre pressure Monitoring Systems (TPMS) (ii) Vehicle Lighting System. (10)
- (B) List the design considerations for thermal management system in Electric Vehicles. What kind of technology alternatives used in EVs for cooling systems? Describe any one of them in detail. (10)
- Q.6 (A) Illustrate the general framework for vehicular power control and energy management. What methodologies for optimization which are adopted for the same? Describe any one method in detail. (10)
- (B) List various design and safety considerations taken into account while manufacturing of Battery pack. What role a 'Battery Management System (BMS)' plays in the performance of the battery pack for EVs. (10)
