

**University of Mumbai**  
**Examinations Summer 2022**

Time: 2 hour 30 minutes

Max. Marks: 80

<b>Q1.</b>	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks – 2 marks each</b>
1.	Which of the following is NOT a Hybrid Vehicle?
Option A:	Plug-in hybrid
Option B:	Parallel hybrid
Option C:	Series hybrid
Option D:	ICE vehicle
2.	..... is associated with the force necessary to overcome the friction of EV tires.
Option A:	Gravitational resistance
Option B:	Aerodynamics resistance
Option C:	Friction resistance
Option D:	Rolling resistance
3.	Electrical Vehicle are generally power by
Option A:	Aluminum battery
Option B:	Lithium Ion Battery
Option C:	Sodium battery
Option D:	Magnesium battery
4.	An EV only needs one of the following maintenance jobs done. Which is it?
Option A:	Oil change
Option B:	Belt replacement
Option C:	New spark plugs
Option D:	Brake pad inspections
5.	When was the first electric car invented?
Option A:	1851
Option B:	1831
Option C:	1832
Option D:	1932
6.	The Field Oriented Control (FOC) enables the induction machine being controlled alike the
Option A:	separately excited DC Machine
Option B:	Permanent magnet DC machine
Option C:	Switched reluctance machine
Option D:	Stepper motor
7.	..... hybrid vehicle is either propelled by ICE or battery
Option A:	Parallel
Option B:	Series
Option C:	Split
Option D:	Mild
8.	For Hybridness $H=100\%$ the vehicle is a pure _____ Vehicle
Option A:	Electrical
Option B:	Mechanical
Option C:	Gasoline
Option D:	Hybrid

9.	Energy management unit cooperates with ..... to control regenerative braking and its energy recovery.
Option A:	Energy refueling unit
Option B:	Electric motor
Option C:	Mechanical transmission
Option D:	Electronic controller
10.	Which strategy is more efficient for ICE engine fuel economy calculation and emission in energy management strategy system?
Option A:	Optimization based system
Option B:	Rule based energy management system
Option C:	Global optimization strategy
Option D:	Fuzzy rule-based energy management system

<b>Q2</b>	<b>Solve any Four out of Six</b>	<b>5 marks each</b>
A	What is the need and importance of electric vehicle?	
B	What are the requirement of energy supplies and energy storages in electric and hybrid electric vehicle?	
C	Explain the characteristics and performance of ultra-capacitor for EV application.	
D	State and explain the vehicle to grid and grid to vehicle operation in electric vehicle technology	
E	Explain briefly the performance parameter of the vehicle.	
F	Comment on the suitability of DC and AC machine for electric and hybrid electric vehicle application.	

<b>Q3</b>	<b>Solve any Two Questions out of Three</b>	<b>10 marks each</b>
A	Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicles	
B	State historical background of EV / HEV technology in brief. Describe the current state of the art of EV / HEV technology along with technology challenges associated with it	
C	Compare and differentiate between the battery electric vehicle (BEV), hybrid electric vehicle (HEV), and plug in HEV (PHEV) technologies.	

<b>Q4.</b>		
A	<b>Solve any Two</b>	<b>5 marks each</b>
i.	Draw the schematic of general configuration of electrical subsystem of an Electric Vehicle (EV) and a Hybrid Electric Vehicle (HEV).	
ii.	State and define the key battery parameters (i) Battery capacity (ii) C rate (iii) SoC (iv) DoD (v) Specific Energy (vi) Energy Density.	
iii.	Describe the concept of "Hybridness" and classify the HEV based on hybridness.	
B	<b>Solve any One</b>	<b>10 marks each</b>
i.	Describe in detail all modes of operation of a series hybrid vehicle	
ii.	Explain the terms rolling resistance and aerodynamic drag in vehicles and derive the expression for vehicle translational speed from fundamentals	