

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**B.Tech. Winter 2022-23 Examination**

**Semester: 7**  
**Subject Code: 203102403**  
**Subject Name: Hybrid Vehicles**

**Date: 06-10-2022**  
**Time: 10:30 to 01:00**  
**Total Marks: 60**

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

**Q.1 Objective Type Questions –****(15)**

1. \_\_\_\_\_ Rotor motor needs an additional planetary gear-set.
2. \_\_\_\_\_ Converters are used in places where battery charging and regenerative braking is required.
3. The \_\_\_\_\_ can be used as a generator to charge the battery by regenerative braking or absorbing power from the ICE when its output is greater than that required to drive the wheels.
4. Capacitor is a device used to store \_\_\_\_\_ energy.
5. A lithium-ion battery is a type of \_\_\_\_\_ battery.
6. Brushless motor doesn't have
  - a) Fixed armature
  - b) Permanent magnet
  - c) Commutator
  - d) None of the above.
7. The Micro-hybrid drive-train is usually used in heavy commercial vehicles, military vehicles and buses. The reason is that large vehicles have enough space for the bulky engine/generator system.
  - a) True
  - b) False
8. Purpose of a generator in a hybrid vehicle is to convert mechanical energy into electrical energy.
  - a) True
  - b) False
9. A wound-rotor motor is the type of induction motor.
  - a) True
  - b) False
10. The overall reversible chemical reaction occurring in a Li-ion cell is
  - a)  $2 \text{Li} + \text{C} + \text{Li}_{1-x} \text{M}_y \text{O}_z \rightleftharpoons \text{C} + 2\text{LiM}_y \text{O}_z$
  - b)  $2 \text{Li} + \text{C} + 2\text{Li}_{1-x} \text{M}_y \text{O}_z \rightleftharpoons \text{C} + \text{LiM}_y \text{O}_z$
  - c)  $\text{Li} + \text{C} + 2\text{Li}_{1-x} \text{M}_y \text{O}_z \rightleftharpoons 2\text{C} + \text{LiM}_y \text{O}_z$
  - d) None of the above
11. Write the definition of ampere hour efficiency
12. Write the definition of Energy Efficiency.

13. Why regenerative braking systems provided in HEVs & EVs?

14. What do you understand about hybrid vehicles?

15. Who has invented the series hybrid?

**Q.2 Answer the following questions. (Attempt any three)**

**(15)**

A. Discuss energy management strategies for automobile vehicles.

B. Give the definition of the following:

(i) Buck Converter (ii) Boost converter (iii) Buck-Boost converter

C. Explain the construction and working of Li-ion Battery.

D. Discuss Interdisciplinary Nature of Hybrid Electric Vehicles.

**Q.3 A. Explain in detail the Series HEV, based on the vehicle operating conditions.**

**(07)**

B. Draw the Layout of subsystem of EV & Explain following major subsystems of EV:

**(08)**

i. Electric propulsion subsystem.

ii. Energy source sub-system.

iii. Auxiliary subsystem in detail.

**OR**

B. Based on Drivetrain Configuration, Explain Electric Vehicle Drivetrain in detail.

**(08)**

**Q.4 A. Discuss the series-parallel HEVs drive train with proper layout diagram.**

**(07)**

**OR**

A. Discuss working and construction of fuel cells.

**(07)**

B. Explain inner-rotor motor & outer-rotor motor with neat sketch.

**(08)**