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BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – Dip.ME-2023

Course Name – Hybrid Vehicles

Course Code - DMEPE602B

(Semester VI)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) State the main reason for the modern revival of electric vehicles.
 - a) Oil crises environmental concerns and battery advancements
 - b) Increased fuel availability
 - c) Growth of diesel engines
 - d) Expansion of road networks
- (ii) Identify the hybrid architecture where engine drives generator only.
 - a) Series hybrid
 - b) Parallel hybrid
 - c) Series parallel hybrid
 - d) Pure electric propulsion
- (iii) Identify the motor type offering high efficiency without brushes.
 - a) Brushless DC motor
 - b) DC motor
 - c) Induction motor
 - d) Switched reluctance motor
- (iv) State the function of regenerative braking control.
 - a) Recover kinetic energy during deceleration
 - b) Increase braking heat loss
 - c) Reduce battery life
 - d) Increase mechanical wear
- (v) Identify the component that physically separates anode and cathode.
 - a) Casing
 - b) Separator
 - c) Electrolyte
 - d) Terminal
- (vi) State the meaning of Depth of Discharge.
 - a) Battery weight
 - b) Battery temperature
 - c) Percentage of battery capacity used
 - d) Battery voltage value
- (vii) Identify the parameter that opposes current flow inside battery.
 - a) Power density
 - b) Cycle life
 - c) Internal resistance
 - d) Energy density
- (viii) Identify the working principle of DC motor.
 - a) Rotating capacitor
 - b) Thermal expansion

- c) Interaction of armature and field magnetic fields d) Electrochemical reaction
- (ix) State the key characteristic of DC shunt motor.
- a) High slip b) Brushless operation
c) High starting torque d) Nearly constant speed
- (x) State the key advantage of Permanent Magnet machine.
- a) Needs field current b) High losses
c) Large size d) Higher efficiency
- (xi) Identify the drive configuration that eliminates gearbox.
- a) Automatic drive b) Direct drive
c) Multi speed drive d) Manual drive
- (xii) State the parameter that determines EV range.
- a) Gear ratio b) Battery capacity
c) Fuel tank size d) Engine displacement
- (xiii) Identify the series hybrid working principle.
- a) Fuel cell drives motor b) Engine drives generator motor drives wheels
c) Engine drives wheels only d) Battery drives wheels only
- (xiv) State the objective of power split control in hybrids.
- a) Increase emissions b) Reduce torque
c) Stop battery use d) Optimize engine and motor power sharing
- (xv) Identify the source that provides instant torque in hybrid vehicles.
- a) Diesel engine b) Fuel pump
c) Alternator d) Electric motor

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Define an electric vehicle drive train. (3)
3. State two advantages of EV transmission systems. (3)
4. Define a Hybrid Electric Vehicle (HEV). (3)
5. Determine 3 technical specifications of a battery. (3)
6. Examine the advantages of series-parallel hybrid configuration over series hybrid configuration. (3)

OR

Analyze how power flow is managed between engine and motor in a parallel hybrid system. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Analyze the role of intelligent automation in reducing road accidents. (5)
8. A lithium-ion battery is charged at a constant voltage of 48 V and draws a current of 10 A for 3 hours. During discharge, the battery supplies 8 A at 46 V at an efficiency of 90%. Predict the time required in hours for full discharge. (5)
9. Justify the advantages of electric vehicles over internal combustion engine vehicles. (5)
10. Define a battery and explain its fundamental electrochemical working with a neat diagram. (5)
11. Explain the construction and working principle of a DC motor. (5)
12. A car of mass 1200 kg moves at a steady speed of 60 km/h on a road having a gradient of 4%. The drag coefficient of the car is 0.35, frontal area is 2.1 m^2 , coefficient of rolling resistance is 0.014, and air density is 1.2 kg/m^3 . Calculate the total tractive effort required to move the car. (5)

OR

Interpret the factors affecting the driving range of a Battery Electric Vehicle. (5)