Register Number:……..

KUMARAGURU college of technology
character is life

B.E DEGREE EXAMINATIONS: MAY 2018

(Regulation 2015)

Sixth Semester

AUTOMOBILE ENGINEERING

U15AUTE33 : Hybrid, Electric and Fuel-Cell Vehicles

COURSE OUTCOMES

CO1: Differentiate electric and hybrid vehicles

CO2: Understand the subsystems and components used in electric and hybrid vehicles

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Matching type item with multiple choice code CO1 [K_1]

List I	List II
A) reformer	i) Extraction of hydrogen
B) electrolysis	ii) Solar rays focussing
C) tracking	iii) Fuel cell material
D) pervoskites	iv) Hydrogen purification

	A	B	C	D
a)	iv	i	ii	iii
b)	iii	i	ii	iv
c)	ii	iii	i	iv
d)	i	ii	iii	iv

2. Pick the odd choice out. CO1 [K_2]

a) Fiat 500E b) Toyota Prius

c) Ford Think City d) BMW i3

3. The main objective of developing a series hybrid vehicles is CO1 [K_2]
   1. Extending the drive range
   2. Limited payload
   3. Limited Volume capacity
   4. Less battery charging time

a) 1,3 b) 1,4

c) 1,2 d) 2,3

4. The advantage(s) of a parallel HEV is/are _____ CO1 [K_1]

a) two propulsion components b) the motor can be used as the generator and vice versa

c) A smaller engine and a smaller motor can be used to get the same performance, until batteries are depleted d) All of these

5. The following items consist of two statements, one labelled as the "Assertion (A)" and the other as "Reason (R). You are to examine those two statements carefully and select the answers to these items using the codes given below: CO1 [K_2]

Assertion (A) : Regenerative braking converts the vehicle's kinetic energy into battery-replenishing electric energy.

Reason (R) : In Regenerative braking engine–generator is turned off and the traction motor is operated as a generator

a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false d) A is false but R is true

6. Vector control of a _____motor is simpler than that of an induction motor, because the motor always rotates at synchronous speed CO2 [K_2]

a) PM synchronous b) Dc

c) BLDC d) Switched reluctance

7. Sequence the following process CO2 [K_3]

1. The hydrogen enters the fuel cell at the anode
2. The oxygen then combines with the ionized hydrogen atoms (H^+), and water (H_2O) is formed as the waste product which exits the fuel cell
3. The oxygen enters at the cathode, usually from the air.
4. If other ions were allowed to flow between the anode and cathode, the chemical reactions within the cell would be disrupted and electricity is generated.

a) 2-3-4-1 b) 1-3-2-4

c) 3-4-2-1 d) 4-1-3-2

8. The drawbacks of the NiCd batteries are CO2 [K_2]

a) insufficient power delivery b) high cost

c) toxic d) All of these

9. Assertion (A): During charging, lithium ions flow from the positive electrode to the negative electrode through the electrolyte. CO2 [K_2]

Reason (R): Electrons also flow from the positive electrode to the negative electrode, but take the longer path around the outer circuit.

a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false d) A is false but R is true

10. _____ is the angle between the equator and a line drawn from the center of the Earth to the centre of the sun. CO2 [K_2]

a) Insolation b) Azimuth angle

c) Declination angle d) Zenith angle

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. What is tractive effort and write the equation of total resistance for a vehicle. CO1 [K_1]
12. Give the requirements of an EV motor. CO1 [K_2]
13. Give the difference between series hybrid and range extender hybrid vehicles. CO1 [K_2]
14. Define power capacity and energy capacity of PPS. CO1 [K_1]
15. Why Permanent magnet motors are preferred over conventional DC motors when used for vehicle propulsion application? CO2 [K_2]
16. List down the classification of electric motor drives for EV and HEV applications. Which dc motor could be used for traction and why? CO2 [K_2]
17. In order to predict the range of an EV, the State of Charge (SoC) or Depth of Discharge (DoD) can be used. Which one will be more accurate? CO2 [K_2]
18. Compare ultra capacitors with that of a battery. CO2 [K3]
19. Compare fuel cells with that of batteries and Internal Combustion Engines. CO2 [K_2]
20. Explain why fuel cells gain importance in the automotive industry? Give the advantages and disadvantages of fuel cells. CO2 [K3]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21.	With suitable block diagram, explain the components and choice for an Electric Vehicle (EV). Also tabulate the relative advantages and disadvantages of an EV over an IC Engine driven vehicle based on the comparison of efficiency, pollution, cost, and dependence on fuel.	CO1 CO2	[K_3]
22.	Explain the architecture of series and parallel hybrid electric drive train.	CO1	[K_3]
23.	Explain the construction and working of BLDC motors with neat sketch.	CO2	[K_2]
24.	Compare the performance of lead acid batteries with that of nickel based and lithium based batteries. Suggest a suitable battery for an EV. Justify the choice of selection with relevant statements.	CO2	[K_4]
25.	Briefly explain the construction and working of lead acid batteries. Elaborate the charging and discharging operation with neat sketch and relevant equations.	CO2	[K_2]
26.	Explain the construction and working of PEM fuel cell with relevant diagrams.	CO1	[K_2]
27.	List the different types of photo voltaic cells available. Explain how the solar energy is trapped on to the panels by different methods. Explain the tracking methods available.	CO2	[K_2]

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