Register Number:……..

KUMARAGURU
college of technology
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B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Seventh Semester

AUTOMOBILE ENGINEERING

U18AUE0011**:** Fuel Cell Technology

COURSE OUTCOMES

CO1: Identify the different components and materials used in a fuel cell

CO2: Familiarize with the safety aspects and the recent advancements in field of fuel cells

CO3: Apply the knowledge of thermodynamics and material science to understand the thermodynamic equations and electrochemical kinetics of the fuel cell

CO4: Compare the different types of fuel cells and choose an appropriate fuel cell suitable for specific application

CO5: Develop a single cell of PEM fuel cell / Microbial fuel cell on their own

CO6: Estimate the performance of the fuel cell

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

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1.	Compare fuel cell with a battery and IC Engine	CO1	[K_4]
2.	Give the advantages and disadvantages of alkaline fuel cells	CO4	[K_2]
3.	What is the role of MEA in the fuel cells?	CO1	[K_2]
4.	Give the functions of bi-polar plates.	CO1	[K_2]
5.	Give the fuel cell reaction and the Nernst equation of a PEM fuel cell.	CO3	[K_2]
6.	What is electrophoresis and electro-osmosis?	CO3	[K_2]
7.	Apply the concept of reforming to biomass, list the contaminants to be removed, and identify the type reformer to be employed if biomass is used as a fuel to fuel cell vehicle.	CO4	[K_3]
8.	Explain the process of extraction of hydrogen from chemical hydrides.	CO4	[K_2]
9.	Explain why fuel cells gain importance in the Energy sector? Why the implementation of fuel cell based vehicle is not effective in India?	CO1	[K_2]
10.	What is life cycle analysis of fuel cell?	CO6	[K_2]

Answer any FIVE Questions:-
PART B (5 x 4 = 20 Marks)
(Answer not more than 80 words)

11.	Tabulate the difference between the Proton Exchange Membrane (PEM) fuel cell with the other types of fuel cells based on the materials used, operating conditions, performance parameters.		CO1	[K_4]
12.	Explain the following: Role of carbon fiber in fuel cells.		CO2	[K_2]
13.	What happens to the output voltage of an alkaline fuel cell if the temperature is increased? Explain with a characteristic curve?		CO6	[K_2]
14.	In which type of fuel cell is the Cathode poisoning predominant? Analyze the process and its effect on the type of fuel cell. How to overcome the effects of cathode poisoning?		CO4	[K_4]
15.	Analyze the role of different controllers employed in the fuel cell control system with neat sketch.		CO2	[K_4]
16.	Analyze why fuel cell based vehicles are used for long range applications? Also comment on the safety measures to be adopted during implementation of fuel cell based vehicles.		CO2	[K_4]

Answer any FIVE Questions:-
PART C (5 x 12 = 60 Marks)
(Answer not more than 300 words)

17.		Explain the working of any one type of low temperature fuel cell with necessary circuit and equations. Explain the materials used with the role of each component present in the fuel cell.	12	CO4	[K_2]
18.	a)	Analyze the performance characteristics of fuel cells.	6	CO3	[K_4]
	b)	Illustrate the different over potentials in fuel cells based on the electrochemical kinetics with necessary explanation.	6	CO3	[K_3]
19.	a)	Briefly explain the technological advancements in fuel cell vehicle systems	6	CO1	[K_2]
	b)	Explain the phosphoric acid fuel cell vehicle with relevant blocks explaining the functions of each system.	6	CO2	[K_2]
20.		Explain the pollutants that are harmful to fuel cells. With neat sketch, explain the different stages of removal of pollutants from the fuel. Also specify the level of tolerance of the pollutants as applicable to the type of fuel cell and estimate the performance of the cell based on these factors.	12	CO6	[K_5]

21.	a)	Explain the different methods of hydrogen storage adopted in India.	6	CO4	[K_2]
	b)	Compare the different reformers employed in the purification of hydrogen.	6	CO4	[K_4]
22.		Analyze the role of NHERM in the implementation of fuel cell based vehicles. Explain the road map of fuel cells to market. State the concerns and challenges that are applicable during implementation of fuel cell based vehicle.	12	CO1	[K_4]

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