

<b>Name:</b>  <b>Enrolment No:</b>	
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**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, May 2022**

<b>Course:</b> Alternative Energy Sources (Elective)	<b>Semester</b> : VI
<b>Program</b> : B. Tech (CE+RP)	<b>Time</b> : 03 hrs.
<b>Course Code</b> : CHCE 3022P	<b>Max. Marks</b> : 100

**Instructions:**

**SET-II**

**SECTION A (5Q x 4M = 20 Marks)**

S. No.		Marks	CO
<b>Q.1</b>	Choose ONLY ONE correct Option, and give justification of your answer in 2-5 lines.  Sunlight, air, soil, and water are examples of (a) renewable resources (b) non-renewable resources (c) conventional resources (d) non-natural resources	<b>4</b>	<b>CO1</b>
<b>Q.2</b>	Choose ONLY ONE correct Option, and give justification of your answer in 2-5 lines.  Which of the following is a disadvantage of most of the renewable energy sources? (a) Unreliable supply (b) Highly polluting (c) High waste disposal cost (d) High running cost	<b>4</b>	<b>CO1</b>
<b>Q.3</b>	Choose ONLY ONE correct Option, and give justification of your answer in 2-5 lines.  The objective of energy management should include (a) Minimizing energy costs (b) Minimizing waste (c) Minimizing environmental degradation (d) All the above	<b>4</b>	<b>CO3</b>
<b>Q.4</b>	Choose ONLY ONE correct Option, and write the full equation of your answer. Also comment on the heat of the reaction.	<b>4</b>	<b>CO4</b>

	The fuel cell is able to produce electrical energy due to flowing reaction of energy (a) Thermionic Action (b) Reaction of Hydrogen with Oxygen (c) Pyrolytic Combustion of Fuel (d) Peltier Effect (e) All the above		
<b>Q.5</b>	Choose ONLY ONE correct Option, and give justification and chemistry of your answer. Also comment on the heat of the reaction.  Is it possible to chemically store the hydrogen for the purpose of fuel? If yes, choose the correct answer: (a) As Ions (b) By compressing hydrogen gas (c) In form of hydrides (d) In form of ice using hydrogen bonding (e) In the cage of natural gas hydrates	<b>4</b>	<b>CO5</b>
<b>SECTION B (4Q x 10M = 40 Marks)</b>			
<b>Q.6</b>	Describe the construction, working of HAWT, and VAWT.	<b>10</b>	<b>CO2</b>
<b>Q.7</b>	Describe the construction, and working of a low penetration Wind-Diesel systems, and explain its operation diagram, with Power-time Characteristics.	<b>10</b>	<b>CO3</b>
<b>Q.8</b>	Describe a Community Scale Hybrid Systems, and show the Hybrid of Wind, PV, Diesel, and Storage with an illustrative diagram.	<b>10</b>	<b>CO3</b>
<b>Q.9</b>	Discuss Conversion Efficiency of Fuel Cells.  <b>OR</b>  Discuss Potential Energy Versus Reaction Progress in Fuel Cells	<b>10</b>	<b>CO4</b>
<b>SECTION-C (2Qx20M=40 Marks)</b>			
<b>Instruction:</b> <b>Question No. 10. Attempt only one Version.</b> <b>Question No. 11. Compulsory.</b>			

<p><b>Q.10</b></p>	<p><b>Version 1:</b> The Proton Exchange Membrane Fuel Cell (PEMFC) is an important electrochemical device that is able to directly convert chemical energy into electrical energy. It has many features, such as high power density, simple construction, and fast start-up. Therefore it may be very suitable for applications in automotive and domestic appliances. A typical schematic of a Proton Exchange Membrane Fuel Cell (PEMFC) is very simple. The cell is consisting of two graphite bipolar plates with micro flow channels and separated by MEA (Membrane Electrode Assembly) which consists of a membrane and two electrode with dispersed Platinum catalyst. As there are no moving parts, fuel cells operate silently and with extremely high reliability. Fuel cells that use pure hydrogen fuel are completely carbon-free, with their only by-products being electricity, heat, and water. <b>[20 Marks]</b></p> <p>(a) Draw a fuel cell stack. [5]          (b) Describe the materials used in anode and cathode. [5]          (c) Explain the role of micro-flow channels [5]          (d) If fuel cells have high power density, explain how they can be used for automotive purpose. [5]</p> <p><b>OR</b></p> <p><b>Version 2:</b> For the Fuel Cells, the Electrochemical Thermodynamics can be very important. The Equilibrium Potential of The cell (system) consists of three sub systems, electrodes (1 and 2) separated by an electrolyte membrane (3). <b>[20 Marks]</b></p> <p>(A) Is it possible to describe the Equilibrium Potential using Gibbs free energy minima or maxima? [5]          (B) Write the <math>\delta G</math>, the variation equation for all the 3 subsystems. [5]          (C) Give an illustration of Fuel Cell Stack. [5]          (D) Provide the mechanism of Mechanism for Methanol Oxidation. [5]</p>	<p align="center"><b>20</b></p>	<p align="center"><b>CO4</b></p>
<p><b>Q.11</b></p>	<p>Hydrogen production is quite leading topic. Discuss critically following topics about hydrogen production.</p> <p>(a) Give an analysis of Hydrogen Colour Spectrum.          (b) Give the Hydrogen Production Process.          (c) Discuss the role of Hydro-desulf.          (d) Discuss pathways of Syngas Hydrogen.</p>	<p align="center"><b>20</b></p>	<p align="center"><b>CO5</b></p>