


| Name:   |  |  |     |
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| Enrolment No:   |  |  |     |
| <b>UNIVERSITY OF PETROLEUM AND ENERGY STUDIES</b><br><b>End Semester Examination, May 2022</b>                              |  |  |     |
| <b>Course: Environmental Management in Power Industry</b><br><b>Program: B. Tech- FSE</b><br><b>Course Code: HSFS 4010P</b> |  | <b>Semester: VI</b><br><b>Time : 03 hrs.</b><br><b>Max. Marks: 100</b>             |     |
| <b>Instructions:</b>  |  |  |     |
| <b>SECTION A</b><br><b>(5Qx4M=20Marks)</b>  |  |  |     |
| S. No.  |  | Marks  | CO  |
| Q 1   | a) In a 'Fluidized Bed Combustion Boiler', to capture _____, limestone & dolomite is used during combustion process.<br><br>b) For a Wind Turbine to operate under wind flowing from various direction _____ Axis type of Wind Turbine is preferable.                  | 4  | CO1 |
| Q 2   | State the 3 major focus areas during the ' <b>Earth Summit</b> '.  | 4  | CO1 |
| Q 3   | a) In a 'Fluidized Bed Combustion Boiler', _____ is used to maintain the ignition temperature & effective mixing of fuel.<br><br>b) In a Run-off, the river (High Velocity & Low Volume), type Hydroelectric Power Plant, _____ type of turbine is more commonly used. | 4  | CO2 |
| Q 4   | a) A 'Pressurized Water Reactor' based Nuclear Power Plants comprises of _____ cycle.<br><br>b) During normal operation of a Gas Turbine Power Plant, the compressor retrieves power from the Gas Turbine _____.   | 4  | CO2 |
| Q 5   | The process of increasing the percentage (%) of U235 in the Nuclear Fuel before it is used for the Nuclear Fission Reaction is known as _____.   | 4  | CO3 |
| <b>SECTION B</b><br><b>(4Qx10M= 40 Marks)</b>   |  |  |     |
| Q 6   | Compare & contrast between ' <b>Open Cycle Gas Turbine Power Plant</b> ' and ' <b>Combined Cycle Gas Turbine Power Plant</b> ' along with their respective environmental advantages & disadvantages.   | 10   | CO3 |
| Q 7   | Differentiate between ' <b>Open Loop Cooling Water cycle</b> ' and ' <b>Closed Loop Cooling Water cycle</b> ' used for steam condenser cooling in Thermal Power Plants along with their respective 'Environmental  | 10   | CO3 |

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|  | Impact Assessments'  |    |     |
| Q 8  | Describe the following three types of ' <b>Geo-thermal Power</b> ' generating systems along with their respective environmental impact(s):<br>1) Dry Steam Open System<br>2) Flash Steam Open System<br>3) Hot Water Closed (Binary) System  | 10 | CO4 |
| Q 9  | Evaluate the <b>Lean Slurry Ash</b> disposal systems associated with a coal fired Thermal Power Plant & justify their respective application from the Environmental Impact Assessment aspect.<br><b>OR</b><br>Evaluate the <b>Thick Slurry Ash</b> disposal systems (HCSD) associated with a coal fired Thermal Power Plant & justify their respective application from the Environmental Impact Assessment aspect.  | 10 | CO4 |
| <b>SECTION-C</b><br><b>(2Qx20M=40 Marks)</b> |  |    |     |
| Q 10   | Justify the application of ' <b>Wind Turbine</b> ' power generation technology in the coastal areas of India with reference to:<br><br>1. Meeting the growing demand of power<br>2. Reduction of Carbon Foot-print<br>3. Promotion of Non-conventional Source Power Generation & promotion of RPO ( <b>Renewable Purchase Obligation</b> )<br><br><b>OR</b><br>Justify the application of ' <b>Supercritical technology</b> ' for the lower grade coal (Bituminous or sub-bituminous) allocated for the Thermal Power Plants in India with reference to:<br><br>1. Meeting the growing demand of power<br>2. Fuel Efficiency<br>3. Reduction of Carbon Foot-print                                      | 20 | CO5 |
| Q 11   | The Bhopal disaster or Bhopal gas tragedy was an industrial accident. It happened at a Union Carbide subsidiary pesticide plant in the city of Bhopal, India. On the night of 2-3 December 1984, the plant released approximately 40 tons of toxic methyl isocyanate (MIC) gas, exposing more than 500,000 people to toxic gases.<br><br>A mixture of poisonous gases flooded the city, causing great panic as people woke up with a burning sensation in their lungs. Thousands died immediately from the effects of the gas. Many were trampled in the panic that followed. The first official immediate death toll was 3,598 in 1989. Another estimate is that 8,000 died within two weeks, that an | 20 | CO5 |

additional 8,000 have since died from gas-related diseases.

The disaster happened because water entered a tank containing Methyl isocyanate. This caused a chemical reaction which resulted in the buildup of much Carbon dioxide, among other things. The resulting reaction increased the temperature inside the tank to reach over 200 °C (392 °F). The pressure was more than the tank was built to withstand. The tank had valves to control the pressure. These were triggered in an emergency, which reduced the pressure. As a result, large amounts of toxic gases (like MIC) were released into the environment. The pipes were rusty. The rust in the iron pipes made the reaction faster. All the contents of the tank were released within a period of about two hours. The water had entered the tank because of a sequence of events. The tank had been maintained badly. When cleaning work was done, water entered the tank.

Factors leading to this huge gas leak include:

- The use of hazardous chemicals (MIC) instead of less dangerous ones
- Storing these chemicals in large tanks instead of over 200 steel drums.
- Possible corroding material in pipelines
- Poor maintenance after the plant ceased production in the early 1980s
- Failure of several safety systems (due to poor maintenance and regulations).
- Safety systems shut down to save money - including the MIC tank refrigeration system which alone would have prevented the disaster.
- Plant design modifications by Indian engineers to abide by government regulations and economic pressures to reduce expenses.

**Questions:**

- 1) Design 'Environmental Impact Assessment' strategies required to be adopted during the 'Design & Construction' phase for the above plant.
- 2) Examine the above case & develop the protocol from the perspective of 'Environmental Management Plan' that should have been adopted by Union Carbide during the operation of the plant.