Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2023

Course: Hazard Identification, Risk Analysis and Management (HSFS 7011) **Semester: II**
Program: MTech HSE/ HSE(DM) **Time : 03 hrs.**
Course Code: HSFS 7011 **Max. Marks: 100**

Instructions: Students are advised to answer questions sequentially and start each answer of a new sheet of paper.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q1	Provide definitions of both "hazard" and "risk", and then explain the distinction between these terms using an illustrative example.	**4**	**CO1**
Q2	Explain Layers of Protection and the concept of multiple barriers with the help of diagram(s).	**4**	**CO2**
Q3	In Fault Tree Analysis what are the three basic measurements generated as a result of quantification and numerical evaluation for decision making relative to risk acceptability and required preventive measurement?	**4**	**CO3**
Q4	Can a BLEVE occur without a fireball, and how does this relate to real-world examples? Please provide an explanation with relevant examples.	**4**	**CO2**
Q5	With the help of an example scenario of a chemical release describe the steps involved in using ALOHA to simulate and analyze the accident, including input data requirements, modeling assumptions, and output interpretations.	**4**	**CO3**
SECTION B **(4Qx10M= 40 Marks)**			
Q6	Explain the fishbone (Ishikawa) diagram and 5-why analysis methods for root cause analysis. Compare and contrast these two methods, highlighting their respective strengths and weaknesses. Provide an example of a workplace problem that could be effectively addressed by each of these methods, and describe the steps involved in using each method to identify and address the root cause(s) of the problem.	**10**	**CO4**
Q7	Explain the principles of hierarchy of controls and how they are used to manage risks in the workplace. Discuss the advantages and limitations of each control measure and provide examples of how they can be applied to control hazards.	**10**	**CO3**
Q8	Define inherently safer design and explain its significance in process safety. Describe the key principles of inherently safer design and provide	**10**	**CO1**

	examples of how they can be applied to reduce hazards in a chemical process.		
Q9	What are the distinctions between a pool fire, a jet fire, a fireball, and a flash fire, and how do these differences impact safety considerations in industrial settings? Provide examples of each type of fire, and describe the conditions that can lead to their occurrence. Additionally, explain the key factors that influence the severity and extent of each type of fire, and discuss the measures that can be taken to prevent and control fires in the workplace.	**10**	**CO4**
SECTION-C (2Qx20M=40 Marks)			
Q10	Define hazardous area classification and explain its importance in ensuring safety in industrial settings. Describe the different types of hazardous areas and provide examples of where they may be found in a typical process plant. Additionally, discuss the various factors that are considered in determining the extent and boundaries of hazardous areas in a plant.	**20**	**CO5**
Q11	Describe the steps involved in constructing an event tree, and explain the purpose and significance of each step. Then, construct an event tree for a chemical storage tank that has the potential to leak due to corrosion. The safety functions for the tank are listed below in the order in which they are intended to occur: • Corrosion monitoring system detects corrosion in the tank wall • Automatic isolation valve shuts off flow of chemical to the tank • Manual isolation valve is closed to prevent further leakage • Emergency response team is notified and responds to contain the leak • Containment system is activated to prevent spilled chemical from entering the environment For each event in the tree, describe the possible consequences and the actions that would be taken to mitigate those consequences. Finally, discuss the benefits and limitations of event tree analysis in the context of risk assessment and risk management. **Or** Discuss the different models used to calculate overpressure from an explosion event, including TNT equivalency, TNO, and BS models. Compare and contrast the advantages and limitations of each model, and provide an example of when each model might be appropriate to use. Additionally, describe the steps involved in using each model to calculate overpressure, and explain any key assumptions that need to be made. Finally, discuss the importance of accurate overpressure calculations in ensuring the safety of people and structures in the vicinity of explosion events.	**20**	**CO5**