Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Advanced Safety Engineering & Management **Semester: VIII**
Programme: B Tech FSE **Time: 03 hrs.**
Course Code: FSEG 431 **Max. Marks: 100**
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Differentiate a) Basic causes and immediate causes of an incident. b) Accident and Incident	**2*2**	**CO1**
Q 2	Differentiate a) Attitude and Behavior. b) Safety audit and Inspection.	**2*2**	**CO1**
Q 3	Differentiate Fault Tree Analysis and Event Tree Analysis.	**4**	**CO2**
Q 4	Illustrate the domino theory of accident causation.	**4**	**CO3**
Q 5	Enlist the objectives of accident investigation.	**4**	**CO1**
	SECTION B		
Q 6	What is safety culture? Explain different theories of leadership.	**10**	**CO4**
Q 7	List out the major changes made in ISO 45001:2018 compared to OHSAS 18001 Or Enlist and briefly explain clauses of ISO 45001:2018 Occupational health and safety management system.	**10**	**CO5**
Q 8	What are the objectives of accident investigation? 'Every accident is a symptom of system failure'- Examine the statement..	**10**	**CO3**
Q 9	Ms. Lisa Evans, QC supervisor sustained leg injury on account of hit by forklift, FL-01 while she engaged in warehouse material inspection. This incident happened when new operator Mr. Bob Daniel was operating the equipment and it happened during early hours of the shift. Identify the potential root causes using 4M analysis.	**10**	**CO3**

<table>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 10</td><td>In a manufacturing company following a process containment failure, a failure detection mechanism should detect the release. Once detected an alarm sounds then a suppressant is activated. Finally, in order to control the initial release, an operator is required to initiate manual control measures following the release of the suppressant. As part of the analysis, the company has decided to quantify the risks associated with the substance released from the process and develop a quantified event tree from the data

<table><tr><th>Activity</th><th>Frequency/ Reliability</th></tr><tr><td>Process containment failure</td><td>0.5 per year</td></tr><tr><td>Release suppression</td><td>0.85</td></tr><tr><td>Alarm sounds</td><td>0.99</td></tr><tr><td>Manual control measures activated</td><td>0.8</td></tr><tr><td>Failure detection</td><td>0.95</td></tr></table>
a. Using the data provided grow an event tree that shows the sequence of events following a process containment failure.
b. Calculate frequency of an uncontrolled release resulting from process containment failure.</td><td>10

10</td><td>CO2</td></tr>
<tr><td>Q 11</td><td>a) What is the philosophy of behavior based safety? How ‘ABC’ model is used to improve behaviors.
or
b) Heinrich’s theory have greatest impact on the practice of safety and have done the most harm. Discuss.</td><td>20</td><td>CO4
CO1</td></tr>
</table>

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SECTION A

S. No.		Marks	CO
Q 1	What do you understand by PDCA cycle?	4	CO1
Q 2	Describe the elements in 5W1H methodology.	4	CO2
Q 3	Define safety leadership.	4	CO4
Q 4	Outline various lagging and leading indicators used to measure safety performance	4	CO2
Q 5	Differentiate basic cause and immediate cause of an accident.	4	CO3

SECTION B

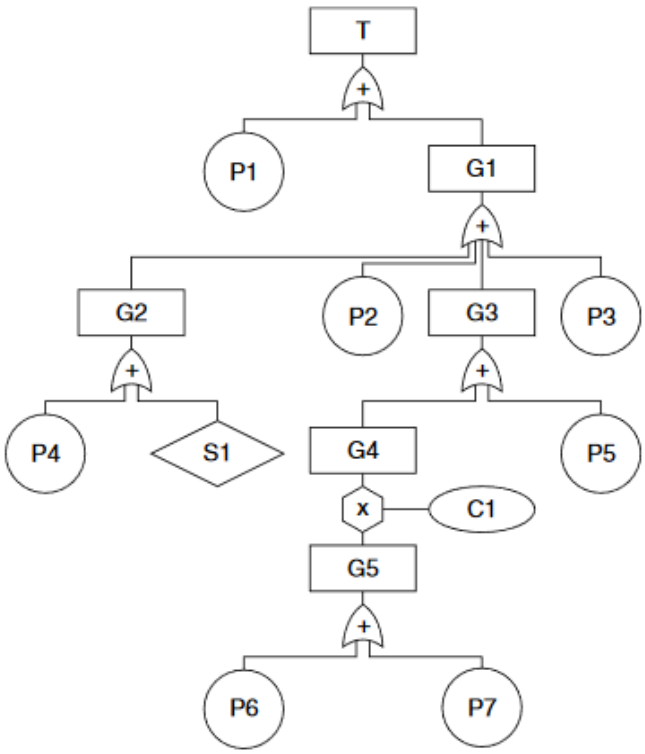
Q 6	What is safety culture? Explain different theories of leadership.	10	CO4
Q 7	List out the major changes made in ISO 45001:2018 compared to OHSAS 18001 Or What is Bradly -DuPont curve? Discuss the various stages in it.	10	CO1
Q 8	Average number of employees per day worked in Avnet Industries for the year 2017 is given below. Total working days during the year was 300 and average working hours for any employee was 8 hours. It is also reported that 1500 hours of overtime works were performed during the year.	10	CO2

Time period- 2016	Morning Shift	Night Shift
January to April	1000	1000
May to August	2000	1000
Sept to Dec.	1000	2000

The following are the injury statistics of the company for the year 2016

a) Number of fatalities - 3
b) Number of reportable accidents – 7

	c) Number of lost time accidents - 15 d) Number of first Aid injuries- 20 Calculate reportable accident and lost time injury frequency rates and incidence rates for the year 2017		
Q 9	What are the objectives of accident investigation? 'Every accident is a symptom of system failure'- Examine the statement.	**10**	**CO3**
	SECTION-C		
Q 10	a. Determine all the minimal cut sets for the following motor problem. b. Calculate the probability of occurrence of the top event for the above problem. Let T denote the top event P denote primary events (circles) G denote intermediate events (rectangles) S denote undeveloped events (diamonds) C denote conditioning events (ovals) [similar to and gate] .	**20**	**CO2**



Event	Description	Probability
P1	Defect in motor	0.01
P2	Wire failure (open)	0.01
P3	Power supply failure	0.01
P4	Switch fails open	0.01
P5	Fuse failure under normal conditions (open)	0.01
P6	Wire failure (shorted)	0.01
P7	Power failure (surge)	0.01
S1	Switch opened erroneously	0.001
C1	Fuse fails open	0.50

Q 11	A forklift skidded on an oil spill causing serious injury to a visitor a) You immediately reached the accident spot, explain how you are going to respond to this accident. b) Explain why this accident should be investigated. c) What are the different evidences that you will scrutinize to identify the root cause of this accident? Or What is the philosophy of behavior based safety? How 'ABC' model is used to improve behaviors.	**8** **4** **8** **20**	**CO3** **CO4**