

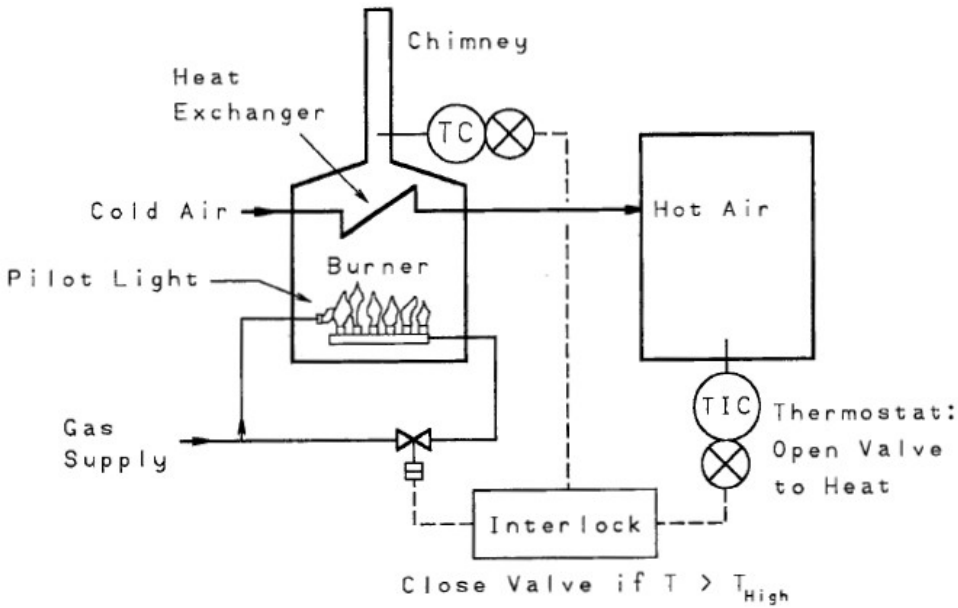
**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, April/May 2018**

**Course:** Hazard Identification, Risk analysis and Management  
**Semester:** 2  
**Program:** M.Tech HSE, DM  
**Time:** 03 hrs.

**Max. Marks: 100**

**Instructions:**

**SECTION A**

S. No.		Marks	CO
Q 1	Explain Consequence Modelling?	5	CO4
Q 2	Compare and Define ERPG, TEEL and AEGL?	5	CO2
Q 3	Explain Ground and Air burst with figure? What is explosion Efficiency?	5	CO2
Q 4	<p>A gas-fired furnace is shown in Figure. The hot combustion gases pass through a heat exchanger to heat fresh air for space heating. The gas flow is controlled by an electric solenoid valve connected to a thermostat. The gas is ignited by a pilot light flame. A high-temperature switch shuts off all gas in the event of high temperature in the fresh air plenum</p>  <p style="text-align: center;">Close Valve if <math>T &gt; T_{High}</math></p>	5	CO1
	<p>a) Determine the various ways in which this system can fail, leading to excessive heating of the plenum and possible fire.</p> <p>b) What type of valve (normally open or normally closed) is recommended for the gas supply?</p> <p>c) What is the most likely failure mode?</p>		

d) A problem can also arise because of failure of the pilot light, leading to combustible gases in the furnace, heat exchanger, and chimney. Suggest at least two ways to prevent this problem

**SECTION B**

Q 5 Draw fault tree for the following cases,  
 a) Road accident while driving a car,  
 b) Fire in HSE lab  
 c) Failure of a road transformer

10

CO5

Q 6 600 people are employed in JSW Steel to transfer coal dust from Building A to building B. On a fine morning a dust explosion happened in where 200 people are working. There is probability of 95 percent that the Explosion will result into fire. Fire detection system, Fire alarms and Sprinklers are being installed for safe purposes. These are the data of the working conditions of the safety functions. Assume that the fire alarm and Water sprinkler are dependent on signal from fire detectors. Draw a Event tree for the above cases with initiating event as Explosion. The probability of Explosion is 0.5/Year. Mark all pivotal events and find the frequency of all Outcomes arising due to initial event.

10

CO5

	Reliability of the Equipment given by manufacture
Fire detectors	Fails 1in 50 time of operation
Fire alarms	99 percent time gives alarm
Water Sprinkler System	Fails 1 in 200 times

Q 7 Explain the various types of Human error and mistake with one example each. Mention various ways to predict human error. Mention the various factors which human error depends on?

10

CO7

Q 8 Determine all the minimal cut sets for the following motor problem.

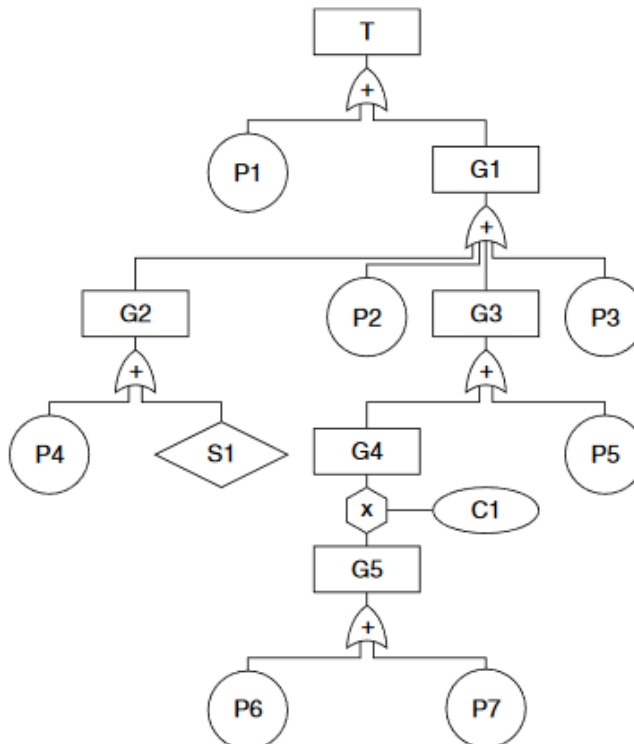
Calculate the probability of occurrence of the top event for the problem.

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]

.

10

CO5



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

### SECTION-C

Q 9

a) Mention the steps involved in HAZOP. Explain the following guidewords uses in HAZOP with an example , As well as, part of, other than, Later than and reverse.

B) Write about the three models that can be created using Dispersion. Explain about various parameters which affect the dispersion of toxic materials into atmosphere. Mention the various release mitigation steps during such dispersion. (3+5+2 marks)

OR

C) What is bow tie diagram? Explain escalation factor control, Escalation factor, Preventive barrier, Mitigation barrier and undesired event with an example?

**20**

**CO1**

Q 10

a) Assuming a lorry is carrying LPG from Chandigarh to Dehradun with flat Cylindrical shaped. During the course of transportation, the accident resulted in BLEVE and followed by Fire ball. The diameter of the cylinder is 3 meter with length of 5 meter. The longitudinal axis of the cylinder is laid in horizontal direction. The cylinder was filled with LPG up to 80 percent of its height. Calculate the maximum Diameter of Fireball, Fireball Combustion duration, Centre height of fireball, Initial Ground level Hemisphere diameter, Distance between ground and bottom surface

**20**

**CO4**

	<p>of maximum Diameter of Fireball. Following are the properties of LPG</p> <p>LPG is colorless. LPG has a low boiling point of - 6°C</p> <p>LPG has a narrow flammability range between 1.8 to 9.5% in air. Flash point of LPG is -60°C. Liquid LPG is half as heavy as water</p> <p>b) Create a bow tie for the undesired event “Failure of pressurized Ammonia Gas cylinder”</p>		
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<p><b>Name:</b></p> <p><b>Enrolment No:</b></p>	
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Q 4	Explain Preliminary Hazard Analysis with an Example?	5	CO1

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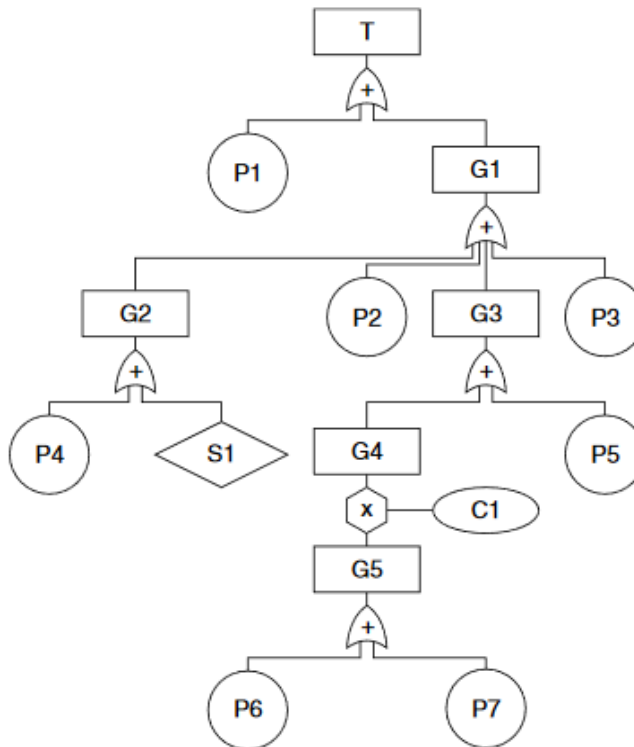
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