UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B. Tech. (Fire and Safety Engineering) **Semester – 7th**
Subject (Course): Hazard Identification & HAZOP **Max. Marks : 100**
Course Code : FSEG 421 **Duration : 3 Hrs**
No. of page/s:03

SECTION: A – ATTEMPT ALL QUESTIONS **(20 Marks)**

Q1. Explain the following briefly

a)HRA Process
b)HEART
c)SHERPA
d)HTA
e)TTA
f)HAZOP
g)SLOD
h)SLOT
i)THERP
j)Probit

SECTION: B – ATTEMPT ALL QUESTIONS **(4 * 10 = 40 Marks)**

Q2.Describe source modelling and types of material release.Consider a leak of benzene from 0.63 cm orifice-like hole in a pipeline. If the pressure (gauge) in the pipe is 8000 kgm^2/s^2, how much benzene would be spilled in 90 minutes? The density of benzene is 879 kg/m^3.

Q3.A lorry having capacity of 65000 kg met an accident while going from Delhi to Dehradun. The lorry was carrying gasoline. Due to this BLEVE occurred and followed by Fireball. Calculate the maximum Diameter of Fireball and time duration.

Q4.What is Probit and dose response function and what do they signify. An XYZ company reported the following data on the effect of explosion of peak overpressure of 84,300N/m^2 on eardrum rupture in humans. Given $Y=-15.6 + 1.93\ln P^{0,}$ where P^0 is the over peak pressure. Find out the Probit relations with percentage?

Table 2-4 Transformation from Percentages to Probits[1]

%	0	1	2	3	4	5	6	7	8	9
0	—	2.67	2.95	3.12	3.25	3.36	3.45	3.52	3.59	3.66
10	3.72	3.77	3.82	3.87	3.92	3.96	4.01	4.05	4.08	4.12
20	4.16	4.19	4.23	4.26	4.29	4.33	4.36	4.39	4.42	4.45
30	4.48	4.50	4.53	4.56	4.59	4.61	4.64	4.67	4.69	4.72
40	4.75	4.77	4.80	4.82	4.85	4.87	4.90	4.92	4.95	4.97
50	5.00	5.03	5.05	5.08	5.10	5.13	5.15	5.18	5.20	5.23
60	5.25	5.28	5.31	5.33	5.36	5.39	5.41	5.44	5.47	5.50
70	5.52	5.55	5.58	5.61	5.64	5.67	5.71	5.74	5.77	5.81
80	5.84	5.88	5.92	5.95	5.99	6.04	6.08	6.13	6.18	6.23
90	6.28	6.34	6.41	6.48	6.55	6.64	6.75	6.88	7.05	7.33
%	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
99	7.33	7.37	7.41	7.46	7.51	7.58	7.65	7.75	7.88	8.09

[1]D. J. Finney, *Probit Analysis,* (Cambridge: Cambridge University Press, 1971), p. 25. Reprinted by permission.

Q5.Write short notes on . (4 * 2.5= 10)

a) Reliability

b) Failure Probability

c)Dose response function

d) Bathtub Curve

SECTION: C – ATTEMPT ANY TWO QUESTIONS (2 * 20 = 40 Marks)

Q6.Describe the Plume models with examples. Find out the plume rise from a power plant having the below mention conditions. Given $u=u_{10} \times (z/z_{10})^{1.5}$, where u_{10} is the wind velocity at 10 meter height and u is the desired but unknown win speed, z is the height where wind speed is unknown and z_{10} is the height where wind speed at 10 meter.

Atmospheric Stability	D
Vs	19 m/s
Ds	3 m
$U_{10\,m}$	4 m/s
Ts	400 ^{o}K
Ta	283 ^{o}K
Stack Height	67 m

Q7. The storage tank system shown in Figure 11-18 is used to store process feedstock. Overfilling of storage tanks is a common problem in the process industries. To prevent overfilling, the storage tank is equipped with a high-level alarm and a high-level shutdown

system. The high-level shutdown system is connected to a solenoid valve that stops the flow of input stock.

a. Develop an event tree for this system using the "failure of level indicator" as the initiating Event. Given that the level indicator fails 4 times/lyr, estimate the number of Overflows expected per year. Use the following data:

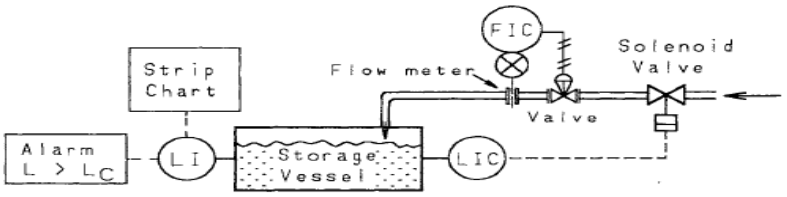

Figure 11-18 Level control system with alarm.

System	Failures/demand
High-level alarm	0.01
Operator stops flow	0.1
High-level switch system	0.01

b. Develop a fault tree for the top event of "storage tank overflows." Use the data of faults give above to estimate the failure probability of the top event and the expected number of occurrences per year. What are the most likely failure modes?

Q8.Explain in detail about Risk Assessment. What do you mean by Risk quantification and explain about LOPA and QRA with examples?

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Q1. Explain the following briefly

a)FMEA
b)HEART
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e)TTA
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g)SLOD
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SECTION: B – ATTEMPT ALL QUESTIONS **(4 * 10 = 40 Marks)**

Q2 Describe source modelling and types of material release .Consider a leak of benzene in a tank at a height of 10 meter from the top most level from a 0.67 cm orifice like hole. If the pressure (gauge) in the tank were 8000kgm^2/s^2, how much benzene would be spilled in 60 minutes? The density of benzene is 879kg/m^3.

Q3.A lorry having capacity of 65ooo kg met an accident while going from Delhi to Dehradun. The lorry was carrying gasoline. Due to this BLEVE occurred and followed by Fireball. Calculate the maximum Diameter of Fireball and time duration.

Q4.What is Probit and Dose response function and what does they signify .In an ABC company suppose there is spillage of gasoline and resulted in pool fire .Given K_1=-14.9, K2=2.56 .Assume the time of exposure as 60 minutes. What will be the fatality probability?

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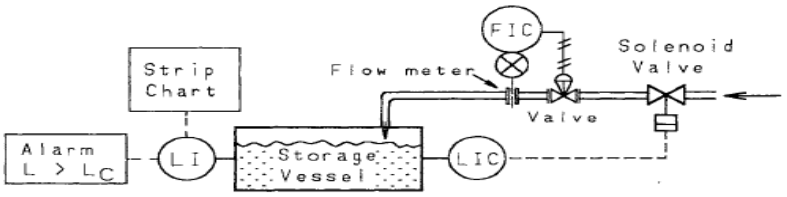

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