B.E. (Fire Engineering) Seventh Semester (C.B.S.)
Fire Risk Calculations

P. Pages : 3   **NRT/KS/19/3977**

Time : Three Hours   *0321*   Max. Marks : 80

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Notes :   1.   All questions carry marks as indicated.
          2.   Solve Question 1 OR Questions No. 2.
          3.   Solve Question 3 OR Questions No. 4.
          4.   Solve Question 5 OR Questions No. 6.
          5.   Solve Question 7 OR Questions No. 8.
          6.   Solve Question 9 OR Questions No. 10.
          7.   Solve Question 11 OR Questions No. 12.
          8.   Due credit will be given to neatness and adequate dimensions.
          9.   Assume suitable data whenever necessary.
          10. Diagrams and chemical equations should be given whenever necessary.
          11. Illustrate your answers whenever necessary with the help of neat sketches.
          12. Use of non programmable calculator is permitted.
          13. Use of statistical table is permitted.

1.   a)   What do you mean by risk assessment? Explain fire protection measures as fire barrier.   **6**

         b)   Describe point scheme method of Risk assessment with examples.   **7**

                                     OR

2.   a)   What is matrix method of Risk assessment? Explain it with the help of example.   **8**

         b)   Explain advantages and limitation of unstructured method and structured method of risk assessment.   **5**

3.   a)   The arrival rate of vehicles arriving at a toll gate follows Poisson distribution with a mean arrival rate of 50 vehicles per hour. Find the probability that: **7**
              a)   No vehicle will arrive in one hour.
              b)   Exactly 40 vehicles will arrive in one hour
              c)   At most 5 vehicle will arrive in one hour
              d)   At least 6 vehicle will arrive in one hour

         b)   Construct the probability mass function of   **6**
              a)   Tossing 2 coins   b)   Tossing 3 coins   c)   Rolling two dies
                                     OR

4.   a)   The power consumption (in lakhs of units) in a region is the function of the period of the day where period is defined as four - hours interval of day, as shown in table. Fit a regression model. $y = a + bx + cx^2$, for the given data. Also find NAD and MSE of the forecasting values-   **9**

Period (x)	Time interval	Power consumption (y)
1	Midnight - 4 a.m.	40
2	4 - 8 a.m.	60
3	8 a.m. - 12 noon	100
4	12 noon - 4 p.m.	70
5	4 - 8 p.m.	60
6	8 p.m. - 12 midnight	90

b) What are rank correlation and auto - correlation. **4**

5. a) Write ANOVA model and perform relevant test and state whether the interaction variation is significant in care of the following information concerning millage based on different brands of gasoline and cars? **10**

		Brands of Gasoline			
		w	x	y	z
CARS	A	13 11	12 10	12 11	11 13
	B	12 13	10 11	11 12	9 10
	C	14 13	11 10	13 14	10 8

b) The following table illustrates the sample psychological health ratings of corporate executives in the field of Banking, manufacturing and fashion retailing **6**

Banking	41	53	54	55	43
Manufacturing	45	51	48	43	39
Fashion retailing	34	44	46	45	51

can we consider the psychological health of corporate executives in the given three fields to be equal at 5% level of significance?

OR

6. a) Explain the term significance of level. **4**

b) Explain type - I error and type - II error with example. **5**

c) The number of days on which the sales exceeds the targeted sales in Retail shop - 1 as well as in Retail shop - 2 of a company follows binomial distribution. The sales manager feels that the performance of the Retail shop - 1 will exceed that of the Retail shop-2. To test his intuition, a sample of 110 days sales records of the Retail shop - 1 is taken and it is found that on 90 days, the sales exceeds the targeted sales. Similarly, a sample of 130 day's sales records of the Retail shop-2 is taken and it is found that on 112 days, the sales exceeded the targeted sales check the intuition of the sales manager at a significance level of 0.10. **7**

7. a) A large steel company has three options with regard to production: **8**
   i) Produce commercially
   ii) Build pilot plant
   iii) Stop producing steel
   The management has estimated that their pilot plant, if built, has 0.8 chance of high yield and 0.2 chance of low yield. If the pilot plant does show a high yield, management assigns a probability of 0.75 that the commercially plant will show high yield. If pilot plant shows low yield, there is only a 0.1 chance that the commercial plant will show a high yield finally, managements best assessment of the yield on a commercial size plant without building pilot plant first has 0.6 chance of high yield. A pilot plant will cost Rs.3,00,000. The profits earned under high and low yield conditions are Rs.1,20,00,000 and Rs.12,00,000 respectively. Find the optimum decision for the company.

b) A critical measuring instrument consists of two sub-systems connected in series sub-system A and B have reliabilities 0.90 and 0.92. Respectively, for certain operating time. If is necessary that the reliability of the instrument be raised to a minimum value of 0.917 by using parallel sub-systems of A alone. **8**
Determine the minimum number of unit of A that should be used with one B to get minimum reliability value of 0.917. What is the actual reliability value obtained? If we use two units of A and two units of B to achieve the desired result? What will be the system reliability in such a case?

OR

8. a) A vibration monitoring system consists of six sub-systems, all connected in series. The predicted reliabilities as obtained from an analysis are $R_1 = 0.993$, $R_2 = 0.996$, $R_3 = 0.998$, $R_4 = 0.997$, $R_5 = 0.987$ & $R_6 = 0.989$. Calculate the system reliability. If it is desired to increase the reliability by $3\frac{1}{3}\%$, determine the percentage by which the reliability of each sub-system should be increased. Assume an constant failure rates for all elements of sub-system. **8**

   b) Explain the following terms: **8**
      i) Markov process
      ii) Transition probabilities
      iii) Weibull Model
      iv) Linearly increasing Hazard

9. Explain various financial objectives which we consider during the risk assessment. **10**

OR

10. Discuss acceptance criteria of risk assessment. **10**

11. Write short notes on following. **12**
      i) Fire Risk Management.
      ii) Alternative fire safety design.
      iii) Techniques of risk assessment.

OR

12. a) Explain the impact of inspections and maintenance on system reliability. **6**

    b) Describe the impact of evacuation Drills on Early occupant response and evacuation. **6**

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