Total No. of Questions : 8] **SEAT No. :**

P4727

[Total No. of Pages : 3

[4760] - 51

M.E. (Civil) (Structure)

STRUCTURAL RELIABILITY

(2008 Pattern) (Elective - III) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 100***

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of calculator is allowed.***
6) ***Assume suitable data if necessary.***

SECTION - I

Q1) a) State and review critically the principal advantages of Probability Based Limit State Design Method over the Deterministic Methods of Design of Civil Engineering Structures. **[6]**

b) Enlist the sources of uncertainty in the reliability based structural analysis of reinforcing steel in RCC structures, brick masonry structures and explain in brief how those are accounted for in the analysis. **[6]**

c) Derive an expression for probability of failure for the case of load (S) and resistance (R) following the log normal distribution. **[5]**

Q2) a) Define the term 'Structural Reliability' with explanation of each significant element in that definition. **[6]**

b) From the statistical analysis of live load survey, it is found that live load follows the lognormal distribution with parameters _____. **[5]**

Median of live 1oad = 1217 N/m^2

Standard deviation of live load = 0.368

Determine the characteristic load for the probability of live load exceeding lifetime maximum live load being 0.05, if there is no change in tenancy during the lifetime of the building.

P.T.O.

c) Samples of soil are collected from various depths below ground level and tested in the laboratory to determine their shear strength. The collected field data are given below: **[5]**

Depth (m)	2	3	4	5	6	7
Shear strength (KN/m^2	14.8	20.3	32.2	39.0	42.0	56.4

Determine the sample covariance and correlation coefficient between the depth of the soil and its shear strength. What do you infer?

Q3) a) Derive the expressions for the reliability of a series system and a parallel redundant system. **[6]**

b) Derive the expression for 'Reliability Index' for the case of load (S) and resistance (R) following normal distribution. **[6]**

c) It is given that the ratio of the mean value of the cube strength of M15 Concrete (design mix) to its characteristic strength is 1.4 and the coefficient of variation of the strength of concrete is 0.18.Determine the allowable stress for the probability of failure of concrete equal to 0.001 and coefficient K value equal to (–3.091) for the given probability. **[5]**

Q4) a) Explain the formulation of probability model for wind load along with the various variables involved. **[6]**

b) Enlist the sources of uncertainty contributing the variation in the strength of concrete. Briefly explain Chi-Square Test to be applied while selecting a probabilistic model fit to the given data. **[5]**

c) What is meant by the Lifetime Maximum Sustained Load? Enumerate the assumptions used in the stochastic analysis of it. **[5]**

SECTION - II

Q5) a) Explain the Inverse Transformation Technique and derive expression for generating random deviates of y having Uniform Distribution. **[6]**

b) Write note on Applications of Monte Carlo Method. **[6]**

c) Explain the procedure stepwise to generate normal variants from the distribution of Y following the normal distribution with mean u and variance s^2. **[5]**

Q6) a) Explain Monte Carlo Method with respect to its objective and procedural steps? **[6]**

b) What is meant by Safety Checking Formats for a design code? Explain in brief CEB & LRFD formats. **[5]**

c) Explain how the system reliability concept can be extended for decision making with design risk. **[5]**

Q7) a) Explain stepwise procedure to determine partial safety factors for the given reliability index. **[6]**

b) Explain in brief the steps involved in the development of reliability based design criteria. **[6]**

c) Write short note on Reliability based design criteria for RCC beams in limit state of collapse calibrated in IS code. Comment on the observations and conclusion on safety factors. **[5]**

Q8) a) Explain how to analyze the risk associated with a decision. **[6]**

b) Write short note on decision tree analysis. **[5]**

c) Comment on how the statistical tools can be used for improving the managerial decisions with calculated desired risk. **[5]**