Total No. of Questions : 8]

SEAT No. :

P5109

[Total No. of Pages : 3

[4960]-50

M. E. (Civil) (Structure)

STRUCTURAL RELIABILITY

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

Time : 4 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer book.***
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) Compare 'Discrete Variables' and 'Continuous Variables' in pretext of their probability laws and simple illustrative examples. **[6]**

b) The cube strength of concrete, X, follows the normal distribution with the mean and the standard deviation values as 25 N/mm^2 and 5 N/mm^2 respectively. Calculate the probability of getting a value for strength less than 20 N/mm^2. **[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) Compare critically the conventional methods of structural design with respect to evaluation of safety. **[6]**

b) The test results of the cube strength and cylinder strength of seven batches of concrete laid in footings in a day on a construction site are given below : **[5]**

Sr. No. of Batch	1	2	3	4	5	6	7
Cube Strength (N/mm^2)	22.07	19.07	24.55	22.39	19.97	18.02	15.75
Cylinder Strength (N/mm^2)	14.25	12.02	15.30	14.55	12.25	11.47	10.05

Determine the sample covariance and correlation coefficient between cube strength and cylinder strength of concrete.

P.T.O.

c) What is meant by 'Structural Reliability'? Explain every important term in the definition. **[5]**

Q3) a) Write short note on application of "Chi-Square Test". **[6]**

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

c) Derive the expressions for the reliability of a series system and a parallel redundant system. **[5]**

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

b) The axial load carrying capacity of a column, R, in normally distributed with mean valve and standard deviation of R being 100KN and 200KN respectively. The column is subjected to an axial load, S, which is normally distributed with mean valve and standard deviation of S being 700KN and 300KN respectively. **[5]**

c) Explain the term "Lifetime Maximum Sustained Load"? Enlist the underlying assumptions in its stochastic analysis. **[5]**

SECTION - II

Q5) a) Write short note on Monte Carlo Method with respect to its objective and procedural steps? **[6]**

b) How to generate normal variates from the distribution of Y following the normal distribution. **[6]**

c) Write a short note on decision models with designed risk level. **[5]**

Q6) a) Derive the expression for generating log normal variates from the distribution of Y following the lognormal distribution with median of Y (i.e. $\hat{Y}$) and standard deviation of lognormal Y (i.e.σ_{lny}). **[6]**

b) Explain Safety Checking Formats used for a design code? **[5]**

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

Q7) a) Derive the expression for partial safety factors specified with respect to the mean values of random variables in the reliability based design of Civil Engineering Structures. **[6]**

b) Short note on the development of reliability based design criteria. **[6]**

c) Explain Reliability based design criteria for RCC Structures. **[5]**

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

b) Explain the steps in the development of a reliability based design criteria, to determine the revised partial safety factors for RCC design, as an improvement over the provisions specified in IS : 456. **[5]**

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