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BICEE-020

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00613

June, 2018

BICEE-020 : RELIABILITY AND OPTIMIZATION OF STRUCTURES

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. Solve the following L.P.P. by Simplex method : *10*

Maximize $z = 3x_1 + 2x_2$

subject to

$$-2x_1 + x_2 \leq 1$$

$$x_1 \leq 2$$

$$x_1 + x_2 \leq 3$$

$$x_1, x_2 \geq 0$$

2. What is the general definition of Reliability Index ? Write a short note on first-order second-moment method. *10*

3. A company manufactures three products. Each product has to pass through three different operations. The time each product takes in each operation is shown in the following table. The table also gives the maximum time for which an operation can work. The profit per item sold is also shown there. Assume that all items manufactured are sold. Formulate this as an LPP to maximize the profit. *10*

Operations	Product 1	Product 2	Product 3	Operations capacity (minutes/day)
1	1	0	1	480
2	0	3	2	500
3	2	4	0	360
Profit/Unit ₹	4	3	6	

4. (a) The first four moments of distribution about x = 4 are 1, 4, 10, and 45. Obtain the mean, variance, skewness and kurtosis of the distribution.

(b) Give the definition of basic solution and basic feasible solution. *6+4*

5. A doctor is to visit a patient. From the past experience, it is known that the probabilities that he will come by train, bus, scooter or by other means of transport are respectively $\frac{3}{10}$, $\frac{1}{5}$, $\frac{1}{10}$ and $\frac{2}{5}$. The probabilities that he will be late are $\frac{1}{4}$, $\frac{1}{3}$ and $\frac{1}{12}$ if he comes by train, bus and scooter respectively, but if he comes by other means of transport, then he will not be late. When he arrives, he is late. What is the probability that he comes by train ? *10*

6. How are the structure reliability methods classified ? What are the necessary steps to apply the Monte Carlo technique to structure reliability problems ? *10*

7. (a) A can solve 90 percent of the problems given in a book and B can solve 70 percent. What is the probability that at least one of them will solve a problem selected at random ?

   (b) Show that Poisson distribution is a limiting case of binomial distribution. *3+7*

8. What are conjugate directions ? Use the Conjugate Gradient method to minimize *10*

$f(x_1, x_2) = 3x_1^2 - 4x_1x_2 + 2x_2^2 + 4x_1 + 6, (x_1, x_2) \in R^2$.

9. Use Dual Simplex method to solve the following L.P.P. *10*

Minimize $z = x_1 + 2x_2 + 3x_3$

subject to the constraints

$$2x_1 - x_2 + x_3 \geq 4$$

$$x_1 + x_2 + 2x_3 \leq 8$$

$$x_2 - x_3 \geq 2$$

$$x_1, x_2, x_3 \geq 0$$

10. (a) Find the mean and variance of binomial distribution.

(b) Assume mean height of soldiers to be 68·22 inches with a variance of 10·8 inches square. How many soldiers in a regiment of 1,000 would you expect to be over 6 feet tall, given that the area under the standard normal curve between z = 0 and z = 0·35 is 0·1368 and between z = 0 and z = 1·15 is 0·3746 ? *4+6*
