

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

December, 2016

00983

**BICEE-020 : RELIABILITY AND OPTIMIZATION OF
STRUCTURES**

Time : 3 hours

Maximum Marks : 70

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

1. India plays two matches each with South Africa and Australia. In any match the probability of India getting points 0, 1 and 2 are 0.45, 0.05 and 0.50 respectively. Assuming that the outcomes are independent, find the probability of India getting at least 7 points. 7

2. A box contains 2 black, 4 white and 3 red balls. One ball is drawn at a time randomly from the box till all the balls are drawn from it. Find the probability that the balls drawn are in the sequence of 2 black, 4 white and 3 red. 7

3. A factory manufacturing televisions has four units a, b, c and d. The units a, b, c and d manufacture 15%, 20%, 30% and 35% of the total output respectively. It was found that out of their output, 1%, 2%, 2% and 3% respectively are defective. A television is chosen at random from the total output, and found to be defective. What is the probability that it came from unit d ?

7

4. In a certain factory producing cycle tyres, there is a small chance of 1 in 500 tyres to be defective. The tyres are supplied in lots of 10. Using Poisson distribution, calculate the approximate number of lots containing no defective, one defective and two defective tyres, respectively, in a consignment of 10,000 lots.

7

5. Differentiate between Hasofer's and Lind's methods.

7

6. Find the coefficient of correlation for the following table :

7

x	y
10	18
14	12
18	24
22	6
26	30
30	36

7. A production line comprises machines A, B and C with reliabilities of 0.99, 0.96 and 0.93 respectively. The machines are arranged so that if one breaks down, the others must shut down. Engineers are thinking two alternative designs for increasing the line's reliability.

Plan 1 involves adding an identical back-up line, and Plan 2 involves providing a back-up for each machine. In either case, three machines (A, B and C) would be used with reliabilities equal to the original three.

- (a) Which plan will provide the higher reliability?
- (b) Explain why the two reliabilities are not the same.

7

8. An appliance manufacturer produces two models of microwave ovens, H and W. Both models require fabrication and assembly work : each H uses four hours of fabrication and two hours of assembly, and each W uses two hours of fabrication and six hours of assembly. There are 600 fabrication hours and 480 hours of assembly are available this week. Each H contributes ₹ 400 to profits and each W contributes ₹ 300 to profits. What mix of H and W will maximize the profits?

7

9. Use the simplex method to solve the following linear programming problem : 7

Minimize $z = 21x_1 + 18x_2$

subject to $5x_1 + 10x_2 \geq 100$

$$2x_1 + x_2 \geq 10$$

$$x_1, x_2 \geq 0.$$

10. Explain with suitable examples the Monte Carlo method for solving the theoretical problems. 7

11. What are the various design variables used in the formulation of optimization of structures ? Also discuss the formulation of any one optimization problem. 7

12. Write short notes on any *two* of the following : $2 \times 3 \frac{1}{2} = 7$

- (a) Uncertainties in Reliability Assessment
 - (b) First Order Second Moment (FOSM) Method
 - (c) Quasi-Newton Method
-