

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

June, 2016

00276

**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. A concrete mixer machine contains a component 'C' that is vital to its operation. The reliability of component 'C' is 80%. To improve the reliability of a machine, a similar component is used in parallel to form a system. The concrete mixer machine will work provided that one of these components functions correctly. Calculate the reliability of the machine. 7

2. A problem of structural design is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$, respectively. What is the probability that the problem will be solved? 7

3. In a bolt factory, machines A, B and C manufacture 25%, 35% and 40% of the total output, respectively. Of their outputs, 5%, 4% and 2% are defective bolts. A bolt is chosen at random and found to be defective. What will be the probability that the bolt came from machine A, B or C ?

7

4. If 20% of the bolts produced by a machine are defective, determine the probability that out of 4 bolts chosen at random (a) 1, (b) 0, and (c) at most 2 bolts, will be defective.

7

5. Describe any two methods of computing structural reliability.

7

6. Find the coefficient of correlation for the following values of x and y :

7

x	y
1	2
2	5
3	3
4	8
5	7

7. The guidance system of a ship is controlled by a computer that has three major modules. In order for the computer to function properly, all three modules must function. Two of the modules have reliabilities of 0.95 and the other has a reliability of 0.99.

- (a) What is the reliability of the computer ?
- (b) A backup computer identical to the one being used will be installed to improve the overall reliability. Assuming the new computer automatically functions if the main one fails, determine the resulting reliability.

7

8. Explain Monte Carlo methods and give the situation where these methods are useful.

7

9. Explain design variables and design constraints in respect of optimization problem with suitable examples.

7

10. Solve the following linear programming problem using graphical method :

7

Minimize $z = 20x_1 + 10x_2$

subject to $x_1 + 2x_2 \leq 40$

$$3x_1 + x_2 \geq 30$$

$$4x_1 + 3x_2 \geq 60$$

$$x_1, x_2 \geq 0.$$

11. Solve by Simplex method the following linear programming problem :

7

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

subject to $3x_1 - x_2 + 2x_3 \leq 7$

$$2x_1 + 4x_2 \geq -12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

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

12. Explain unimodal functions with suitable examples. Also discuss in brief the Quasi-Newton method.

7