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BICEE-020

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00344

June, 2017

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 problem in statistics is given to five students A, B, C, D and E. Their chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{6}$. What is the probability that the problem will be solved ? 7

2. Find the expected value and variance of the following probability distribution : 7

x :	– 10	– 20	30	75	80
p(x) :	$\frac{1}{5}$	$\frac{3}{20}$	$\frac{1}{2}$	$\frac{1}{10}$	$\frac{1}{20}$

3. A manufacturer of pins knows that on an average 5% of his products are defective. He sells pins in boxes of 100, and guarantees that not more than 4 pins will be defective.

   (a) What is the probability that a box will meet the guaranteed quality ?

   (b) What is the probability that a box will fail to meet the guaranteed quality ?

   Given $e^{-5} = 0{\cdot}0067$. 7

4. Explain design variables and design constraints in respect of optimization problem with suitable examples. 7

5. Determine the maximum and minimum values of the function $f(x) = 12x^5 - 45x^4 + 40x^3 + 5$. 7

6. Find the maximum of the function

   $$f(x) = 2x_1 + x_2 + 10$$

   subject to $g(x) = x_1 + 2x_2^2 = 3$

   using the Lagrange multiplier method. Also find the effect of changing the right hand side of the constraint on the optimum value of f. 7

7. Solve by conjugate gradient method : 7

   Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$

   starting from the point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$.

8. Solve by dual simplex method the following LPP : 7

Minimize $f = 20x_1 + 16x_2$

subject to $x_1 \geq 2{\cdot}5$

$x_2 \geq 6$

$2x_1 + x_2 \geq 17$

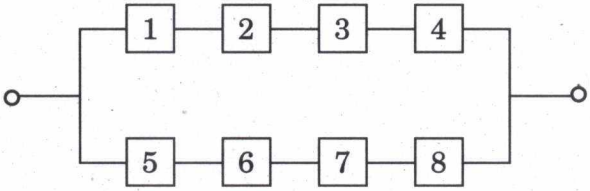
$x_1 + x_2 \geq 12$

$x_1 \geq 0, x_2 \geq 0$

9. Explain unimodal functions with suitable examples. Also discuss in brief the steepest descent method. 7

10. Explain Monte Carlo methods and give the situations where these methods are useful. 7

11. Derive a general expression for the reliability of the modal shown in the following figure and hence evaluate the system reliability if all components have a reliability of 0·9. 7



12. Explain the Hasofer-Lind method briefly. 7