B.TECH. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00398

December, 2013

BICEE-020 : RELIABILITY AND OPTIMIZATION OF STRUCTURES

Time : 3 hours   *Maximum Marks : 70*

Note :   *(i)*   *All answers to be written in **english** only.*

   (ii) *Attempt **any seven** questions out of **ten**.*

   (iii) *Programmable calculators are **not** allowed.*

1. (a) What do you understand by conditional   4
         probability? Examine the validity of the
         following statement :

         If $P(A/B) = P(A)$, then events A and B are
         independent?

    (b) The probability that a contractor will get a   6
         plumbing contract is 2/3 , and the
         probability that he will not get an electric
         contract is 5/9. If the probability of getting
         at least one contract is 4/5 , what is the
         probability that he will get both the
         contract?

2. (a) For two events A and B , prove that   4
 $P(A \cup B) \leq P(A) + P(B)$

(b) In a railway reservation office, two clerks **6** are engaged in checking reservation forms. On an average , the first clerk checks 55% of the forms, while the second does the remaining. The first clerk has an error rate of 0.03 and second has an error rate of 0.02. A reservation form is selected at random from the total number of forms checked during a day , and is found to have an error. Find the probability that it was checked

    (i)   by the first clerk

    (ii)   by the second clerk

3. (a) State conditions under which Binomial **3** probability function tends to behave like probability function of Poisson distribution.

   (b) State the characteristics of Normal **2** distribution curve.

   (c) The mean and standard deviation of the **5** wages of 6,000 workers engaged in a factory are Rs. 1200 and Rs. 400 respectively. Assuming the distribution to be normal , estimate the percentage of workers getting wages above Rs. 1600. (Note : use normal distribution table).

4. (a) What do you understand by linear **2** programming problem ?

   (b) Explain objective function and design space **2** in optimization problem.

   (c) Find the dimensions of a box of largest **6** volume that can be inscribed in a sphere of unit radius.

5. The Winframe company is a company with only **10** three employees which makes two different kinds of hand-crafted window : a wood - framed and an aluminum - framed window. They earn Rs. 3000 profit for each wood framed window and Rs. 1500 profit for each aluminum - framed window. Rajesh makes the wood frame, and can make 6 per day while Vijay makes 4 aluminum frame per day. Sanjay forms and cuts glass, and can make 48 square feet of glass. Each aluminum-framed window uses 8 square feet of glass and each wood-framed window uses 6 square feet of glass.

Formulate a linear programming problem with the objective of maximizing profit.

6. (a) State the various methods available for **3** solving a multivariable optimization problem with equality constraints.

(b) Consider the following problem : **7**
Minimize $f(x_1, x_2) = (x_1 - 1)^2 + x_2^2$
Subject to,

$$g_1(x_1, x_2) = x_1^3 - 2x_2 \leq 0$$
$$g_2(x_1, x_2) = x_1^3 - 2x_2 \leq 0$$

Determine whether the constraint qualification and the Kuhn - Trucker conditions are satisfied at the optimum point.

7. (a) What do you mean by slack variable and **2** surplus variable in linear programming problem ? Why are they used?

(b) State any four applications of simplex **2** method.

(c)   Solve the following problem using dual   6
      simplex method :
      minimize $Z = 20x_1 + 16x_2$
      subject to, $x_1 \geqslant 2.5$
                   $x_2 \geqslant 6$
                   $2x_1 + x_2 \geqslant 17$
                   $x_1 + x_2 \geqslant 12$
                   $x_1 \geqslant 0,\ x_2 \geqslant 0$

8.   (a)   Give three reasons why the study of   3
           unconstrained minimization methods is
           important ?
     (b)   State the iterative approach used in   4
           unconstrained optimization.
     (c)   Describe briefly quasi - Newton method.   3

9.   (a)   List different Random search methods in   3
           unconstrained optimization problem ?
     (b)   State the iterative approach used in   7
           univariate method ?

10. (a)   Write short notes on any two of the   4
           following :
           (i)   Monte Carlo method
           (ii)   Level 2 reliability methods
           (iii) First order Second Moment Method
                  (FOSM)
     (b)   A system consists of eight different   6
           components as shown in the following
           figure.
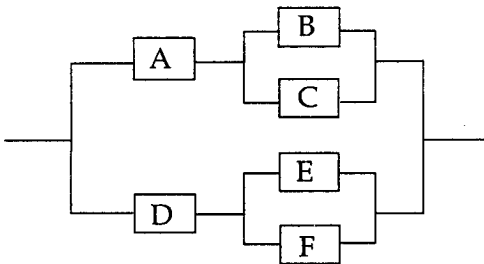
Assuming the exponential model and that the reliabilities are given for 10 hours of operation. The failure rates of all eight components (in failure per thousand hours) are given below.

Components	A	B	C	D	E	F	G	H
Failure rate	5.1	1.0	35.7	35.7	35.7	28.8	28.8	10.5

Find the Mean Time to Failure (MTTF).

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