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BICEE-020

B.Tech. IN CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00455

December, 2014

BICEE-020 : RELIABILITY AND OPTIMIZATION OF STRUCTURES

Time : 3 hours *Maximum Marks : 70*

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

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1. (a) State Bayes' Theorem and express it in mathematical form. *3*

(b) Discuss de Morgan's rule in brief. *3*

(c) A person has undertaken a construction job. The probabilities are 0·65 that there will be a strike, 0·80 that the construction job will be completed on time if there is no strike, and 0·32 that the construction job will be completed on time if there is a strike. Determine the probability that the construction job will be completed on time. *8*

2. (a) Explain the terms Normal distribution, Standard Normal distribution and Poisson distribution. *6*

(b) A car manufacturing factory has two plants, X and Y. Plant X manufactures 70% of cars and plant Y manufactures 30%. 80% of the cars at plant X and 90% of the cars at plant Y are rated of standard quality. What is the probability that a standard car has come from plant X ? *8*

3. (a) Write down the mathematical expression of probability function of Binomial distribution. State various conditions under which Binomial distribution is valid. *4*

(b) Four balls are to be drawn without replacement from a box containing 8 red and 4 white balls. If X denotes the number of red balls drawn, find the probability of X. *8*

(c) Explain the terms gamma distribution and extreme value distribution. *2*

4. (a) Explain the Conjugate Gradient method in brief. *4*

(b) Use the Conjugate Gradient method to solve the following problem : *10*

Minimize

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

from the point $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$.

5. (a) Explain the Steepest Descent method with suitable example. *4*

(b) Find the minimum of the function

$$f(\lambda) = 0{\cdot}65 - \frac{0{\cdot}75}{1 + \lambda^2} - 0{\cdot}65\ \lambda\ \tan^{-1}\left(\frac{1}{\lambda}\right)$$

using quasi-Newton method with starting point $\lambda_1 = 0{\cdot}1$ and step size $\Delta\lambda = 0{\cdot}01$ in central difference formulas. Use $\varepsilon = 0{\cdot}01$ in

$$|\, f'(\lambda_{i+1})\, | = \left| \frac{f(\lambda_{(i+1)} + \Delta\lambda) - f(\lambda_{i+1} - \Delta\lambda)}{2\,\Delta\lambda} \right| \le \varepsilon$$

for checking the convergence. *10*

6. (a) Minimize

$f = 20x_1 + 16x_2$ using Dual Simplex method subject to

$x_1 \ge 2{\cdot}5$

$x_2 \ge 6$

$2x_1 + x_2 \ge 17$

$x_1 + x_2 \ge 12$

$x_1 \ge 0,\ x_2 \ge 0$ *8*

(b) Explain the objective function and design space with respect to optimization problem with suitable examples. *6*

8. Write short notes on any ***four*** the following : $4 \times 3\frac{1}{2} = 14$

(a) Monte Carlo Method

(b) Hasofer and Lind Method

(c) Series and Parallel Systems

(d) Uncertainties in Reliability Assessment

(e) First Order Second Moment Method (FOSM)