6E3054

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B.Tech VI Sem. (Back) Exam. April- May 2012
Mechanical Engg.
6ME6 Numerical Methods and Applied Statistics

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five questions,** selecting one question from **each unit.** All Question carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clerly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1.**Probability Distribution Tables** 2. _____**Nil**_____

Unit-I

1. (a) Find linear and quadratic Taylor polynomial approximations to $f(x) = \sqrt[3]{x}$ about the point a = 8. Bound the error in each of your approximations on the interval $8 \le x \le 8+8$ with $\delta > 0$. Obtain an actual numerical bound an the interval [8, 8.1] 8

(b) Find the real roots of the equation log x – Cos x = 0 by Newton – Raphson's method 8

Or

1. (a) The function f(x) = Cos x can be expanded as

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots.$$

Compute the number of terms required to estimate Cos (π/4) so that the result is correct to at least two significant digits. 8

(b) Using Bisection method, find a real root of the equation

$f(x) = 3x - \sqrt{1 + \sin x} = 0$ 8

Unit-II

2. (a) By Gauss's elimination method solve:

$x + 2y + z = 3$

$2x + 3y + 3z = 10$

$3x - y + 2z = 13$

(b) With usual notation prove that

$$\Delta^n\left(\frac{1}{x}\right) = (-1)^n \frac{n!\,h^n}{x(x+h)\ldots\ldots(x+nh)}$$ 8

Or

2. (a) Apply Bessel's formula to obtain y_{25} given that

$Y_{20} = 2854$, $Y_{24} = 3162$, $Y_{28} = 3544$, $Y_{32} = 3992$ 8

(b) Find the third divided difference with arguments 2, 4, 9, 10 of the function $f(x) = x^3 - 2x$ 8

Unit - III

3. (a) Calculate the value of the integral

$$\int_4^{5.2} \log x \, dx$$

(b) Using Adams-Bash forth method, find

$y(1.4)$ given $y^1 = x^2(1+y)$

$y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$

$y(1.3) = 1.979$ 8

Or

3. Solve the initial value problem $u' = -2t\,u^2$, $u(0) = 1$ with $h = 0.2$ on the interval [0,0.4] Use Range – Kutta fourth order method and compare your result with exact solution. 16

Unit - IV

4. The probability distribution of a random variable X in given by

$P_x(x) = 1/2 \quad x = 0$

$= 1/4 \quad x = 1$

$= 1/8 \quad x = 2$

$= 1/8 \quad x = 3$

$= 0 \quad$ other wise.

(a) Determine the mean and variance of X from the moment generating function.

(b) If $y = (X - 2)^2$ find the CDF for y.

Or

4. Assume $X_1, X_2, \ldots\ldots, X_9$ is a randam sample of a normal randam variable X with unknown mean μ and variance $\sigma^2 = 1$

(a) Evaluate $P(|x - \mu| \leq ½)$

(b) Evaluate $P(|\bar{x} - \mu| \leq ½)$ [2x8]

Unit-V

5. If T has a t-distribution with 8 degrees of freedom find 16

(a) $P(T \geq 1)$

(b) $P(T \leq 2)$

(c) $P(-1 < T < 1)$

Or

5. A screw manufacturer is interested in giving out data to his customers on the relation between nominal and actual lengths. The following resets (in which) were observed.

Nominal x	Actual y		
¼	0.262	0.262	0.245
½	0.496	0.512	0.490
¾	0.743	0.744	0.751
1	0.976	1.010	1.004
1¼	1.265	1.254	1.252
1½	1.498	1.518	1.504
1¾	1.738	1.759	1.750
2	2.005	1.992	1.992

(b) (i) Estimate the regression coefficient.

(ii) Estimate the variance involved in manufacturing a screw.

(iii) For a large set of nominal 1 inch screws, find a 90% confidence interval for the average length.

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