

Total number of printed pages – 7 B. Tech
BSCM 2202

Fourth Semester Examination – 2008

MATHEMATICS – IV

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory
and any **five** from the rest.*

*The figures in the right-hand margin
indicate marks.*

1. Answer the following questions : 2×10
- (a) State the rules of rounding off a decimal number.
 - (b) Explain the order of convergence of an iteration process.
 - (c) What is ill conditioning of a system of linear equations ? Explain.



- (d) What is the geometrical interpretation of Secant method to solve an equation ?
- (e) What do you mean by basic feasible solution and degenerate feasible solution ?
- (f) What is a standard random variable ? What are the mean and standard deviation of a standard random variable ?
- (g) State the conditions under which an experiment will involve Poisson distribution.
- (h) What is the idea of the maximum likelihood method in estimating a parameter ? Why do you say likelihood rather than probability ?
- (i) What are the different types of errors we encounter in testing a hypothesis ?
- (j) What do you mean by one-tail and two-tail testing ? Give one example in each case.

2. (a) Find a solution of the equation $x^4 - x - 0.12 = 0$ by using fixed point iteration method, correct up to three decimal places. You can take the initial solution $x_0 = 1$. 5

(b) Describe Lagrange Interpolation technique and find the value of $f(0)$ for the given data : 5

x :	-2	-1	2	4	5
f(x) :	-9	-1	11	23	69

3. (a) Evaluate the value of the following integral by using Simpson's 1/3 rule with 10 equal subintervals 5

$$\int_0^1 \frac{dx}{1+x^2}$$

(b) Evaluate the following integral by Gauss integration with number of subintervals $n = 5$. 5

$$\int_0^1 \cos x^2 dx$$

4. (a) Using Gauss-Seidel iteration method solve the following system of linear equations correct up to three decimal places.

$$6x_1 + 15x_2 + 2x_3 = 72$$

$$x_1 + x_2 + 54x_3 = 110$$

$$27x_1 + 6x_2 - x_3 = 85 \quad 5$$

(b) Compute $y(0.1)$ and $y(0.2)$ by using Runge-Kutta method of fourth order for the following differential equation 5

$$\frac{dy}{dx} = xy + y^2, \quad y(0) = 1$$

5. (a) What is the basic idea of Linear Programming Problems and their solutions? What are slack and artificial variables and why do you introduce them? 5

(b) A batch of 200 iron rods consists of 50 oversized rods, 50 undersized rods and 100 rods of desired length. If two rods are drawn at random without replacement,

what is the probability of obtaining (i) two rods of desired length (ii) exactly one of the desired length (iii) none of the desired length. 5

6. (a) Let X be the random variable denoting the ratio of sales to profits of some firm. Assume that X has the distribution function

$$F(x) = \begin{cases} 0 & \text{if } x < 2 \\ (x^2 - 4)/5 & \text{if } 2 \leq x < 3 \\ 1 & \text{if } x \geq 3 \end{cases}$$

Find the density function of X . Also find the probability that X lies between 20% to 40% profit range. 5

- (b) Suppose that in the production of 60-ohm radio resistors, non-defective items are those that have a resistance between 58 and 62 ohms and the probability of a resistor's being defective is 0.1%. The resistors are sold in lots of 200, with the

guarantee that all resistors are non-defective. Find the probability that a given lot will violate this guarantee. 5

7. (a) The copper content (%) in brass of 10 samples are given below 5

65, 65, 64, 63, 65, 66, 63, 64, 62, 63

Assuming that the population from which the above samples are drawn is normal, determine a 99% confidence interval for the mean of the population.

Given that

$\Phi(z)$:	0.9	0.95	0.975	0.99	0.995
z :	1.282	1.645	1.960	2.326	2.576

- (b) If a sample of 2 tyres of a certain kind has mean life of 35000 miles and a standard deviation of 5000 miles, can the manufacturer claim that the true mean life of such tyres is greater than 35000 miles ?

Set up and test a corresponding hypothesis at the 5% level, assuming normality.

Given that 5

$\Phi(z)$: 0.9 0.95 0.975 0.99 0.995

z : 1.282 1.645 1.960 2.326 2.576

8. (a) Find the regression line of y (expansion of gelatin [%]) on x (humidity of air [%]) using the following data : 5

$(x, y) = (10, 0.8), (20, 1.6), (30, 2.3), (40, 2.8)$

- (b) What do you mean by point and interval estimation? Find the maximum likelihood estimate of θ in the density $f(x) = \theta e^{-\theta x}$ if $x \geq 0$ and $f(x) = 0$ if $x < 0$. 5
