B.TECH /AEIE/ ECE/IT/3RD SEM/ MATH 2002/2017
NUMERICAL AND STATISTICAL METHODS
(MATH 2002)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) If $y = f(x)$ be defined at (n+1) distinct interpolating points, the degree of the Lagrangian function is
(a) at least n (b) at most n (c) n+1 (d) n.

(ii) $(\Delta - \nabla)x^2$ is equal to (the notations have their usual meanings)
(a) h^2 (b) $-2h^2$ (c) $2h^2$ (d) $-h^2$.

(iii) In the Gauss Elimination method, the given system of equations represented by $AX = B$ is converted to another system $UX = Y$, where U is
(a) diagonal matrix (b) upper triangular matrix
(c) identity matrix (d) null matrix.

(iv) The maximum and minimum values for correlation coefficient are
(a) 1, 0 (b) 2, 1 (c) 0, -1 (d) 1,-1.

(v) A continuous random variable X has a probability density function $f(x) = e^{-x}, 0 < x < \infty$, then $P(X > 1)$ is
(a) 0.368 (b) 0.5 (c) 0.632 (d) 1.0.

(vi) A random variable X has the following probability density function
$$f(x) = \begin{cases} 1, & 0 \le x < 1 \\ 0, & otherwise \end{cases}$$
Then the value of $Var(3-4X)$ is
(a) 3/4 (b) 3/2 (c) 4/3 (d) 1/2.

(vii) An unbiased coin is tossed 5 times. The probability of getting at least one head is
(a) 1/32 (b) 13/32 (c) 16/32 (d) 1/2.

(viii) If $x+3y-7=0$ and variance of y is 25, then the standard deviation of x is
(a) 15 (b) 18 (c) -15 (d) 12.

(ix) If $\frac{dy}{dx} = x+y$ and $y(1)=0$, then $y(1.1)$ according to Euler's method is $[h = 0.1]$
(a) 0.1 (b) 0.3 (c) 0.5 (d) 0.9.

(x) In Trapezoidal rule , portion of the curve is replaced by
(a) a straight line (b) circular path
(c) parabolic path (d) elliptic path.

Group – B

2. (a) Use Newton Raphson method to find the value of $\sqrt[7]{111}$ correct upto four significant figures.

(b) Use Gauss Elimination method to solve
$$3x + 2y + 4z = 7$$
$$2x + y + z = 4$$
$$x + 3y + z = 2$$

5 + 7 = 12

3. (a) Using method of bisection find a root of the equation $3x + \sin x - e^x = 0$, correct up to 2 decimal places.

(b) Solve the following system of linear equations by Gauss-Seidel method correct upto 4 decimal places:
$$x + 10y + z = 36$$
$$x + y - 10z = -35$$
$$10x - y - z = 13$$

6 + 6 = 12

Group – C

4. (a) The velocity v (m/s) of a particle at time t sec is given in the below table

t(s)	0	2	4	6	8	10	12
v(m/s.)	4	6	16	34	60	94	133

Find the distance travelled by the particle in 12 sec using the best approximation method.

(b) Applying suitable formula, find $\sqrt{2}$ correct upto a 4 significant figures from the following table:

x	1.9	2.1	2.3	2.5	2.7
$\sqrt{x}$	1.3784	1.4491	1.5166	1.5811	1.6432

6 + 6 = 12

5. (a) Using modified Euler's method, find $y(2.2)$ correct up to 2 decimal places from the following equation:

$$\frac{dy}{dx} = xy^2 \text{ where } y(2)=1,\ h=0.1.$$

(b) Find the value of $y(0.2)$ using Runge-Kutta method of 4th order, given that

$$\frac{dy}{dx} = 3e^x + 2y,\ y(0)=0 \text{ taking } h=0.1.$$

6 + 6 = 12

Group – D

6. (a) There are three candidates A, B and C for the position of a manager whose chances of getting the appointment are in proportion 4 : 2 : 3 . The probability that A, if selected would launch a new product in the market is 0.3. The probability of B and C doing the same as 0.5 and 0.8 respectively. What is the probability that the new product was launched in the market by C?

(b) An urn contains 3 white and 5 black balls. One ball is drawn and its colour is noted, kept aside and another ball is drawn. What is the probability that the 2nd ball is (i) black (ii) white?

6 + 6 = 12

7. (a) A purse contains 2 silver and 4 copper coins and a second purse contains 4 silver and 4 copper coins. If a coin is selected at random from one of the two purses, what is the probability that it is a silver coin?

(b) If the probability of n mutually independent events are $p_1, p_2, \ldots, p_n$, then show that the probability that at least one of these events will occur is $1-(1-p_1)(1-p_2)(1-p_3)\ldots\ldots(1-p_n)$.

(c) If two fair dice are tossed, what is the probability that the sum is 9?

6 + 4 + 2 = 12

Group – E

8. (a) The probability mass function of a random variable X is zero except at the points $x = 0, 1, 2$. At these points it has the values $p(0) = 3c^3$, $p(1) = 4c - 10c^2$ and $p(2) = 5c - 1$ for some $c > 0$

(i) Determine the value of c

(ii) Compute the probability $P(1 < X \leq 2)$

(b) X is a Poisson variate such that $P(X = 1) = 0.2$ and $P(X = 2) = 0.2$. Find $P(X = 0)$.

(c) The weight of students in a college is normally distributed with mean (m) = 40 kg, standard deviation (σ) = 5 kg. Find the percentage of the students that have weight

(i) greater than 40 kg

(ii) greater than 50 kg

(iii) between 38 kg and 52 kg.

(Given that: $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{2} e^{-\frac{t^2}{2}}dt = 0.9772$, $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{0.4} e^{-\frac{t^2}{2}}dt = 554$ and $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{2.4} e^{-\frac{t^2}{2}}dt = 0.9918$)

4 + 2 + 6 = 12

9. (a) The probability density function of a continuous distribution is given by:

$$f(x) = \begin{cases} \frac{3}{4}x(2-x), & 0 < x < 2 \\ 0, & otherwise \end{cases}$$

Find the mean and variance.

(b) The following are the scores of 10 students studied for a mathematics test and their scores on the test:

6+6= 12

Hour of study (x)	4	9	10	14	4	7	12	22	1
Test score (y)	31	58	65	73	37	44	60	91	21

Find the regression line to predict the average test score of a student who studied 14 hours for the test.

5 + 7 = 12

6+4+2= 12