

B. Tech/ AEIE/ECE/IT/ 3<sup>rd</sup> Sem/MATH-2002/2016

2016

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 x 1=10]

- i) Lagrange's interpolation formula is used for
  - a) equispaced arguments only
  - b) unequispaced arguments only
  - c) both equispaced and unequispaced arguments
  - d) none of these
- ii) Which of the following relation is true?
  - a)  $E = 1 + \Delta$
  - b)  $E = 1 - \Delta$
  - c)  $E = 1 / \Delta$
  - d) none of these
- iii) The rate of convergence of bisection method is
  - a) linear
  - b) quadratic
  - c) cubic
  - d) none of these
- iv) Error in the 4<sup>th</sup> order Runge-Kutta method is
  - a)  $o(h^3)$
  - b)  $o(h^2)$
  - c)  $o(h^4)$
  - d)  $o(h^5)$

B. Tech/ AEIE/ECE/IT/ 3<sup>rd</sup> Sem/MATH-2002/2016

- v) In Trapezoidal rule for finding the value of  $\int_a^b f(x)dx$  there exists no error if  $f(x)$  is
- a) parabolic function                      b) linear function  
c) logarithmic function                      d) none of these
- vi) If X and Y are independent variates then correlation coefficient of X and Y is
- a) 1                      b) 0                      c) -1                      d) 2
- vii) A problem in Mathematics is given to three students A, B and C. The chances of solving the problem by A, B and C are  $\frac{1}{3}$ ,  $\frac{1}{4}$  and  $\frac{1}{5}$  respectively. The probability that the problem will be solved is
- a)  $\frac{2}{5}$                       b)  $\frac{3}{5}$                       c)  $\frac{1}{60}$                       d)  $\frac{47}{60}$
- viii) If A and B are mutually exclusive then  $P(B/A)$  is
- a) 1                      b) 0                      c)  $\frac{1}{2}$                       d)  $P(B)$
- ix) A continuous random variable X has a p.d.f  $f(x) = e^{-x}$ ,  $0 < x < \infty$ ; then  $P(X > 1)$  is
- a) 0.368                      b) 0.5                      c) 0.632                      d) 1.0
- x) The mode and median of the observations 4,6,8,6,7,8,8,4 are
- a) 8 and 7.5                      b) 8 and 8                      c) 7.5 and 7                      d) 8 and 6.5

**GROUP - B**

- 2 a) Find a non zero positive real root of the function  $x^3 + 2x + 2 = 0$  by Regula Falsi method correct to three decimal places.

**B. Tech/ AEIE/ECE/IT/ 3<sup>rd</sup> Sem/MATH-2002/2016**

b) Solve the following system of linear equations by LU factorization method.

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

$$-x + 4y + 2z = 20$$

$$5x + 2y + z = -12$$

6+6=12

3 a) Find the root of the equation  $x \tan x = 1.28$  by Bisection Method that lies in the interval (0,1) correct to 4 places of decimal.

b) Solve the system of equations by Gauss- Siedel method correct upto three decimal places.

$$3y - 2z = 3$$

$$2x - y + 4z = 27$$

$$4x - y - 3z = 3$$

6+6=12

**GROUP - C**

4 a) Find the value of  $\log 2^{\frac{1}{3}}$  from  $\int_0^1 \frac{x^2}{1+x^2} dx$  using Simpson's 1/3 rule with  $h=0.25$ .

b) Estimate the population of a town in the year 1955 by Newton's backward interpolation formula where the decennial census of the town is provided in the following table. Round off your answer to two decimal places.

Year:	1921	1931	1941	1951	1961
Population(in thousands):	46	66	81	93	101

B. Tech/ AEIE/ECE/IT/ 3<sup>rd</sup> Sem/MATH-2002/2016

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- 5 a) Use Runge Kutta method of fourth order to find  $y(0.2)$  taking  $h=0.2$  where

$$\frac{dy}{dx} = 1 + y^2 ; y = 0 \text{ when } x = 0$$

- b) Given  $\frac{dy}{dx} = (x^2 + y^2)$  where  $y(0) = 1$ . Use Euler's method to find the value of  $y(0.1)$  and  $y(0.2)$  correct to four decimal places taking  $h = 0.05$

6+6=12

GROUP - D

- 6 a) An urn contains 10 white and 3 black balls. Another urn contains 3 white and 5 black balls. Two balls are drawn from the first urn and put into the second. Then a ball is randomly drawn from the second. What is the probability that it is a white ball ?

b) Show that  $f(x) = \begin{cases} x; & 0 \leq x < 1 \\ k - x; & 1 \leq x \leq 2 \\ 0; & \text{otherwise} \end{cases}$

is a probability density function for a suitable value of  $k$ . Find the distribution function of the random variable  $X$ . Calculate

$$P\left(\frac{1}{2} < X < \frac{3}{2}\right)$$

6+6=12

B. Tech/ AEIE/ECE/IT/ 3<sup>rd</sup> Sem/MATH-2002/2016

- 7 a) Find the mean and variance of a continuous random variable having p.d.f

$$f(x) = \begin{cases} 1 - |1 - x|; & 0 < x \leq 2 \\ 0; & \text{otherwise} \end{cases}$$

Also find  $E(x^3)$ .

- b) Show that a function which is  $|x|$  in  $(-1,1)$  and zero elsewhere is a p.d.f and find the corresponding distribution function.

6+6=12

GROUP - E

- 8 a) The radius  $X$  of a circle has uniform distribution in  $(1,2)$ . Find the mean and variance of the area of the circle.

b) In a certain factory turning out razor blades, there is a small chance  $\frac{1}{500}$  for any blade to be defective. The blades are in packets of 10. Use Poisson distribution to calculate the approximate number of packet containing

i) no defective

ii) one defective

iii) two defective blades respectively in one consignment of 10,000 packets

6+6=12