

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (New) • EXAMINATION – WINTER 2016

Subject Code: 2140606

Date: 18/11/2016

Subject Name: Numerical and Statistical Methods for Civil Engineering

Time: 02:30 PM to 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 Answer the following questions in brief:

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- 1 Define Arithmetic Mean, Median and Mode.
- 2 What is the point of intersection of two regression lines?
- 3 What is the significance of using Numerical Integration in numerical techniques?
- 4 Write down the iterative formula for obtaining the root of non linear equation by Newton – Raphson method.
- 5 How many significant digits are there in the number 204.020050?
- 6 In Gauss elimination method which matrix is obtained after triangularization?
- 7 If total sum of square is 20 and the sample variance is 5 then find the total number of observations.
- 8 What is the standard deviation of sampling distribution if standard deviation of population is 35 and sample size is 9.
- 9 Write down the two direct methods for solving the system of linear equation.
- 10 Write down the formula for Lagrange's interpolation given the points (x_1, y_1) , (x_2, y_2) and (x_3, y_3) .
- 11 State atleast two differences between binomial and Poisson Probability distribution.
- 12 For applying the Simpson's $\frac{3}{8}$ th rule state the minimum number of y-values required.
- 13 Explain the difference between interpolation and extrapolation.
- 14 What is the formula of Karl Pearson for calculation of correlation co-efficient?

Q.2 (a) Four cards are drawn from a pack of cards. Find the probability that (i) all are diamonds 03

(ii) there is one card of each suit (iii) there are two spades and two hearts.

(b) Assume that on the average one telephone number out of fifteen called between 1 p.m. and 2 p.m. on week days is busy. What is the probability that if 6 randomly selected telephone numbers are called (i) not more than three, (ii) at least three of them would be busy? 04

(c) Using Gauss – Seidel iteration method solve the system of equations. 07

$$10x - 2y - z - w = 3; -2x + 10y - z - w = 15; -x - y + 10z - 2w = 27; -x - y - 2z + 10w = -9$$

OR

(c) Solve the following system of equations by Gauss elimination method: 07

$$3x + y - z = 3; 2x - 8y + z = -5; x - 2y + 9z = 8.$$

Q.3 (a) Find an approximate value of the root the equation $x^3 + x - 1 = 0$ using the method of false position. 03

(b) Obtain Picard's second approximate solution of the initial value problem 04

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

- (c) Using Taylor's series method, solve $\frac{dy}{dx} = x^2 - y, \quad y(0) = 1$ at $x = 0.1, 0.2$ and 0.3 . Also compare the values with exact solution. 07

OR

- Q.3** (a) Find the real root of the equation $x^4 - x - 9 = 0$ by Newton – Raphson method, correct to three decimal places. 03
- (b) Given that $\frac{dy}{dx} = x + y^2$ and $y = 1$ at $x = 0$. Find an approximate value of y at $x = 0.3$ by Modified Euler method. 04
- (c) Using Runge – Kutta fourth order method solve for $y(0.1)$ and $y(0.2)$ given that $\frac{dy}{dx} = xy + y^2, \quad y(0) = 1.$ 07

- Q.4** (a) Prove the relation: 03
- (i) $\mu = \frac{1}{2} \left(E^{\frac{1}{2}} + E^{-\frac{1}{2}} \right)$ (ii) $\mu = \frac{1}{4} \delta^2$
- (b) Using Lagrange's formula, find the form of the function $f(x)$ given that 04
- | | | | | |
|-------|-----|-----|-----|-----|
| x: | 0 | 2 | 3 | 6 |
| f(x): | 659 | 705 | 729 | 804 |
- (c) State Baye's theorem. A microchip company has two machines that produce the chips. Machine I produces 65% of the chips, but 5% of its chips are defective. Machine II produces 35% of the chips and 15% of its chips are defective. A chip is selected at random and found to be defective. What is the probability that it came from Machine I? 07

OR

- Q.4** (a) The population of the town in decennial census was as given below. Estimate the population for the year 1895. 03
- | | | | | | |
|---------------------------|------|------|------|------|------|
| Year: | 1891 | 1901 | 1911 | 1921 | 1931 |
| Population (in thousand): | 46 | 66 | 81 | 93 | 101 |
- (b) Evaluate $\int_{0.2}^{1.4} (\sin x - \log x + e^x) dx$ with $h = 0.2$ by Simpson's $\frac{1}{3}$ rd and $\frac{3}{8}$ th rule. 04
- (c) An urn contains 10 white and 3 black balls, while another urn contains 3 white and 5 black balls. Two balls are drawn from the first urn and put into the second urn and then a ball is drawn from the latter. What is the probability that it is a white ball? 07
- Q.5** (a) Use secant method to estimate the root of $\cos x = xe^x$ correct to four significant digits. 03
- (b) Fit a second degree parabola $y = ax^2 + bx + c$ in the least square sense for the following data and hence estimate y at $x = 6$. 04

x:	1	2	3	4	5
y:	10	12	13	16	19

- (c) Obtain the line of regression of monthly sales (Y) on advertisement expenditure (X) and estimate the monthly sales when the company will spend Rs.50,000 on advertisement, if the data on Y and X are as follows: 07

Y (in lac):	74	76	60	68	79	70	71	94
X (in thousand):	43	44	36	38	47	40	41	54

OR

- Q.5** (a) A car hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed on a Poisson distribution with mean 1.5. Calculate the proportion of days on which neither car is used and proportion of days on which some demand is refused 03

$(e^{-1.5} = 0.2231)$.

- (b) Determine the coefficient of correlation if **04**
 $\bar{x} = 5.5; \bar{y} = 4; \sum x^2 = 385, \sum y^2 = 192; \sum (x + y)^2 = 947.$

- (c) Compute $f(9.2)$ from the following value using Newton's divided difference formula: **07**

x:	8	9	9.5	11
f(x):	2.079442	2.197225	2.251292	2.397895
