

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2018

Subject Code: 2140606

Date: 22/11/2018

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 (a) In usual notations show that $\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$ **03**

(b) Find the cubic polynomial which takes on the values **04**
 $f(0) = 4, f(1) = 1, f(2) = 2, f(3) = 11, f(4) = 32, f(5) = 71$. Also find $f(6)$
and $f(2.5)$.

(c) Obtain by Power method the numerically largest eigen value of the matrix **07**

$$A = \begin{bmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{bmatrix}$$

Q.2 (a) In how many different ways can the director of a research laboratory choose 2 **03**
chemists from among 7 applicants and 3 physicists from among 9 applicants?

(b) A class consists of 6 girls and 10 boys. If a committee of three is chosen at random **04**
from the class, find the probability that, (i) three boys are selected; (ii) exactly
two girls are selected.

(c) Solve the following system of equations using Gauss Jacobi iteration method: **07**
 $4x_1 + x_2 + x_3 = 2; x_1 + 5x_2 + 2x_3 = -6; x_1 + 2x_2 + 3x_3 = -4$

OR

(c) At checkout counter customers arrive at an average of 2.0 per minute. Find the **07**
probabilities that

- (i) At most 3 will arrive in any given minute
- (ii) At least 3 will arrive during an interval of 4 minutes
- (iii) At most 10 will arrive during an interval of 6 minutes.

Q.3 (a) Using Regula – Falsi method determine the root of the equation $x \log x = 1.2$. **03**

(b) Use Euler's method to solve the initial value problem $\frac{dy}{dx} = \frac{x-y}{2}$ on the interval **04**
 $[0, 3]$ with $y(0) = 1$. Compare the numerical solution with exact solution for the step
size $h = 0.25$.

(c) Using Runge – Kutta fourth order method solve $\frac{dy}{dx} = y - \frac{2x}{y}; y(0) = 1$. **07**
Evaluate the value of y when $x = 0.2, x = 0.4$, take step size 0.2.

OR

Q.3 (a) Using Taylor's series method, find $y(1.1)$ correct to four decimal place, given by **03**

$$\frac{dy}{dx} = xy^{1/3}; y(1) = 1.$$

(b) Evaluate $\int_0^1 \frac{dx}{1+x}$ by Simpson's $\frac{1}{3}^{rd}$ rule taking eleven ordinates and hence find the value of $\log_e 2$ correct to five significant digits. 04

(c) Use Newton's divided difference method to evaluate $f(4)$ from the below data: 07

$x:$	0	1	2	3
$f(x):$	2	3	12	147

Q.4 (a) The runs scored by two batsmen A and B in 9 consecutive matches are given below. Find which batsman is more consistent? 03

A	85	20	62	28	74	5	69	4	13
B	72	4	15	30	59	15	49	27	26

(b) Derive an iteration formula for $\sqrt[3]{N}$ and hence find $\sqrt[3]{58}$. 04

(c) Solve the following system of equation using Gauss – Seidel method: 07
 $5x + y - z = 10$; $2x + 4y + z = 14$; $x + y + 8z = 20$

OR

Q.4 (a) Find the mean and standard deviation for the following data: 03

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	6	14	10	8	1	3	8

(b) Find the equation of the cubic curve which passes through the points $(0, -5)$, $(1, -10)$, $(2, -9)$, $(3, 4)$, and $(4, 35)$. 04

(c) Solve the following system of equations using Gauss elimination method with partial pivoting. $x + y + z = 7$; $3x + 3y + 4z = 24$; $2x + y + 3z = 16$ 07

Q.5 (a) Find the median from the following data. 03

Class limits	0-30	30-60	60-90	90-120	120-150	150-180
Frequency	8	13	22	27	18	7

(b) Compute the correlation coefficient between X and Y using the following data: 04

X	2	4	5	6	8	11
Y	18	12	10	8	7	5

(c) Following table gives the data on rainfall and discharge in a certain river. Obtain the line of regression of Y on X. 07

Rainfall(inch) X:	1.53	1.78	2.60	2.95	3.42
Discharge(1000cc) Y:	33.5	36.3	40.0	45.8	53.5

OR

Q.5 (a) A train is moving at the speed of 30 m/s suddenly brakes are applied. The speed of the train per second after t seconds is given by the following table: 03

Time(t)	0	5	10	15	20	25	30
Speed(v)	30	24	19	16	13	11	10

Apply Simpson's $\frac{3}{8}^{th}$ rule to determine the distance moved by the train 30 sec.

(b) An unbiased coin is tossed 6 times. Find the probability of getting (i) exactly 4 heads, (ii) at least 4 heads. 04

(c) At constant temperature, the pressure P and the volume V of a gas are connected by the relation $PV^\gamma = \text{constant}$. Find the best fitting equation of this form to the following data and estimate V when P=4. 07

P(Kg. Sq. cm)	0.5	1.0	1.5	2.0	2.5	3.0
V(cc)	1620	1000	750	620	520	460
