

JK Lakshmipat University, Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), November, 2017
B. Tech (All Branches), Semester III

Roll No.....

MA 302: Computer based Numerical and Statistical Techniques

Time: 3 hours Max. Marks: 100

Instructions to students:

1. Do not write or mark anywhere other than your roll number on question paper.
2. Use of calculator and statistical tables is permitted.

Q.1 Choose the correct answer for the following problems (10 questions @ 1 mark) 10

- i. If $f(x)$ is a real continuous function in $[a, b]$, and $f(a).f(b) < 0$, then for $f(x) > 0$, there is (are) _____ in the domain $[a, b]$;
(a) one root (b) an undeterminable number of roots
(c) no root (d) at least one root
- ii. The number of significant digits in the number 204.020050 is;
(a) 5 (b) 6 (c) 8 (d) 9
- iii. The expected value of the random variable;
(a) will also be the most likely value of the random variable
(b) is another term for the mean value
(c) is also called the variance
(d) cannot be greater than 1
- iv. The shifting/step operator is denoted by;
(a) μ (b) Δ (c) ∇ (d) E
- v. Gauss Jordan and Gauss elimination methods are;
(a) direct methods (b) indirect methods
(c) iterative methods (d) (a) and (c) both
- vi. Parametric test of hypothesis is applicable when;
(a) population is normal (b) sample is random
(c) estimation of population parameters are possible (d) (a) and (c) both
- vii. A numerical method for solving a system of equations is;
(a) Simpsons 1/3 rule (b) Gauss-Seidel method
(c) Euler Method (d) all of the above
- viii. A numerical description of the outcome of an experiment is called a;
(a) descriptive statistic (b) probability function
(c) variance (d) random variable
- ix. An important application of the chi-square distribution is;
(a) making inferences about a single population variance
(b) testing for goodness of fit
(c) testing for the independence of two variables
(d) All of these alternatives are correct

- x. If a hypothesis is rejected at the 5% level of significance, it;
- (a) will always be rejected at the 1% level
 - (b) will always be accepted at the 1% level
 - (c) will never be tested at the 1% level
 - (d) may be rejected or not rejected at the 1% level

Q.2 Solve the following problems (4 questions @ 2.5 marks) 10

- i. Solve the following differential equation using Euler's method $y' - 1 = xy$, where $y(0) = 1$. Find $y(0.1)$, take $h = 0.05$.
- ii. Explain by taking suitable example, how to choose a particular interpolation method.
- iii. A bag contains 6 red and 8 green balls. If one ball is drawn at random, then what is the probability of the ball being green and if two balls are drawn at random then what is the probability that one is red and other is green.
- iv. Explain the difference between discrete probability distribution and continuous probability distributions by taking suitable example.

Q.3A Find the root of the equation $x^3 - 2x - 5 = 0$ between the given interval $[2, 3]$ using *regula-falsi* method. Perform till 2 iterations. 05

Q.3B Using Newton's forward interpolation method, find the value of $f(1.2)$, if 05

x	1	1.4	1.8	2.2
y	3.49	4.82	5.96	6.5

Q.4A The following data of the velocity of a body is given as a function of time. 05

Time (s)	4	7	10	15
Velocity (m/s)	22	24	37	46

Determine the best estimate of the distance in meters covered by the body from $t = 4$ to $t = 15$ using Simpson's 1/3 rule and the Trapezoidal rule.

Q.4B Given $\frac{dy}{dx} = 1 + y^2$, $y(0) = 0$. Find $y(0.2)$ correct to four decimal places using Runge Kutta fourth order method taking $h = 0.2$. 05

Q.5A The following data of the velocity of a body is given as a function of time. 05

Time (s)	0	15	18
Velocity (m/s)	22	24	37

Use Lagrange interpolation to find the value of the velocity at $t = 14$ seconds.

Q.5B A random sample of 100 teachers in a large metropolitan area revealed a mean weekly salary of Rs. 2000 with a standard deviation of Rs. 43. With what percentage of chances can we assert that the average weekly salary of all teachers in the metropolitan area is between Rs. 1985 to Rs. 2015? 05

Q.6A The mean muscular endurance score of a random sample of 60 subjects was found to be 145 with a standard deviation of 40. Construct a 95% confidence interval for the true mean. 05

- Q.6B Samples of two types of electric bulbs were tested for length of life and the following data were obtained. 05

	Type I	Type II
Sample size	8	7
Sample means	1,234 hours	1,036 hours
Sample standard deviations	36 hours	40 hours

Is the difference in the means significant to warrant that Type I is superior to Type II regarding the length of life? (Given: $\alpha = 0.05$)

- Q.7A It is known that 60% of the mice inoculated with a serum are protected from a certain disease. If 5 mice are inoculated, find the probability that fewer than 2 contract the disease. 05

- Q.7B The table below shows the number of absences, x , in a Calculus course and the final exam grade, y , for 7 students. Find the correlation coefficient and interpret your result. Find the regression line of y on x . 05

x	1	0	2	6	4	3	3
y	85	80	70	55	90	90	95

- Q.8 The following data gives the melting point of an alloy of lead and zinc; where T is the temperature in $^{\circ}\text{C}$ and P is the percentage of lead in the alloy. Find the melting point of the alloy containing 76% of lead using central difference interpolation. 10

P	60	70	80	90
T	226	250	276	304

OR

- Q.8 A drug is claimed to be effective in curing cold. In an experiment on 164 persons with cold, half of them were given drug, and half were given sugar pills. The treatments are recorded as follows. (Given: $\alpha = 0.05$) 10

Treatment	Effect		
	Helped	Harmed	No effect
Drug	52	10	20
Sugar pills	44	12	26

Find the value of χ^2 . Test the hypothesis that there is no dependency of drug or sugar pills in curing cold.

- Q.9A Explain the following by taking a suitable example. 10
- Central limit theorem
 - Point estimation
 - Sampling
 - Errors in computation

- Q.9B** To infer the surface shape of an object from images taken of a surface from three different directions, one needs to solve the following set of equations. 10

$$5x - 2y + z = 4; 7x + y - 5z = 8; 3x + 7y + 4z = 10$$

The right hand side values are the light intensities from the middle of the images, while the coefficient matrix is dependent on the light source directions with respect to the camera. The unknowns are the incident intensities that will determine the shape of the object. Find the values of x , y and z using Gauss Seidel iteration method.

OR

- Q.9B** A book has 700 pages. The number of pages with various numbers of misprints is recorded below. 10

No. of misprints	0	1	2	3	4	5
No. of pages with misprints	616	70	10	2	1	1

Can a Poisson distribution be fitted to this data? Use 0.05 level of significance.