



JK Lakshmipat University, Jaipur

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), May 2015

B. Tech (All Branches), Semester IV

Roll No.....

MA 402: Numerical and Statistical Methods

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything 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. The relationship between E and Δ is;
(a) $\Delta = E - 1$ (b) $\Delta = 1 - E$ (c) $\Delta = 1 - E^{-1}$ (d) $\Delta = E^{-1} - 1$
- ii. The order of Newton Raphson Method is;
(a) 1 (b) 2 (c) 3 (d) 4
- iii. The modification of Gauss Elimination Method is;
(a) Gauss Jordan Method (b) Jacobi Method
(c) Gauss Seidel Method (d) LU Factorization Method
- iv. In Euler's method: Given initial value problem $\frac{dy}{dx} = f(x, y), y(x_0) = y_0$, then approximation is given by;
(a) $y_{n+1} = y_n + hf(x_{n-1}, y_{n-1})$ (b) $y_{n+1} = y_n + hf(x_n, y_n)$
(c) $y_{n+1} = y_n + hf(x_{n-1}, y_n)$ (d) $y_{n+1} = y_n + hf(x_n, y_{n-1})$
- v. _____ is used to denote the process of finding the values inside the interval (x_0, x_n) ;
(a) Interpolation (b) Extrapolation (c) Iterative (d) Polynomial equation
- vi. Which method gives a unique set of values to the constants in the equation of the fitting curves?
(a) Method of least squares (b) Interpolation
(c) Newton's Method (d) None of the above
- vii. The value of $z_{0.00625}$ is?
(a) 1.96 (b) 2.576 (c) 2.692 (d) 2.170
- viii. Ignoring twins and other multiple births, assume babies born at a hospital are independent events with the probability that a baby is a boy and the probability that a baby is a girl both equal to 0.5. If the first 4 children born are girls, what is the probability the next born child is a boy?;
(a) 0.5 (b) 0.75 (c) 0.80 (d) 1.00
- ix. The correlation coefficient measures;
(a) the strength of the straight line relationship between two variables
(b) whether or not a scatterplot shows an interesting pattern.
(c) whether a cause and effect relation exists between two variables
(d) permissible variance in y due to x
- x. The degree of freedom used for testing the difference of means for $n_1 = 12$ and $n_2 = 10$ is; (a) 22 (b) 20 (c) 19 (d) none of the above



10

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

- An approximate value of π is given by 3.1428571 and its true value is 3.1415926. Find the absolute and relative errors.
- Use Trapezoidal rule to evaluate $\int_0^1 x^3 dx$ considering five subintervals.
- A batch of 100 capacitors contains 73 which are within the required tolerance values, 17 which are below the required tolerance values, and the remainders are above the required tolerance values. Determine the probabilities that when randomly selecting a capacitor and then a second capacitor: (a) both are within the required tolerance values when selecting with replacement, and (b) the first one drawn is below and the second one drawn is above the required tolerance value, when selection is without replacement.
- Given, the regression equations $y = 0.516x + 33.73$ and $x = 0.512y + 32.52$, find the correlation coefficient r .

Q.3A Find the root of the equation $e^{-x} = \sin x$ near to $x_0 = 0.6$ using Newton Raphson Method. 05

Q.3B Find $\frac{dy}{dx}$ at $x = 0.1$ from the following table 05

x	0.1	0.2	0.3	0.4
y	0.9975	0.9900	0.9776	0.9604

Q.4A Evaluate $\int_0^1 \frac{1}{1+x} dx$ using Simpson's 1/3 rule by dividing the interval of integration into 8 equal parts. Hence find $\log_e 2$ approximately. 05

Q.4B Given $\frac{dy}{dx} = y - x$, $y(0) = 2$. Find $y(0.1)$ correct to four decimal places using Runge Kutta fourth order method. 05

Q.5A Out of the two types of tubes A and B installed in a television set. Three quarter of the tubes are of type A. The probability that the tube of type A will fail within one year is $1/8$ and that of type B will fail is $1/4$. If a set fails within a year, what is the probability that tube of type B was installed on it? Use Baye's theorem. 05

Q.5B If 10% of the pens manufactured by a company are defective, find the probability that a box of 12 pens contain (i) exactly two defective pens (ii) at least two defective pens. Use suitable distribution. Whether the distribution is discrete or it is continuous? 05

Q.6A The distribution of weekly wages for 500 workers in a factory is approximately normal with the mean and standard deviation of Rs. 75 and Rs. 15. Find the number of workers who receive weekly wages more than Rs. 90. 05

Q.6B The length of life X of certain computers is approximately normally distributed with mean 800 hours and standard deviation 40 hours. If a random sample of 30 computers has an average life of 788 hours, test the null hypothesis that $\mu = 800$ against the alternative hypothesis $\mu \neq 800$ at 0.05 level of significance. 05

Q.7A The function $y = f(x)$ is given at the points (7, 3), (8, 1), (9, 1) and (10, 9). Find the value of y for $x = 9.5$ using Lagrange's interpolation formula. 05

Q.7B The standard deviation calculated from two random samples of sizes 9 and 13 are 2.1 and 1.8 respectively. May the samples be regarded as drawn from normal populations with the same standard deviation? 05

Q.8A Find $y(2)$ if $y(x)$ is the solution of $\frac{dy}{dx} = \frac{1}{2}(x + y)$ where $y(0) = 2$, $y(0.5) = 2.636$, $y(1) = 3.595$, $y(1.5) = 4.968$. 05

Q.8B Test the goodness of fit of a Poisson distribution to the following observed frequencies using χ^2 distribution: 05

x	0	1	2	3	4
f	122	60	15	2	1

OR

Q.8B Find the correlation coefficient and the equation of regression line of y on x for the following values: 05

x	1	2	3	4	5
y	2	5	3	8	7

Q.9A Show that (i) $\mu^2 = 1 + \frac{\delta^2}{4}$ (ii) $\Delta = \nabla E = \delta E^{1/2}$. 05

Q.9B Use Stirling's formula to find y_{35} , given $y_{20} = 512$, $y_{30} = 439$, $y_{40} = 346$ and $y_{50} = 243$. 05

OR

Q.9B A random sample of 40 'geyers' produced by company A have a mean lifetime (mlt) of 647 hours of continuous use with a s.d. of 27 hours, while a sample of 40 produced by another company B have mlt of 638 hours with s.d. 31 hours. Does this substantiate the claim of company A that their 'geyers' are superior to those produced by company B? Test the claim at 0.05 level of significance. 05

Q.10 In order to find out the opinion about "ragging" in professional colleges, a campus study was conducted with the following results. 10

Ragging	Faculty	Students	Administration	Total
For	82	70	62	214
Against	93	62	67	222
Undecided	25	18	21	64
Total	200	150	150	500

Determine whether the overall opinion pertaining to ragging is same irrespective of categories of persons. Use 0.05 level of significance.

OR

Q.10 Solve the following system of equation by Gauss-Seidel iteration method. 10
 $6x + y + z = 20$; $x + 4y - z = 6$; $x - y + 5z = 7$. ($x^{(0)} = y^{(0)} = z^{(0)} = 0$).
 Perform upto five iterations.