

**Model Question-01**  
**GOVERNMENT AUTONOMOUS COLLEGE, PANPOSE**  
**ROURKELA**

**Subject –Statistics (UG-2nd year, 3rd Semester).**

**Full MARK-60**

**Paper code:C-7 (Mathematical Analysis)**

**Time-3 Hrs**

**Answer All Questions**

**The figures in right hand margin indicate marks.**

**1. Answer all questions**

**[1X8=8]**

- a) . A set that has both an upper bound and a lower bound is called?
- b) The collection of all points that lie within a certain distance from a given point is called as?
- c) What is the limit of the function  $f(x) = \frac{x^{3/2}-8}{x-4}$  as x approaches 4?
- d) A function is said to be continuous at a point  $x = a$  under which condition?
- e) Give the example of a set which is both and closed.
- f) The union of two open set is ?
- g) What is the domain of a sequence?
- h) What is the relation between Operator  $\Delta$  and E

**2) Answer any Eight questions**

**[1.5X8=12]**

- a) D'Alembert's ratio test is based on the limit of the ratio of consecutive terms. If the limit is less than 1, the series?
- b) The interior point of R set of real numbers is the \_\_\_\_\_ set.
- c) If a set X is open the  $X^c$  is closed or open?
- d) How many limit point of a finite set exists?
- e) The set of real number between [0,1] is \_\_\_\_\_ (countable/uncountable).
- f) Give the example of open set?
- g) Which interpolation formula is useful unequal interval?
- h) Evaluate  $\Delta \tan^{-x}$ ?
- i) Evaluate  $\Delta C$ , where C is constant?
- j) Evaluate  $\Delta \nabla f(x)$  ?

**3) Answer any Eight questions**

**[2X8=16]**

- a) Define Interpolation?
- b) Define the neighborhood of a set.
- c) Write the errors in Trapezoidal Rule.
- d) Write the error in Simpson's 1/3 Rule.
- f) Define Rolle's Theorem.
- g) Write the general formula of Trapezoidal Rule.
- h) Evaluate  $\Delta(\log x)$  ?
- i) Evaluate  $\Delta \nabla f(x)$  ?

j) Evaluate  $\Delta(\tan^{-1}x)$  ?

4) **Answer any Four questions**

**[6X4=24]**

a) Show that  $\sqrt{8}$  is not a rational number?

b) Ever bounded set has a unique Supreimum?

c) Prove that the intersection of finite number of open set is an open set?

d) Prove that a set is closed if its complement is open?

e) Show that the sequence  $\{S_n\}$ , where

$$S_n = 1 + \frac{1}{2} + \frac{1}{2} + \dots + \frac{1}{n} \text{ cannot converges?}$$

f) Evaluate  $\frac{\Delta^2}{E} \sin(x+h) + \frac{\Delta^2 \sin(x+h)}{E \sin(x+h)}$

g) Find the missing value

x	0	5	10	15	20	25
y	6	10	—	17	—	31

i) Prove that  $e^x = \frac{\Delta^2}{E} e^x X \frac{E e^x}{\Delta^2 e^x}$



**Model Question-02**  
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**Subject –Statistics (UG-2nd year, 3rd Semester).**

**Full MARK-60**

**Paper code:-C-7 (Mathematical Analysis)**

**Time-3 Hrs**

**Answer All Questions**

**The figures in right hand margin indicate marks.**

**2. Answer all questions**

**[1X8=8]**

- a) A set that has both an upper bound and a lower bound is called?
- b) The collection of all points that lie within a certain distance from a given point is called as?
- c) A function  $f$  said to be continuous at a point  $c$ ,  $a < c < b$ , if  $\lim_{x \rightarrow c} f(x) = \underline{\hspace{2cm}}$ ?
- d) A function  $f(x)$  is continuous at  $x=a$ , then its limit may exit at “a” (yes/no)?
- e) What is the range of a sequence?
- f) The set which contains all its limit point is called as \_\_\_\_\_?
- g) What is the relation between Operator  $\nabla$  and  $E$
- h) Evaluate  $\Delta f(x)$

**2) Answer any Eight questions**

**[1.5X8=12]**

- a) Evaluate  $\Delta \tan(x)$
- b) Every convergent sequence is \_\_\_\_\_
- c) What other name of limit point of a sequence?
- d) Find limit point of the sequence  $\{1 + \frac{1}{n}\}$
- e)  $\Delta x^{(m)}$  and  $\Delta x^m$  are same or different.
- f) The  $n$ th order divided difference of a polynomial of  $n$ th degree is \_\_\_\_\_?
- g) Can you apply Newton's divided difference formula for equal intervals?(Yes/No)
- h) A set that does not have an upper bound is called?
- i) Define Shift Operator ( $E$ )
- j) Write Average Operator ( $\mu$ )

**3) Answer any Eight questions**

**[2X8=16]**

- a) Write D'Alembert ratio test.
- b) Verify Rolle's theorem for  $f(x) = x^2$  in  $[-1,1]$ .
- c) Define Field.
- d) When a series is said to be convergent?
- e) What is Cauchy's convergence principle for series?
- f) Verify the function  $x^2 + 2x - 8$  satisfies Lagrange Mean Value Theorem.
- g) Define Numerical Integral?

**Model Question-03**  
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**Subject –Statistics (UG-2nd year, 3rd Semester).**

**Full MARK-60**

**Paper code:-C-7 (Mathematical Analysis)**

**Time-3 Hrs**

**Answer All Questions**

**The figures in right hand margin indicate marks.**

**3. Answer all questions**

**[1X8=8]**

- j) . The representation of real numbers as points on the line is known as \_\_\_\_\_?
- k) Which property characterizes the set of real numbers as a complete ordered field?
- l) The least upper bound of a set is also known as ?
- m) A set that contains all its limit points is called as?
- n) Stirling interpolation formula is used for Equally/Unequally spaced data points.
- o) The average of Gauss forward and backward interpolation is \_\_\_\_\_?
- p) Find the value  $\lim_{x \rightarrow 0} \frac{\tan x}{x}$
- q) The relation between the operator  $\mu$  and  $E$ ,

**2) Answer any Eight questions**

**[1.5X8=12]**

- a) Define neighbourhood.
- b) Simpson's one-third rule is most accurate when dealing with, the function of degree \_\_\_\_\_.
- c) The set  $S=[ a,b]$  is open or closed.
- d) Find the value  $\lim_{x \rightarrow 0} \frac{\tan x}{\sin x}$  ?
- e) Give an interpolation which is based on unequal interval?
- f) Which interpolation formula is most suitable when dealing with equally spaced data ?
- g) The Stirling's approximation commonly used for to find out?
- h) The series  $\sum \frac{1}{n^2}$  converges for what value of p?
- i) The positive term Geometric series  $\sum n^r$  converges when r value is \_\_\_\_\_?
- j) A sequence convergence to more than one limit point (Yes/No)

**3) Answer any Eight questions**

**[2X8=16]**

- a) if  $f(x) = e^{ax+b}$  find  $\Delta^2 f(x)$  ?
- b) Write the necessary condition for convergence of an infinite series  $\sum u_n$  ?
- c) What is the difference between Newton's forward and backward interpolation?
- d) The union of two closed set is \_\_\_\_\_?
- e) Every convergent sequence is bounded having \_\_\_\_\_ limit point?
- d) In comparison test if  $\sum u_n$  is convergent then  $\sum v_n$  \_\_\_\_\_?
- e) In D'alemert's ratio test is fail for what value of l ?
- g) Evaluate  $\Delta\left(\frac{1}{f(x)}\right)$  ?

h) Evaluate  $\frac{\Delta}{E}(\sin x)$ ?

i) In Newton's Divided difference interpolation write  $[x_0]$  ?

j) Why the Gauss Forward Interpolation is used ?

4) **Answer any Four questions**

**[6X4=24]**

a) A necessary condition for convergence of an Infinite series  $\sum u_n$  is that  $\lim_{n \rightarrow \infty} u_n = 0$ ?

b) Test the convergence of the series  $\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \dots$  ?

c) If  $\sum u_n$  and  $\sum v_n$  are two positive term series and  $k \neq 0$  a fixed +ve real number and there exist a +ve integer  $m$  such that  $u_n \leq kv_n$  for all  $n \geq m$ . Then prove that  $\sum u_n$  is convergent if  $\sum v_n$  is convergent.

d) Show that the series  $1 + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$  is convergent?

e) Find the cubic polynomial which takes the following values.

f) Evaluate the Integral by using Trapezoidal rule  $\int_0^5 \frac{1}{1+x} dx$

g) Evaluate  $\int_0^1 \frac{dx}{1+x^2}$  using Simpson's  $\frac{3}{8}$  th rule by taking  $h=1/6$ .

h) Evaluate  $\int_0^\pi \sqrt{\sin x} dx$  using Simpson's  $\frac{1}{3}$  th rule by taking  $n=10$ .

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**Model Question-04**  
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**Paper code:-C-7 (Mathematical Analysis)**

**Time-3 Hrs**

**Answer All Questions**

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**4. Answer all questions**

**[1X8=8]**

- r) The sequence  $a_n = \frac{1}{n}$  converges to?
- s) The finite set has how many limit point?
- t) A function  $f(x)$  is derivable at a point, then it may continuous at that point?(yes/no)
- u) By Rolle's theorem if a function  $f$  is defined on  $[a,b]$ , then  $f(a)=$ \_\_\_\_\_?
- v) What is the limit of the function  $f(x) = 2x^2 - 3x + 1$  as  $x$  approaches 2
- w) The value of  $c$  in Roll's theorem if  $f(x) = x^2 - 2x$  in the interval  $[0,2]$ .
- x) Interpolation provides a mean for estimating functions \_\_\_\_\_?
- y) Gaussian process is a \_\_\_\_\_ interpolation process?

**2) Answer any Eight questions**

**[1.5X8=12]**

- a) When a function is called continuous?
- b) Define extrapolation?
- c) Write the error in Simpson's  $1/3^{\text{rd}}$  rule?
- d) The series  $\sum \frac{1}{n^p}$  is convergent for what value of  $p$ ?
- e) Evaluate  $\Delta^2 e^{ax+b}$ ?
- f) The Shifting operator is denoted by symbol \_\_\_\_\_?
- g) Evaluate  $\Delta^3 y_0$ ?
- h) Find the derived set of set  $R$ ?
- i) State that  $\Delta = \nabla E$  true or false?
- j) When you used Newton's backward Interpolation?

**3) Answer any Eight questions**

**[2X8=16]**

- a) Find  $\Delta(x + \cos x)$  ?
- b) Maclaurin's series is a special case of ?
- c) The derivative of a function gives us information about?
- d) Which test is used to determine the convergence of infinite series by comparing it with a known convergent series?
- e) What is the supremum of a set?
- f) Define Newton's forward interpolation?
- g) Define forward difference?

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- h) Write Newton's forward interpolation formula ?  
 i) Write one central difference formula?  
 j) Write the formula for Simpson's 3/8 th rule?

## 4) Answer any Four questions

[6X4=24]

- a) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  by using Simpson's 1/3 rd rule.  
 b) Find an approximate value of  $\log_5$  by calculating to 3 decimal places, by Simpson 1/3 rule  $\int_0^5 \frac{dx}{4x+5}$  where  $n=10$ .  
 c) Given  $\frac{dy}{dx} = \frac{y-x}{y+x}$  with initial conditions  $y=1$  at  $x=0$ , find  $y$  for  $x=0.1$  by Euler's method.  
 d) Using Runge-Kutta method of fourth order solve  $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$  with  $y(0)=1$  at  $x=0.2$ .  
 e) Prove D'Alembert,s Ratio test for convergence  $l < 1$ ?  
 f) Prove Raabe's test for diverges if  $l < 1$  ?  
 g) State and prove Lagrange's mean value theorem?  
 h) Examine the validity of the hypothesis and the conclusion of Rolle's Theorem for  $f(x) = x^3 - 4x$  on  $[-2,2]$ .
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**Model Question-05**  
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**Subject –Statistics (UG-2nd year, 3rd Semester).**

**Full MARK-60**

**Paper code:-C-7 (Mathematical Analysis)**

**Time-3 Hrs**

**Answer All Questions**

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**5. Answer all questions**

**[1X8=8]**

- z) Give an example of a set which satisfy complete order field?
- aa) Which set is both closed and open?
- bb) Lagrange's Mean Value Theorem is an extension of \_\_\_\_\_ theorem.
- cc) Rolle's theorem states that for a function  $f(x)$  continuous on  $[a, b]$  and differentiable on  $(a, b)$  there exists a  $c$  in  $(a, b)$  such that  $f'(c) = \underline{\hspace{2cm}}$ ?
- dd) If  $f(x) = 2x^2 - 3x + 1$ , Find  $\Delta^2 f(x)$  ?
- ee) If the increment of  $x$  is  $h$  evaluate  $\Delta^3 f(x)$ ?
- ff) The Trapezoidal rule is obtained from newton's-Cote's quadrature formula if  $n = \underline{\hspace{2cm}}$ ?
- gg) Which method is used to solved differential equation of first order?

**2) Answer any Eight questions**

**[1.5X8=12]**

- a) The sequence  $a_n = \frac{1}{n}$  converges to \_\_\_\_\_?
- b) The series  $\sum_{n=1}^{\infty} \frac{1}{2^n}$  is an example of a \_\_\_\_\_?
- c) D'Alembert's ratio test is based on the limit of the ratio of consecutive terms. If the limit is less than 1, the series \_\_\_\_\_?
- d) A set that does not have an upper bound is called \_\_\_\_\_?
- e) Lagrange's Mean Value theorem states that for a function  $f(x)$  continuous on  $[a, b]$  and differentiable on  $(a, b)$ , there exists at least one  $c$  in  $(a, b)$  such that  $f'(c) = \underline{\hspace{2cm}}$ ?
- f) Taylor's theorem allows us to approximate a function using \_\_\_\_\_?
- g) Maclaurin's series is a special case of Taylor's series where the expansion is centered at \_\_\_\_\_?
- h) which value of  $n$  in Newton's cote formula the Simpson 1/3 rule is derived.
- i) Simpson's three-eighths rule is an extension of \_\_\_\_\_?
- j) The Weddle's rule is an extension of which rule ?

**3) Answer any Eight questions**

**[2X8=16]**

- a) Find the first difference of the function  $(x + \sin x)$ .
- b) Write down the value of  $\Delta(u_x v_x)$ ?
- c) Evaluate  $\lim_{x \rightarrow 0} \frac{1 - \cos 2x}{x^2}$ ?
- d) Evaluate  $\Delta^n (ax^n + b)$ ?

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e) Test the continuity of the function at  $x=0$

$$\begin{cases} \frac{\sin 2x}{x} & \text{at } x \neq 0 \\ 2 & \text{at } x = 0 \end{cases}$$

f) Newton's Interpolation is not suitable for \_\_\_\_\_ point?

g) Write the Taylor's remainder after  $n$  terms.

h) For what value of "p" the Taylor's remainder converted to Cauchy's form of remainder?

i) Show that  $\Delta E = E\Delta$

j) The interior point of N,I or Q set is the \_\_\_\_\_ set.

**4) Answer any Four questions**

**[6X4=24]**

a) State and prove the comparison test for convergence of a series.

b) Find "c" of the mean value theorem, if  $f(x)=x(x-1)(x-2)$  at  $a=0$  and  $b=1/2$ .

c) Obtain the function whose first difference is  $9x^2 + 11x + 5$ .

d) Evaluate  $\Delta^3\{(1-x)(1-2x)(1-3x)\}$

e) Find the 3<sup>rd</sup> divided difference with arguments 2,4,9,10 of the function  $f(x) = x^3 - 2x$

f) The table gives the difference distance related to height compute distance for height 21.27.

Height	100	150	200	250	300	350	400
Distance	10.63	13.03	15.04	16.81	18.42	19.90	21.27

g) Show that the sequence  $\{f_n\}$  where  $f_n(x) = \tan^{-1}nx, x \geq 0$  is uniformly convergent in any interval  $[a,b]$ .

h) Test the function for Lagrange's Mean Value Theorem.

$$f(x) = 2x^2 - 7x + 10 \text{ on } [2,5].$$

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