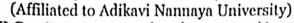
Paper Code: 4101

Regd. No

SRI Y.N.COLLEGE (AUTONOMOUS)-NARSAPUR, W.G.Dt.



II B.Sc., Degree Examinations, Mar/Apr 2017

(At the end of 4th Semester)

(For 2015-18 batch)

Part - II

MATHEMATICS

Paper - II B

(Real Analysis)

Date: 06.04.2017 FN

Max Marks: 75

Duration:3hrs

PART-I

Answer any FIVE questions, each questions carries FIVE marks.

 $5 \times 5 = 25M$

1. If
$$S_n = \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)}$$
 then $\{S_n\}$ is increasing and bounded.

- 2. Prove that every convergent sequence is bounded.
- 3. Test for the convergence of the series $\sum_{n=1}^{\infty} (\sqrt[3]{n^3 + 1} n).$
- 4. Test for convergence of $\sum \frac{1 \cdot 3 \cdot 5 \cdot \cdots \cdot (2n-1)}{2 \cdot 4 \cdot 6 \cdot \cdots \cdot 2n} x^{n-1}$
- 5. Examine whether the function f defined by $f(x) = x \sin\left(\frac{1}{x}\right)$ when $x \neq 0$ and f(0) = 0 is continuous at the origin.
- 6. Show that f(x) = |x| + |x-1| is not derivable at x = 0 and x = 1.
- 7. Verify Cauchy's mean value theorem for $f(x) = x^2$ and $g(x) = x^3$ in [1,2].
- 8. If the function f is defined by $f(x) = \begin{cases} 1 & \text{if } x \in Q \\ 0 & \text{if } x \in R Q \end{cases}$ then show that f is not Riemann Integrable over any interval of R.

<u>PART-II</u>

Answer any FIVE questions from the following, choosing at least TWO questions from each section. Each question carries TEN marks. 5X10 = 50M

SECTION-A

- 9. If $S_n = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{n}$ then show that $\{s_n\}$ is not convergent by using Cauchy's general principle of convergence theorem.
- 10. Prove that a sequence is convergent iff it is a Cauchy sequence.
- 11. State and prove Cauchy's nth root test.
- 12. Define Alternating series. State and Prove Leibnitz's test.
- 13. Prove that the function f defined on R⁺ as $f(x) = Sin(\frac{1}{x})$ for every x > 0 is continuous but not uniformly continuous on R⁺.

SECTION-B

- 14. State and prove Rolle 's Theorem.
- 15. Find c of Lagrange's mean value theorem for f(x) = (x-1)(x-2)(x-3) on [0, 4].
- 16. If f is continuous on [a, b] then prove that f is R-Integrable on [a, b].
- 17. Show that $\frac{1}{\pi} \le \int_0^1 \frac{\sin \pi x}{1 + x^2} dx \le \frac{2}{\pi}.$
- 18. State and prove fundamental theorem of integral calculus.

Paper Code: 4101

Regd. No.

SRI Y.N.COLLEGE (AUTONOMOUS)-NARSAPUR, W.G.Dt.

(Affiliated to Adikavi Nannaya University)

II B.Sc., Degree Examinations, Mar/Apr 2018

(At the end of 4th Semester)

Regular (2016-19 batch), Supplementary (2015-18 batch)

MATHEMATICS

Paper - IV

(Real Analysis)

Date: 31.03.2018 FN

Max Marks: 75

Duration:3hrs

PART - I

Answer any FIVE questions:

5x5=25

- 1. If $\{S_n\}$ is a sequence such that $S_n > 0 \forall n \in \mathbb{Z}^+$ and $\lim \frac{S_{n+1}}{S_n} = l$ then $\lim \sqrt[n]{S_n} = l$
- 2. Prove that $\lim_{n \to \infty} \left\{ \frac{1}{\sqrt{n^2 + 1}} + \frac{1}{\sqrt{n^2 + 2}} + \dots + \frac{1}{\sqrt{n^2 + n}} \right\} = 1$
 - 3. Examine the convergence of $\sum_{n=1}^{\infty} \left(-1\right)^n \frac{1}{n} \left(1 + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}\right)$
 - 4. Test for convergence $\sum_{n=1}^{\infty} 3^{-n-(-1)^n}$
 - 5. Show that $f: R \to R$ defined by f(x) = 1 if $x \in Q$ and f(x) = -1 if $x \in R Q$ is discontinuous for all $x \in R$
 - 6. If $f:[a,b] \to R$ is derivable at $c \in [a,b]$ then prove that f is continuous at C
- 7. Prove that $\frac{\Pi}{6} + \frac{\sqrt{3}}{15} < \sin^{-1} 0.6 < \frac{\Pi}{6} + \frac{1}{8}$
 - 8. Prove that $f(x) = \sin x$ is integrable on $\left[0, \frac{\Pi}{2}\right]$ and $\int_{0}^{\Pi/2} \sin x dx = 1$

PART - II

Answer any FIVE questions choosing atleast TWO questions from each section: 5x10=50

SECTION - A

- 9. If $S_n = \left(1 + \frac{1}{n}\right)^n$ then show that $\{S_n\}$ is convergent
- 10. Discuss the nature of the sequence $\{r^n\}$ for all $r \in R$
- 11. Test for convergence of $\sum (\sqrt[3]{n^3+1}-n)$

- 12. Define alternating series. State and prove Leibnitz's test
- 13. State and prove Bolzano's intermediate value theorem

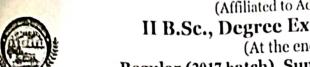
SECTION - B

- 14. State and prove Rolle's theorem
- 15. Show that $\frac{v-u}{1+v^2} < Tan^{-1}V Tan^{-1}u < \frac{v-u}{1+u^2}, 0 < u < v$ and deduce that $2 < \prod < 4$
- 16. A bounded function $f:[a,b] \to R$ is Riemann integrable on [a,b] iff for each $\epsilon > 0$ there exists a partition P of [a,b] such that $0 \le U(P,f) L(P,f) < \epsilon$
- 17. State and prove first mean value theorem
- 18. Show that $\frac{1}{\prod} \le \int_0^1 \frac{\sin \prod x}{1 + x^2} dx \le \frac{2}{\prod}$



Paper Code: 4101 Regd. No

SRI Y.N.COLLEGE (AUTONOMOUS)-NARSAPUR, W.G.Dt. (Affiliated to Adikavi Nannaya University)



II B.Sc., Degree Examinations, Mar/Apr 2019

(At the end of 4th Semester)

Regular (2017 batch), Supplementary (2016,2015 batches)

MATHEMATICS

Paper - IV

(Real Analysis)

Date: 15.04.2019 FN

Max Marks:75

Duration:3hr

PART - I

Answer any FIVE questions, each question carries Five marks 5×5=25M

- 1. Prove that every convergent sequence is bounded
- 2. Prove that the sequence (Sn) defined by $Sn = 1 + \frac{1}{1!} + \frac{1}{2!} + \cdots + \frac{1}{n!}$ is convergent.
- 3. Test for convergence of $\sum_{n=1}^{\infty} (\sqrt{n^4+1} \sqrt{n^4-1})$.
- 4. Test for convergence of $\sum_{n=1}^{\infty} \frac{(n!)^2}{(2n)!}$
- 5. Show that the function f defined by $f(x) = x^3$ is uniformly continuous in [-2,2].
- 6. If $f:[a,b] \to R$ is derivable at $c \in [a,b]$ then prove that f is continuous at C.
- 7. Prove that $\frac{x}{1+x^2} < \tan^{-1}x < x$, when x>0
- 8. If $f(x)=x^2$ on [0,1] and $p=\{0,\frac{1}{4},\frac{2}{4},\frac{3}{4},1\}$ find L (p,f) and U (p,f).

PART - II

Answer any FIVE questions. Choosing at least TWO questions from each section. Each question carries 10 Marks 5×10=50M

SECTION - A

- 9. State and prove Cauchy's first theorem on limits.
- 10. Prove that a monotone sequence is convergent iff it is bounded.
- 11. State and prove D-Alembert's test.
- 12. State and prove liebnitz test.
- 13. Find the constants a,b so that the function f defined by f(x)=2x+1 if $x \le 1$, $f(x) = ax^2+b$ if 1 < x < 3, f(x)=5x+2a if $x \ge 3$ is continuous at x=1,x=3.

SECTION - B

- 14. State and prove Rolle's theorem.
- 15. Prove that $\frac{\pi}{6} + \frac{\sqrt{3}}{15} < \sin^{-1}0.6 < \frac{\pi}{6} + \frac{1}{8}$ by using lagranges mean value theorem.
- 16. A bounded function f:[a,b] →R is Riemann integrable on [a,b] iff for each €>0 there exists a partition P of [a,b] such that 0≤U(p,f)-L(p,f)< €.
- 17. If f:[a,b] →R is monotonic on [a,b] then prove that f is integrable on [a,b]
- 18. Prove that $\frac{\pi^3}{24} \le \int_0^{\pi} \frac{x^2}{5+3\cos x} dx \le \frac{\pi^3}{6}$.

SRI Y.N.COLLEGE (AUTONOMOUS)-NARSAPUR, W.G.Dt.



(Affiliated to Adikavi Nannaya University)

II B.Sc., Degree Examinations, October 2020

(At the end of 4th Semester) Regular (2018-21 batch)

MATHEMATICS

Paper – IV

(Real Analysis)

Date: 03.11.2020 FN Duration:3hrs

Max Marks:75

PART - I

Answer any **FIVE** questions, Each question carries **FIVE** marks.

 $5 \times 5 = 25 \text{ M}$

- State and prove sandwich theorem.
- If $S_n = 1 + \frac{1}{1!} + \frac{1}{2!} + \cdots + \frac{1}{n!}$ then show that $\{S_n\}$ converges. 2.
- Test for convergence of $\sum (\sqrt{n^4+1} \sqrt{n^4-1})$ 3.
- State and prove Leibnitz's Test.

 Sove that

 If f is continuous on [a, b] then f is bounded on [a, b]. 4.
- 5.
- Find 'C' of Lagrange's theorem for f(x) = x(x-1)(x-2) on $[0, \frac{1}{2}]$. 6.
- The Maclaurin's Expansion of Sin x. 7. Prove that
- If f: [a, b] --> R is continuous on [a, b] then f is R Integrable on [a, b] 8.

PART - II

Answer any FIVE questions. Choosing atleast TWO questions from Each section.

Each Question carries **TEN** marks.

 $5 \times 10 = 50 \text{ M}$

SECTION - A

- 9. State and prove cauchy's First theorem on Limits.
- A monotonic sequence is convergent iff it is bounded.
- State and prove P-Test. 11.
- 12. State and prove limit comparison test.

13. Let
$$f: R \longrightarrow R$$
 be such that $f(x) = \begin{cases} \frac{\sin(a+1)x + \sin x}{x} & \text{for } x < 0 \\ C & \text{for } x = 0 \\ \frac{(x+bx^2)^{1/2} - x^{1/2}}{bx^{3/2}} & \text{for } x > 0 \end{cases}$

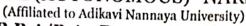
Determine the values of a, b, c for which the function is continous at x = 0.

SECTION - B

- 14. State and prove Rolle's theorem.
- 15. State and prove cauchy's mean value theorem.
- 16. A bounded function $f: [a, b] \longrightarrow R$ is Riemann integrable on [a, b] iff for each E > 0 there exists a partition p of [a, b] such that $0 \le U(p, f) L(p, f) < E$.
- 17. State and prove Fundamental theorem of integral calculus.
- 18. Prove that $\frac{73}{24} \le \int_{0}^{\infty} \frac{X^2}{5+3\cos x} dx \le \frac{73}{6}$

Paper Code: 4101 Regd. No

SRI Y.N.COLLEGE (AUTONOMOUS)-NARSAPUR, W.G.Dt.





II B.Sc/B.Com/B.B.A/B.A., Degree Examinations, June 2022

(At the end of 4th Semester)

Supplementary (2019,2018,2017,2016 batches)

MATHEMATICS

Paper - IV

(Real Analysis)

Date: 29.06.2022 FN Duration:3hrs

Max Marks:75

SECTION-A

Answer any FIVE Questions, each question carries FIVE marks

 $5 \times 5 = 25M$

- 1. Prove that every convergent sequence is bounded.
- 2. Prove that $\lim_{n \to \infty} \left[\frac{1}{(n+1)^2} + \frac{1}{(n+2)^2} + - + \frac{1}{(n+n)^2} \right] = 0$.
- 3. Test the convergence of $\sum_{n=1}^{\infty} \frac{2^n-2}{2^n+1} x^n$, (x > 0).
- 4. Test the convergence of $\frac{1}{1.2} \frac{1}{3.4} + \frac{1}{5.6} \frac{1}{7.8} + -----$
- 5. Examine the continuity of the function $f(x) = \frac{1-\cos x}{x^2}$, $x \neq 0$, f(0) = 1 at x = 0.
- 6. If $f: [a, b] \to R$ is derivable at $c \in [a, b]$, then prove that f is continuous at c.
- 7. Verify Cauchy's mean value theorem for $f(x) = x^2$, $g(x) = x^3$ in [1,2].
- 8. Prove that $f(x) = \sin x$ is integrable on $[0, \frac{\pi}{2}]$ and $\int_0^{\frac{\pi}{2}} \sin x \, dx = 1$.

Answer any FIVE Questions from sections B and C choosing at least Two questions from each section. Each question carries 10 marks.

5 x 10 = 50M

SECTION-B

- 9. Prove that a sequence is convergent if and only if it is a Cauchy sequence.
- 10. If $s_n = \frac{1}{n+1} + \frac{1}{n+2} + - - + \frac{1}{n+n}$ then Show that $\{s_n\}$ is convergent.
- 11. State and prove p-test.
- 12. State and prove Cauchy's nth root test.
- 13. Prove that if f is continuous on [a,b] then prove that f is bounded on [a,b].

SECTION-C

- 14. State and prove Rolle's theorem.
- 15. using Lagrange's theorem, show that $x > \log(1+x) > \frac{x}{1+x} \forall x > 0$.
- 16. If $f: [a, b] \to R$ is continuous on [a,b], then prove that f is R- integrable on [a,b].
- 17. State and prove fundamental theorem of integral calculus.
- 18. Prove that $\frac{\pi^3}{24} \le \int_0^{\pi} \frac{x^2}{5 + 3\cos x} dx \le \frac{\pi^3}{6}$.

Paper Code: 4101

Regd. No

SRI Y.N.COLLEGE (AUTONOMOUS)-NARSAPUR, W.G.Dt.

(Affiliated to Adikavi Nannaya University)



II B.Sc/B.Com/B.B.A/B.A., Degree Examinations, June 2022

(At the end of 4th Semester)

Supplementary (2019,2018,2017,2016 batches)

MATHEMATICS

Paper - IV

(Real Analysis)

Date: 29.06.2022 FN Duration:3hrs Max Marks:75

SECTION-A

Answer any FIVE Questions, each question carries FIVE marks

 $5 \times 5 = 25M$

- 1. Prove that every convergent sequence is bounded.
- 2. Prove that $\lim_{n \to \infty} \left[\frac{1}{(n+1)^2} + \frac{1}{(n+2)^2} + \dots + \frac{1}{(n+n)^2} \right] = 0$.
- 3. Test the convergence of $\sum_{n=1}^{\infty} \frac{2^{n}-2}{2^{n}+1} x^{n}$, (x > 0).
- 4. Test the convergence of $\frac{1}{1.2} \frac{1}{3.4} + \frac{1}{5.6} \frac{1}{7.8} + -----$
- 5. Examine the continuity of the function $f(x) = \frac{1-\cos x}{x^2}$, $x \neq 0$, f(0) = 1 at x = 0.
- 6. If $f:[a,b] \to R$ is derivable at $c \in [a,b]$, then prove that f is continuous at c.
- 7. Verify Cauchy's mean value theorem for $f(x) = x^2$, $g(x) = x^3$ in [1,2].
- 8. Prove that $f(x) = \sin x$ is integrable on $\left[0, \frac{\pi}{2}\right]$ and $\int_0^{\pi} \sin x \, dx = 1$.

Answer any FIVE Questions from sections B and C choosing at least Two questions from each section. Each question carries 10 marks.

5 x 10 = 50M

SECTION-B

- 9. Prove that a sequence is convergent if and only if it is a Cauchy sequence.
- 10. If $s_n = \frac{1}{n+1} + \frac{1}{n+2} + - - + \frac{1}{n+n}$ then Show that $\{s_n\}$ is convergent.
- 11. State and prove p-test.
- 12. State and prove Cauchy's nth root test.
- 13. Prove that if f is continuous on [a,b] then prove that f is bounded on [a,b].

SECTION-C

- 14. State and prove Rolle's theorem.
- 15. using Lagrange's theorem, show that $x > \log(1+x) > \frac{x}{1+x} \forall x > 0$.
- 16. If $f: [a, b] \to R$ is continuous on [a,b], then prove that f is R- integrable on [a,b].
- 17. State and prove fundamental theorem of integral calculus.
- 18. Prove that $\frac{\pi^3}{24} \le \int_0^{\pi} \frac{x^2}{5+3\cos x} dx \le \frac{\pi^3}{6}$.