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Candidate's Seat No :________

B.Sc. Sem.-6 (Rep) Examination

CC-308

Mathematics

Time : 2-30 Hours] October-2025 [Max. Marks : 70

Instruction: 1) **All the questions are compulsory**

2) **Notations and Terminology are standard**

3) **Figures to the right indicates the full marks.**

Q.1

A) **Let f be a bounded function on the closed bounded interval [a, b]. Then f is Riemann Integrable if and only if $\in > 0$, there exists a Subdivision P of [a, b] such that** $U(P,f)-L(P,f)<\in$ **(7)**

B) **Let** $f(x)=x^3$ **on [0, 1]. For each** $n \in N$ **let** $P_n=\left\{0,\frac{1}{n},\frac{2}{n}....1\right\}$ **of [0, 1]. Compute** $\lim\limits_{n\to\infty}U(f,P_n)$ **and** $\lim\limits_{n\to\infty}L(f,P_n)$. **(7)**

OR

A) **State and prove Second Mean Value theorem of Integral.** **(7)**

B) **Discuss the convergence of**

i) $\displaystyle\int_0^\infty \frac{x^2}{(k^2+x^2)^2}dx$ ii) $\displaystyle\int_{-\infty}^0 \frac{1}{1+x^2}dx$ **(7)**

Q.2 A) **State and prove Comparison Test** **(7)**

B) **Discuss the convergence of the following series.**

i) $\displaystyle\sum_1^\infty \frac{n}{3^n}$ ii) $\displaystyle\sum_1^\infty \frac{n!}{n^n}$ **(7)**

OR

A) **Prove that** $\inf x_n \le \underline{\lim}\, x_n \le \overline{\lim}\, x_n \le \sup x_n$ **(7)**

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B) Discuss the convergence of $\sum_{0}^{\infty} 2^{(-1)^n - n}$ (7)

Q.3

A) Prove that following two statements are equivalent. (7)

i) C is complete.

ii) Every absolutely convergent series in C is convergent.

B) Prove that the series $\sum_{1}^{\infty} \frac{(-1)^{n-1}}{n}$ is conditionally convergent. (7)

OR

A) State and prove Merten's Theorem. (7)

B) Discuss the convergence of following series. (7)

$$\sum_{0}^{\infty} \frac{z^{3n}}{2^n}$$

Q.4

A) State and prove Taylor's theorem with Lagrange form remainder. (7)

B) Write down Taylor formula with the Cauchy form of the remainder for

$f(x) = (1-x)^{1/2}$ about a =0 and -1 < x < 1. (7)

OR

A) State and prove Taylor's theorem with Cauchy form remainder. (7)

B) Find the power series solution of the differential equation $(1-x)y'+1=0$, (7)

with condition y (0) = 1.

Q.5 Answer any Seven in short: (14)

1) Define: Riemann Integral.

2) State First Fundamental theorem of Calculus.

3) Define: Improper Integral.

4) Define: Limit superior.

5) Define: Complex Sequence

6) State Cauchy Root Test.

7) Define: Absolute Convergence series.

8) Define: Radius of convergence.

9) Define: Conditionally convergence series.

10) State Maclaurin's theorem with Lagrange form of remainder.

11) Define: Power series.

12) State Binomial Expansion theorem.

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