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Maximum Weight : 10

Section II

ME 010 104—MCQ—REAL ANALYSIS

[TO BE ATTACHED TO THE MAIN ANSWER-BOOK]

M.Sc. DEGREE (C.S.S.) PRIVATE EXAMINATION, MAY 2026

DO NOT WRITE YOUR REGISTER NUMBER OR NAME ANYWHERE IN SECTION II OF
THE QUESTION PAPER

*Answer **all** questions.*

All questions carry equal weight.

Put a tick mark [✓] against the correct answer.

1. Find the point of discontinuity of the function $f(x) = \frac{1}{x-2}$.

(A) -2.

☐

(B) 0.

☐

(C) 2.

☐

(D) 1.

☐

2. A function of bounded variation is :

(A) Necessarily bounded.

☐

(B) Necessarily unbounded.

☐

(C) May be bounded or unbounded.

☐

(D) None of the above.

☐

3. Assume that f and g are each of bounded variation on $[a, b]$. Then :

(A) $v_{f-g} = v_f + v_g$.

☐

(B) $v_{f-g} \leq v_f + v_g$.

☐

(C) $v_{f-g} \geq v_f + v_g$.

☐

(D) None of the above.

☐

4. Let $I = [1, 13]$ be closed and bounded interval in $\mathbb{R}$. Let $P = (1, 2, 5, 9, 12, 13)$ be any partition of I , then $\|P\|$ is :

(A) 3.

☐

(B) 4.

☐

(C) 2.

☐

(D) 1.

☐

Turn over





26151745

5. Let $I = [2, 8]$ be closed and bounded interval in $\mathbb{R}$. Let $P_1 = (2, 5, 7, 8)$ and $P_2 = (2, 4, 6, 7, 8)$ then common refinement of P_1 and P_2 is :

- (A) $(2, 7, 8)$. ☐ (B) $(2, 4, 6, 7, 8)$. ☐
 (C) $(2, 4, 6, 6, 7, 8)$. ☐ (D) $(2, 5, 7, 8)$. ☐

6. If f is continuous function on $[a, b]$ then :

- (A) f is differentiable on $[a, b]$. ☐
 (B) f is non-differentiable on $[a, b]$. ☐
 (C) f is Reimann Steiljets integrable on $[a, b]$. ☐
 (D) f is not Reimann Steiljets integrable on $[a, b]$. ☐

7. If f be bounded in $[a, b]$ and c be a constant, then evaluate $\int_a^b f dc$:

- (A) 0. ☐ (B) 1. ☐
 (C) $\frac{1}{2}$. ☐ (D) -1. ☐

8. Which one of the following statements are correct :

- (A) Pointwise convergence $\rightarrow$ uniform convergence. ☐
 (B) Uniform convergence $\rightarrow$ pointwise convergence. ☐
 (C) Uniform convergence $\rightarrow$ uniform continuity. ☐
 (D) All of the above. ☐

9. Let a sequence of continuous functions $\{f_n\}$ converges pointwise to a continuous function f on a set K such that $f_n(x) \geq f_{n+1}(x) \forall x \in K$. Then the convergence is uniform if :

- (A) K is open. ☐ (B) K is closed. ☐
 (C) K is compact. ☐ (D) K is bounded. ☐

10. Which one of the following sequence of functions converges uniformly :

- (A) $f_n(x) = \frac{1}{nx+1}; x \in (0, 1)$. ☐ (B) $f_n(x) = \frac{1}{nx+1}; x \in [0, 1]$. ☐
 (C) $f_n(x) = \frac{1}{nx+1}; x \in (0, 1]$. ☐ (D) All of the above. ☐





26151745

11. A series of functions $\sum f_n$ converges uniformly to a function f on a set E if :

(A) $\{f_n\}$ converges to f on E .

☐

(B) Sequence of partial sums converges uniformly on E .

☐

(C) Each f_n is continuous and $\{f_n\}$ converges to f on E .

☐

(D) None of the above.

☐

12. Let $f_n \in \mathcal{R}(\alpha)$ on $[a, b]$ and let $\sum f_n(x) = f(x); x \in [a, b]$. Then $\int_a^b f(x) d\alpha = \sum_n \int_a^b f_n(x) d\alpha$ if :

(A) f_n converges.

☐

(B) f_n converges uniformly.

☐

(C) $\sum f_n$ converges to a bounded function.

☐

(D) None of the above.

☐

13. Which one of the following statements are correct :

(A) Uniform convergence of $\{f_n\}$ implies uniform convergence of $\{f'_n\}$.

☐

(B) $f_n \in \mathcal{R}(\alpha)$ on $[a, b]; n = 1, 2, 3, \dots$ and $\{f_n\} \rightarrow f$ uniformly on $[a, b]$ implies $f \in \mathcal{R}(\alpha)$.

☐

(C) Pointwise converges of a sequence implies uniform convergence of that sequence.

☐

(D) None of the above.

☐

14. If $\{f_n\}$ and $\{g_n\}$ converge uniformly on E . Then $\{f_n, g_n\}$ converge uniformly on E if :

(A) $\{f_n\}$ and $\{g_n\}$ are continuous.

☐

(B) $\{f_n\}$ and $\{g_n\}$ are differentiable.

☐

(C) $\{f_n\}$ and $\{g_n\}$ are bounded functions.

☐

(D) $\{f_n\}$ and $\{g_n\}$ are monotonic functions.

☐

Turn over





26151745

15. Which of the following statements are false ?

- (A) There exists real continuous function on the real line which is differentiable. ☐
- (B) There exists no real continuous function on the real line which is nowhere differentiable. ☐
- (C) There exists real continuous function on the real line which is integrable. ☐
- (D) All of these. ☐

16. Suppose the series $\sum a_n x^n$ and $\sum b_n x^n$ converge in the segment $S = (-R, R)$. Let E be the set of all $x \in S$ at which $\sum a_n x^n = \sum b_n x^n$. Then what is the condition for satisfying $\sum a_n x^n = \sum b_n x^n$ for all $x \in S$:

- (A) E is bounded. ☐ (B) E has a limit point in S . ☐
- (C) E is a finite set. ☐ (D) $E = \emptyset$. ☐

17. If we define $E(z) = \sum_{n=0}^{\infty} \frac{z^n}{n!}$, then which of the following is true ?

- (A) $E(Z + W) = E(Z) + E(W)$. ☐ (B) $E(Z + W) \leq E(Z) + E(W)$. ☐
- (C) $E(Z + W) = E(Z) \cdot E(W)$. ☐ (D) $E(Z + W) \geq E(Z) + E(W)$. ☐

18. If we define $E(z) = \sum_{n=0}^{\infty} \frac{z^n}{n!}$, which of the following is true ?

- (A) $E(z) = 0$ for some z . ☐ (B) $E(x) < 0$ for all real x . ☐
- (C) $E(x) < 0$ if $x > 0$. ☐ (D) $E(z) \neq 0$ for all z . ☐

19. Suppose the series $\sum_{n=0}^{\infty} c_n x^n$ converges for $|x| < R$ and define $f(x) = \sum_{n=0}^{\infty} c_n x^n, |x| < R$. Then $\sum_{n=0}^{\infty} c_n x^n$ converges uniformly on $[-R + \varepsilon, R - \varepsilon]$ no matter which $\varepsilon > 0$ is chosen. The function f is continuous and differentiable in :

- (A) $(-R + \varepsilon, R - \varepsilon)$. ☐ (B) $[-R + \varepsilon, R - \varepsilon]$. ☐
- (C) $[-R, R]$. ☐ (D) $(-R, R)$. ☐





26151745

20. Let $f_n(x) = \frac{x^2}{x^2 + (1 - nx)^2}$, $0 \leq x \leq 1$, $n = 1, 2, 3, \dots$. Then which statement is true :

(A) $\lim_{n \rightarrow \infty} f_n(x) = 0$.

☐

(B) $\{f_n\}$ is uniformly bounded on $[0, 1]$.

☐

(C) $f_n\left(\frac{1}{n}\right) = 1$.

☐

(D) Subsequence converges uniformly on $[0, 1]$.

☐

No. of MCQ's attempted

Weight Scored

(To be entered by the examiner)

No. of MCQ's not attempted

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