K25U 0182

Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree (C.B.C.S.S. – OBE – Regular/Supplementary/ Improvement) Examination, April 2025
(2019 to 2022 Admissions)
CORE COURSE IN STATISTICS
6B10STA : Mathematical Methods for Statistics – II

Time : 3 Hours Max. Marks : 48

PART – A
(Short Answer)

Answer **all** questions. **Each** question carries **one** mark.

1. Define Refinement of a partition on a closed interval [a, b].
2. When do you say that a function f(x, y) has a limit at the point (a, b) ?
3. Evaluate $\int_0^{\infty} e^{-x} x^{-\frac{1}{2}} dx$.
4. Check whether $\int_0^1 \log x dx$ is convergent or divergent.
5. Define linearly dependent vectors on a vector space V.
6. State Cayley-Hamilton theorem. **(6×1=6)**

PART – B
(Short Essay)

Answer **any seven** questions. **Each** question carries **two** marks.

7. State any two properties of Reimann Integral.
8. Evaluate $\int_0^3 [x]\, dx$.
9. Show that every monotonic function is integrable.
10. Let
$$f(x, y) = \begin{cases} \dfrac{xy}{\sqrt{x^2+y^2}}, & \text{if } (x, y) \neq (0, 0). \\ 0, & \text{otherwise.} \end{cases}$$
Show that f(x, y) is continuous at the origin.
11. Find the maxima of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.

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12. Show that $\int_0^1 \frac{\log x}{\sqrt{x}} dx$ is convergent.
13. If n is a positive integer then show that $\Gamma(n) = (n - 1)!$
14. Examine whether the vectors {(1, –1, 0), (1, 1, 0), (0, 1, 1)} are linearly independent.
15. The characteristic equation of a 2 × 2 matrix is $x^2 - 4x - 5 = 0$. Find its determinant. **(7×2=14)**

PART – C
(Essay)

Answer **any four** questions. **Each** question carries **four** marks.

16. If f is bounded and integrable on [a, b], then show that $\left|\int_a^b f\,dx\right| \leq \int_a^b |f|\,dx$.
17. If f is integrable on [a, b], then show that f^2 is also integrable on [a, b].
18. State and prove the fundamental theorem of integral calculus.
19. Explain Lagrange's method of multipliers.
20. State and prove the limit comparison test for improper integrals.
21. Show that the characteristic roots of an idempotent matrix are 0 or 1. **(4×4=16)**

PART – D
(Long Essay)

Answer **any two** questions. **Each** question carries **six** marks.

22. State and prove the necessary and sufficient condition for the integrability of a bounded function.
23. Show that the function $f(x, y) = 2x^4 - 3x^2y + y^2$ has neither a maximum nor a minimum at origin, where $f_{xx}f_{yy} - (f_{xy})^2 = 0$.
24. Show that the integral $\int_a^b \frac{dx}{(x-a)^n}$ converges if and only if n < 1.
25. Find the characteristic vectors of $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$. **(2×6=12)**

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