16671

BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – B.Tech.(CSE)-2024/B.Tech.(CSE)-AIML-2024/B.Tech.(CSE)-DS-2024/B.Tech.(CSE)-AIR-2024/B.Tech.(CSE)-CYS-2024/B.Tech.(CSE)-2025/B.Tech.(CSE)-AIML-2025/B.Tech.(CSE)-CYS-2025/B.Tech.(CSE)-DS-2025/B.Tech.(CSE)-AIR-2025
Course Name – Calculus
Course Code - BBS00005
(Semester I)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) If $f(x)$ satisfy all the conditions of Rolle's theorem in $[a, b]$, then choose the correct one: $f'(x)$ becomes zero

a) only at one point in (a, b)
b) at two points in (a, b)
c) at least one point in (a, b)
d) none of these

(ii) Select the correct value of $\beta\left(\frac{1}{2}, \frac{1}{2}\right)$

a) π
b) $\sqrt{\pi}$
c) $\frac{\sqrt{\pi}}{2}$
d) $\frac{\pi}{2}$

(iii) Select the value of $\Gamma\left(\frac{1}{3}\right)\Gamma\left(\frac{2}{3}\right)$

a) $\frac{2\pi}{\sqrt{3}}$
b) $\frac{3\pi}{\sqrt{2}}$
c) $\frac{\pi}{\sqrt{3}}$
d) $\frac{\pi}{\sqrt{2}}$

(iv) Identify the value of $\int_0^{\infty} e^{-x^2} dx$

a) π
b) $\sqrt{\pi}$

c) $\frac{\sqrt{\pi}}{2}$

d) $\frac{\pi}{2}$

(v) Identify the convergence of the sequence $\left\{1, \frac{1}{3}, \frac{1}{3^2}, \ldots\ldots, \frac{1}{3^n}, \ldots. \infty\right\}$

a) convergent

b) divergent

c) oscillatory

d) none of these

(vi) If the series $\sum_{n=1}^{\infty} \frac{1}{n^{(p+1)}}$ is divergent then select the correct value of p.

a) $p \leq 0$

b) $p > 1$

c) $p > 0$

d) $p \leq 1$

(vii) Select the correct option. The sequence $\left\{\frac{3n+1}{n+2}\right\}$ is

a) Bounded

b) Unbounded

c) Divergent

d) None of these

(viii) For a given differential equation, if C.F.= $c_1 \cos 2x + c_2 \sin 2x$, identify the Wronskian

a) 1

b) 2

c) $\cos 2x$

d) $\sin 2x$

(ix) Identify the value of $\frac{1}{D^2+4}(x) =$

a) $\frac{1}{4}$

b) $\frac{1}{4}\left(x^2 - \frac{1}{2}\right)$

c) $\frac{x}{4}$

d) $4x^2 - 2$

(x) Choose the correct option. The Gamma function is undefined for:

a) Positive integers

b) Rational numbers

c) Negative integers and zero

d) Irrational numbers

(xi) Choose the correct option. The integral $\int_0^{\infty} \frac{1}{1+x^2} dx$ is

a) 0

b) 1

c) $\frac{\pi}{2}$

d) ∞

(xii) Choose the correct option. For $f(x, y) = x^4 - 4x^2 + y^4$, the point $(0,0)$ is:

a) A local minimum

b) A local maximum

c) A saddle point

d) None of these

(xiii) The region V in space is bounded by $x = 0, x = 1,\ y = 0, y = 1, z = 0$, and $z = 1$. Write the volume of V

a) 1

b) 2

c) 3

d) 4

(xiv) Choose the correct option. Given a region V in space, the volume of V can be found using the triple integral:

a) $\iiint x dV$

b) $\iiint dV$

c) $\iiint y dV$

d) $\iiint z dV$

(xv) Choose the correct option. The volume under z = x + y, over square 0 ≤ x, y ≤ 1, is

a) 1

b) $\frac{3}{2}$

c) 2

d) $\frac{1}{2}$

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Interpret the triple integral $\iiint f(x, y, z) dx\, dy\, dz$ in cylindrical coordinates. (3)

3. Identify the area bounded by the region x=0, y = 0, and x+ y=1. (3)

4. Show that $\lim_{n\to\infty} \frac{3n^2+2n+1}{n^2+1} = 3$ (3)

5. Identify the characteristic equation and general solution of the D.E. (3)

$y^{(5)} - 3y^{(4)} + 3y^{(3)} - y'' = 0$

6. Evaluate the Maclaurin Series expansion of cos x. (3)

OR

For the function $f(x)=x^2+2x$ over [−2,0], verify that the function satisfies the criteria stated in Rolle's theorem and calculate all values of c in the given interval where f′(c)=0. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

(5)

7. For $k > 0, n > 0$, identify the value of $\int_0^\infty e^{-kt} t^{n-1} dt$.

(5)

8. Identify and classify the critical points of the function $f(x, y) = x^2 + y^2 - 4x - 6y + 13$.

(5)

9. If $u = r$ and $r^2 = x^2 + y^2 + z^2$ establish that $r\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right) = 2$

(5)

10. Illustrate that $f_{xy}(0,0) = f_{yx}(0,0)$ for the function

$$f(x, y) = \frac{x^2 y^2}{x^2+y^2}, \quad (x, y) \neq (0,0)$$

$$= 0, \quad (x, y) = (0,0)$$

(5)

11. Identify the solution of the Cauchy-Euler equation $x^2 y'' + 2xy' - y = x$

(5)

12. For $f(x) = \ln(x)$ on the interval $[1, e]$ evaluate the value of c that satisfies the Mean Value Theorem.

OR

(5)

Evaluate the solution of the differential equation: $y'' - 2y' + y = e^x$ using method of variation of parameters.

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