



BRAINWARE UNIVERSITY

Term End Examination 2024-2025

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

Course Name – Calculus

Course Code - BBS00005

(Semester I)

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398, Ramkrishnapur Road, Barasat
Kolkata, West Bengal-700125

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) Identify the value of $\int_{-\pi}^{\pi} \sin 6x \, dx$

- | | |
|-------|------------------|
| a) 0 | b) 1 |
| c) -1 | d) None of these |

(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 $\left\{1, \frac{1}{3}, \frac{1}{3^2}, \dots, \frac{1}{3^n}, \dots, \infty\right\}$
- a) convergent
b) divergent
c) oscillatory
d) none of these
- (vi) Select the correct option. The sequence $\{(-1)^n \cdot 2^n\}$ is
- a) monotone
b) bounded
c) convergent
d) oscillatory infinitely
- (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 correct test from the followings that can be used to determine the convergence of the series $\sum_{n=1}^{\infty} \frac{(-1)^n}{n}$
- a) Ratio Test
b) Root Test
c) Alternating Series Test
d) Comparison Test
- (x) Select the correct option. The integral $\int_0^1 \ln x \, dx$ is:
- a) Convergent
b) Divergent
c) Undefined
d) Finite but not evaluated
- (xi) Select the correct option. The Beta function $B(x, y)$ is symmetric, that means:
- a) $B(x, y) = \frac{1}{B(y, x)}$
b) $B(x, y) = -B(y, x)$
c) $B(x, y) = B(y, x)$
d) None of these
- (xii) If $f(x, y) = x^2 - y^2$, then calculate f_{xy}
- a) $2xy$
b) $-2xy$
c) 0
d) -2
- (xiii) If $f(x, y) = e^{xy}$, then calculate $\lim_{(x,y) \rightarrow (0,0)} f(x, y)$
- a) 1
b) 0
c) e
d) Does not exist
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(xiv) Write the total differential of $z = x^2 + y^2$

a) $dz = xdx + ydy$

b) $dz = dx + dy$

c) $dz = 2xdx + 2ydy$

d) $dz = 2xdy + 2ydx$

(xv) Select the characteristic equation of $y'' + 4y = 0$

a) $r^2 + 4r = 0$

b) $r^2 + 4r + 2 = 0$

c) $r^2 + 4 = 0$

d) $r^2 + 4r - 2 = 0$

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Calculate all the second partial derivatives of $f(x, y) = x^3 e^{-2y} + y^2 \cos(x)$. (3)

3. Examine that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. (3)

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

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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 $\sin x$. (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 evaluate all values of c in the given interval where $f'(c) = 0$. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Examine that $\int_0^{\frac{\pi}{2}} \sin^4 x \cos^4 x \, dx = \frac{3\pi}{256}$. (5)

8. Identify the interval and radius of convergence $\sum \frac{(x-2)^n}{(n+1)n^3}$ (5)

9. Examine whether the limit of $f(x, y) = \frac{xy}{y^2 - x^2}$ exist when $(x, y) \rightarrow (0, 0)$. (5)

10. Illustrate that $f_{xy}(0,0) = f_{yx}(0,0)$ for the function (5)

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

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11. Identify the solution of the differential equation $y''' - y = e^x$. (5)

12. For $f(x) = \ln(x)$ on the interval $[1, e]$ evaluate the value of c that satisfies the Mean Value Theorem. (5)

OR

Evaluate the solution of the differential equation: $x^2 y'' - 4xy' + 6y = x^2 \log x$, using method of variation of parameters. (5)
