Roll No. Total No. of Pages : 02

Total No. of Questions : 11

B.Sc. (Honours) Chemistry (2019 Batch) (Sem.-1)

MATHS-I (CALCULUS-I)

Subject Code : UC-BSHM-104-19

M.Code : 77226

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of EIGHT questions carrying TWO marks each.
2. SECTION-B contains EIGHT questions carrying FOUR marks each and students have to attempt any SIX questions.
3. SECTION-C will comprise of two compulsory questions with internal choice in both these questions. Each question carries TEN marks.

SECTION-A

1. Attempt the following :

a) Determine the value of k for which the following function is continuous at $x = 3$.

$$f(x)=\begin{cases} \dfrac{x^2-9}{x-3}; & x\neq 3 \\ k; & x=3 \end{cases}$$

b) State Lagrange's Mean Value Theorem.

c) Evaluate $\int xe^{2x}dx$.

d) Find the value of the integral $\int_{-\pi/2}^{\pi/2} \sin^7 x\,dx$.

e) If $u = x^m y^n$, find the total derivative of u.

f) If $Z = f(x + ct) + \phi(x - ct)$, prove that $\dfrac{\partial^2 z}{\partial t^2} = c^2 \dfrac{\partial^2 z}{\partial x^2}$

g) Evaluate $\int_0^3 \int_0^1 (x^2 + 3y^2)\,dy\,dx$.

h) If $x = r\cos\theta$ and $y = r\sin\theta$, find the value of $\dfrac{\partial(x,y)}{\partial(r,\theta)}$.

SECTION-B

2. Find the derivative of the function $x^{\sin x}$.

3. Find the interval in which the function $f(x) = 2x^3 + 9x^2 + 12x + 20$ is increasing.

4. Evaluate the integral $\int \frac{2x+1}{(x+1)(x-2)} dx$.

5. Evaluate : $\int_0^{1/\sqrt{2}} \frac{\sin^{-1} x}{(1-x^2)^{3/2}} dx$.

6. Let be a $f(x, y)$ function defined as $f(x,y)=\begin{cases} \frac{xy}{x^2+y^2}; & (x,y)\neq(0,0) \\ 0 \quad ; & (x,y)=(0,0) \end{cases}$. Show that $f(x, y)$ is discontinuous at (0, 0).

7. If $T=\frac{x^3y^3}{x^3+y^3}$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=3T$.

8. Evaluate $\int_0^{\infty}\int_x^{\infty}\frac{e^{-y}}{y}dydx$ by changing the order of integration.

9. Find the area bounded by the circle $x^2 + y^2 = p^2$ using polar coordinates.

SECTION-C

10. Show that the surface area of a closed cuboid with square base and given volume is minimum, when it is a cube.

Or

Using definite integrals, find the area bounded by the curves $y^2 = 4ax$ and $x^2 = 4ay$.

11. Find the dimensions of the rectangular box, open at the top, of maximum capacity whose surface is 432 cm^2.

Or

Using triple integration, find the volume of the sphere $x^2 + y^2 + z^2 = a^2$.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.