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B. Sc (Hons. Math) (Semester – 1st)
CALCULUS-I
Subject Code: BMATS1121
Paper ID: 22131201

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:

a) Find the value of $\frac{5x^3+8x^2}{3x^4-16x^2}$.

b) If $\sqrt{3-2y^2} \le f(y) \le \sqrt{3-y^2}\, for\ -1 \le y \le 1,\ find f(y)$.

c) Check whether $y = \sqrt{x}$ is differentiable at X=0 or not.

d) Find the absolute minimum and maximum values of $f(x) = 4 - x^2, -3 \le x \le 1$.

e) Define the inflection point and concavity of a curve.

f) Find the polar form of $x^2 + (y-4)^2 = 16$.

g) Find the asymptotes for the hyperbola $9x^2 - 25y^2 = 225$.

h) What are the tangents to the curve $x^3 + y^3 = 3axy$ at the origin?

i) What is the working rule to find the extreme values of a function $z = f(x,y)$.

j) Define composite function with an example.

Section – B **(5 marks each)**

Q2. Compute $div\,\vec{F}\ and\ curl\,\vec{F} for\ \vec{F} = x^2 y\,\vec{i} - \left(z^3 - 3x\right)\vec{J} + 4y^2\,\vec{K}$.

Q3. Show that every differentiable function is continuous.

Q4. Find the value of $\partial z/\partial x$ at the point (1,1,1) if the equation $xy + Z^3 x - 2yz = 0$ defines z as a function of the two independent variables x and y and the partial derivatives exists.

Q5. Find the derivative of the function $g(x,y,z) = 3e^x \cos cos\, yz$ at point P(0,0,0) in the direction of $A = 2i + j - 2k$.

Q6. Solve the system $u = x - y, v = 2x + y$ for x and y in terms of u and v. Then find the value of the Jacobian $\partial(x,y)/\partial(u,v)$.

Section – C **(10 marks each)**

Q7. Solve and prove Euler's theorem for homogenous function.

Q8. Find the tangent plane and normal line at the point $P(3,5,-4)$ on the surface $x^2 + y^2 - z^2 =- 18$.

Q9. Find the greatest and smallest values that the function $f(x,y) =- xy$ takes on the ellipse $\frac{x^2}{8} + \frac{y^2}{2} = 1$ using the method of Lagrange's multipliers.