UNIVERSITY OF EDUCATION
"UExam" Semester-III, 2023
BS Chemistry/Physics/Mathematics Session:2021-25

Course Code: MATH2111
Subject: Calculus-III

No. 229

Roll No. (in fig.)_____

Roll No. (in words)_____

Candidate's Signature._____

Signature of Addl. Supdt._____

SECTION: I (MCQ's)

Time Allowed: 20 Minutes **Max. Marks: 24**

NOTE: Encircle the correct/ best answer in each of the followings. Each Question carries 1.5 mark. Use of remover carries zero mark. Cutting and Overwriting is not allowed.

Q1.

- The divergence of vector field is a _____function.
  a) Vector b) scalar c) zero vector d) None
- If $F = xi + yj + zk$ then div F = _____.
  a) 0 b) 1 c) 2 d) 3
- If $Ff(x,y,z) = 1 - 2xy^2z + x^2y$ then value of f_{yxy}____
  a) $-4yz + 2x$ b) -4 c) $-4xyz + x^2$ d) $-4z$
- If $f(x,y) = \frac{x^2}{2} + \frac{y^2}{2}$ then gradient f at (1,1) is_____
  a) $i + j$ b) $i - j$ c) $-i - j$ d) $-i + j$
- If $f_{xx}f_{yy} - f_{xy}^2 < 0$, then function has _____
  a) Critical point b) saddle pointc) local minimum d) None
- The gas is neither expanding nor compressing at any point. If _____.
  a) $\nabla \times F = 0$ b) $\nabla . F = 0$ c) $\nabla . \nabla \times F = 0$ d) None
- The value of dV in spherical coordinates coordinate is _____
  a) $\rho sin\vartheta \, d\rho d\vartheta d\theta$ b) $\rho^2 sin\vartheta \, d\rho d\vartheta d\theta$ c) $\rho cos\theta \, d\rho d\vartheta d\theta$ d) $\rho d\rho d\vartheta d\theta$
- If div F = 2c then the gas undergoes expansion if _____
  a) $c > 0$ b) $c < 0$ c) $c = 0$ d) None
- The extreme values can occur only at
  a) Critical point b) boundary point c) both a) & b) d) None
- If $F = yi - xj + x^2k$ then curl F = _____
  a) 2x i + 2k b) -2x j + 2k c) -2x j - 2k d) -2x i - 2k
- $\iint F.n \, d\tau = \iiint \nabla . F \, dV$ is the statement of _____theorem.
  a) Green's b) Divergence c) Cauchy residue d) Stoke's
- $\oint F.dr = \iint \nabla \times F.n \, dr$ is known as _____theorem.
  a) Green's b) Divergence c) Stokes' d) None
- Stokes theorem generalizes _____theorem in three dimensions.
  a) Green's b) Divergence c) Cauchy Gorsat d) None
- The chain rule is used for _____function.
  a) Even b) odd c) composite d) None
- $\oint Mdx + Ndy =$_____
  a) $\iint (N_x - M_y)dA$ b) $\iint (M_x - N_y)dA$ c) $\iint (N_{xx} - M_{yy})ds$ d) None
- The volume of ellipsoid is _____
  a) $\frac{4abc}{3}$ b) $\frac{4\pi abc}{3}$ c) $\frac{\pi r^2 h}{3}$ d) $\frac{4\pi r^3}{3}$

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Time Allowed: 100 Minutes. **Max. Marks: 56**

Section II (Short Answer)

Q.2- Write short answers of the following. **3x8 = 24**

I. Evaluate $\lim_{(x,y)\to(0,0)} \frac{x^2-xy}{\sqrt{x}-\sqrt{y}}$.

II. Find f_y, if $f(x,y) = y \sin xy$.

III. Write the chain rule using branch diagram and find $\partial z/\partial v$, $z = tan^{-1}(x/y)$, $x = ucos\ v$, $y = usinv$;

IV. Find the gradient of the function at the given point. $f(x,y) = \sqrt{2x+3y}$, $p(-1,2)$

V. Write an iterated integral using horizontal cross-section $y = \sqrt{x}$, $y = 0$ & $x = 9$.

VI. State the divergence theorem.

VII. Find the divergence, and interpret what it means, $\boldsymbol{F} = -cy\boldsymbol{i} + cy\boldsymbol{j}$.

VIII. Find the curl of $\boldsymbol{F} = yz\boldsymbol{j} + z^2\boldsymbol{k}$.

Section III (Essay Type)

Answer the following Questions **8x4 = 32**

Q.3. Verify the Green's theorem for the field $\boldsymbol{F} = M\boldsymbol{i} + N\boldsymbol{j}$, Take the domain of integration to be the disk R, $x^2 + y^2 \le a^2$ and its bounding circle C: $\boldsymbol{r} = (\text{acos}\ t)\boldsymbol{i} + (\text{asin}\ t)\boldsymbol{j}$, $0 \le t \le 2\pi$. $\boldsymbol{F} = -y\boldsymbol{i} + x\boldsymbol{j}$. [8]

Q.4. Find the line integrals along the given path C. $\int (x-y)dx$, Where $x = t, y = 2t+1,\ 0 \le t \le 3$. [8]

Q.5. Evaluate the integral $\int_{-1}^{1}\int_{0}^{1}\int_{0}^{2}(x+y+z)\,dy\,dx\,dz$ [8]

Q.6. Find all the local maxima, local minima, and saddle points of the function $f(x,y) = x^3 + 3xy + y^3$. [8]