



A Charutar Vidya Mandal's Institution
V. P. & R. P. T. P. SCIENCE COLLEGE
 (AUTONOMUS) (Grant-in-Aid)

Affiliated to Sardar Patel University, Vallabh Vidyanagar -388120

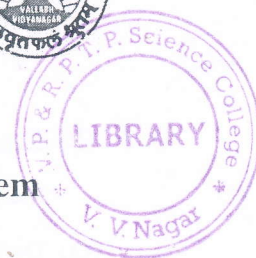
Bachelor of Science (Semester 3) Internal Examination-2025
US03MAMTH02: Multivariate Calculus and The Real Number system

Date: 24-09-2025 (Wednesday)

Time: 2:45 pm to 4:15 pm

Total marks: 30

NOTE: The symbols used in this paper have usual meaning unless specified.



Q. 1 Write the most appropriate answer from the following multiple-choice questions. [06]

- (1) The region $R : 0 \leq x \leq \pi, 0 \leq y \leq x$ can be express as

(a) $R : 0 \leq y \leq \pi, \pi \leq x \leq y.$	(b) $R : 0 \leq y \leq \pi, 0 \leq x \leq \pi.$
(c) $R : 0 \leq y \leq \pi, y \leq x \leq \pi.$	(d) None of these.
- (2) Area of the region R bounded by $y = x$ and $y = x^2$ is.....

(a) $\frac{1}{6}$	(b) $\frac{1}{3}$	(c) $\frac{1}{2}$	(d) $\frac{1}{4}$
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- (3) The Jacobian of the coordinate transformation $x = g(u, v), y = h(u, v)$ is given by

(a) $J(x, y) = \frac{\partial u}{\partial x} \frac{\partial v}{\partial y} - \frac{\partial u}{\partial y} \frac{\partial v}{\partial x}.$	(b) $J(x, y) = \frac{\partial u}{\partial y} \frac{\partial v}{\partial x} - \frac{\partial u}{\partial x} \frac{\partial v}{\partial y}.$
(c) $J(u, v) = \frac{\partial x}{\partial v} \frac{\partial y}{\partial u} - \frac{\partial x}{\partial u} \frac{\partial y}{\partial v}.$	(d) $J(u, v) = \frac{\partial x}{\partial u} \frac{\partial y}{\partial v} - \frac{\partial x}{\partial v} \frac{\partial y}{\partial u}.$
- (4) $\iiint_S dV = \dots$; if S is given by $S : 0 \leq x \leq 1, 1 \leq y \leq 3, 2 \leq z \leq 3.$

(a) 1	(b) 2	(c) 4	(d) 6
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- (5) If $\oint_C \mathbf{F} \cdot d\mathbf{r} = 0$ for each closed curve in the domain then $\mathbf{F}$ is field.

(a) solenoid	(b) conservative	(c) irrotational	(d) potential
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- (6) Suppose E is bounded below subset of $\mathbb{R}$. Then

(a) infimum of E may not exist in $\mathbb{R}.$	(b) infimum of E exists and E contains its infimum.
(c) infimum of E exists and E may not contain its infimum.	(d) None of these.

Q. 2 (A) Define the double integral as the limit of sum over the rectangular region. [02]

(B) Find the volume of the solid bounded by the surface $f(x, y) = 4 - \frac{1}{9}x^2 - \frac{1}{16}y^2$, the planes $x = 3, y = 2$ and the three coordinate planes. [04]

OR

Q. 2 Evaluate the double integral $\iint_R e^{x+y} dA$, where $R = \{(x, y) \in \mathbb{R}^2 : |x| + |y| \leq 1\}$ with sketch of the region R . [06]

Q. 3 (A) Evaluate $\iint_R e^{x^2+y^2} dA$, where R is the region bounded by the circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 9$. [03]

(B) For constant c , draw a sketch of the graph of each of the following equations

(1) $r = c$ (2) $\theta = c$ (3) $z = c$. [03]

OR

Q. 3 (P) Evaluate the triple integral $\iiint_S y \, dV$ if S is the region bounded by the tetrahedron formed by the plane $12x + 20y + 15z = 60$ and the coordinate planes. [05]

(Q) Define $\text{curl} F$ for a vector field $F = Mi + Nj + Pk$. [01]

Q. 4 State and prove Green's theorem in plane. [06]

OR

Q. 4 (A) Evaluate $\int_C xy^3 \, ds$ where C is the line segment of $y = 2x$ in xy -plane from $(-1, -2, 0)$ to $(1, 2, 0)$ [03]

(B) Show that $F = (e^x \cos y + yz)i + (xz - e^x \sin y)j + (xy + z)k$ is conservative over $\mathbb{R}^3$ and find a potential function for it. [04]

Q. 5 (A) Prove that the set $\{p \in \mathbb{Q}^+ : p^2 < 2\}$ contains no largest element. [03]

(B) State and prove Archimedean property. [03]

OR

Q. 5 (P) If A is a set with m elements and B is a set with n elements and if $A \cap B = \emptyset$ then prove that $A \cup B$ has $m + n$ elements. [04]

(Q) Show that infimum of the set $\{\frac{1}{n} : n \in \mathbb{N}\}$ is 0. [02]

Best of Luck





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Bachelor of Science (Semester 3) QUIZ TEST-2025**US03MAMTH02: Multivariate Calculus and The Real Number system**

Date: 24-09-2025 (Wednesday)

Time: 20 minutes

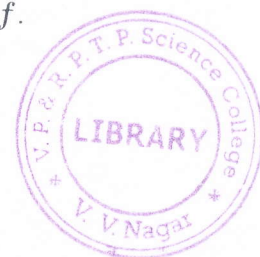
Total marks: 15

NOTE: The symbols used in this paper have usual meaning unless specified.

Q. 1 Fill in the blanks with appropriate answer.

[08]

- (1) Countable union of countable sets is
- (2) If p is a prime and $p|ab$ then $p|a$ $p|b$.
- (3) Area of the region R is, if $R : -3 \leq x \leq 3, 0 \leq y \leq \sqrt{9-x^2}$.
- (4) If $f(x, y) > 0$ then $\iint_R f \cdot dA$ gives generated by f .
- (5) Jacobian of $x = r \cos \theta, y = r \sin \theta$ is $J(r, \theta) =$
- (6) $\text{curl} \bar{F} = \bar{0}$ then $\bar{F}$ is
- (7) If $\oint_C \bar{F} \cdot d\bar{r}$ is independent of path then $\bar{F}$ is called
- (8) If $\bar{F} = \nabla f$ then f is called function for $\bar{F}$.

**Q. 2 Whether the following statement is true or false. Write your answer in the box.**

[07]

- (1) If $I_n = [a_n, b_n], n \in \mathbb{N}$ is a nested sequence of closed and bounded intervals then $\bigcap_{n=1}^{\infty} I_n$ can never be an infinite set. []
- (2) Let S be an ordered set with the least upper bound property. Then any nonempty bounded below subset of S has the greatest lower bound in S . []
- (3) If $f(x, y) = 1$ then the double integral of f over R gives area of the region R . []
- (4) Spherical coordinate equation of the cone $z = \sqrt{x^2 + y^2}$ is $\phi = \frac{\pi}{6}$. []
- (5) If $\text{div} \bar{F} = 0$ then $\bar{F}$ is solenoid. []
- (6) If $\bar{F}$ represents the force field of the particle then $\int_C \bar{F} \cdot T ds$ gives the work done by the particle along C . []
- (7) Green's theorem convert the line integral into double integral over a region enclosed by a closed curve C . []

All The Best