

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY
 End Term Examination (Make up), December 2025
 B. Tech., Odd Semester, 2025-26

Roll No.

AS1109: CALCULUS

Time: 2.5 hours

Max. Marks: 30

Instructions to students:

1. Do not write anything, other than your roll number, on the question paper.
2. Calculator is not allowed.
3. Mention all the assumptions for your answers clearly.

Q. 1.1 For what values of x does the power series, $\sum_{n=1}^{\infty} \frac{(2x+3)^n}{10^n}$ converges? 1
(CO1)

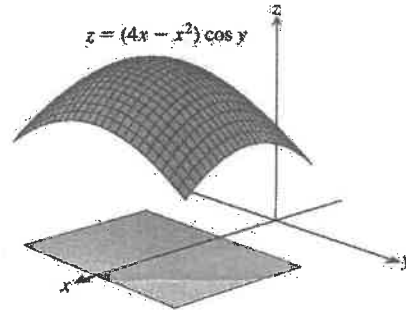
Q. 1.2 Check whether alternating sequence, $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n^{2/3}}$, converges absolutely or conditionally. 2
(CO1)

Q. 2.1 For the function, $f(x, y) = \ln(9 - x^2 - y^2)$, determine: 2
(CO2)

- a) domain.
- b) range.
- c) boundary of the function.
- d) level curves.

Q. 2.2 The flow rate Q of water through a circular pipe is $Q(r, v) = \pi r^2 v$, where r is the radius of pipe and v is the velocity of water. A hydrologist measures r as 0.12 m with error of 2% and v as 2.8 m/s with error of 5%. Using the chain rule for function of two variables, estimate the percentage error in Q . 2
(CO2,3)

Q. 2.2 Find the absolute maxima and minima of the function, $f(x, y) = (4x - x^2) \cos y$, on the rectangular plate, $1 \leq x \leq 3, -\frac{\pi}{4} \leq y \leq \frac{\pi}{4}$.



4
(CO2, 3)

Q. 3.1 A steady wind blows a kite due west. The kite's height above ground from horizontal position $x = 0$ to $x = 80$ ft is given by $y = 150 - \frac{1}{40} (x - 50)^2$. Set up the integral to find distance travelled by the kite. 1
(CO2,3,4)

Q. 3.2 Change the Cartesian integral into an equivalent polar integral: $\int_0^6 \int_0^y x \, dx \, dy$. 1
(CO2,4)

Q. 3.3 Find the volume of the solid generated by revolving the region in the first quadrant bounded above the line $y = \sqrt{2}$, below by the curve $y = \sec x \tan x$, and on the left by the y -axis, about the line $y = \sqrt{2}$. 2
(CO2,4)

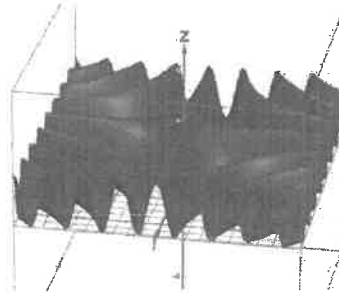
Q. 3.4 Evaluate the following triple integral, $\int_0^1 \int_0^{1-x^2} \int_3^{4-x^2-y} x \, dz \, dy \, dx$. 3
(CO2,4)

- Q. 3.5 Evaluate $\iint_D (x + 2y) dA$, where D is the region bounded by the parabolas $y = 2x^2$ and $y = 1 + x^2$. Sketch the region of integration. 3
(CO2,4)

- Q. 4.1 With respect to the right-handed coordinates, find $\text{div}(\vec{u} \times \vec{v})$ for vector fields, $\vec{u} = [y, z, 4z - x]$ and $\vec{v} = [y^2, z^2, x^2]$, 2
(CO5)

- Q. 4.2 Let $\vec{v} = y\vec{i} - x\vec{j}$ be the velocity vector of the steady fluid flow. Sketch the vector field and also check whether the flow is irrotational or not. 2
(CO5)

- Q. 4.3 Find a normal vector of the surface, $z - \cos(xy) - 1 = 0$ at the point $(\frac{\pi}{2}, 0, 2)$. 2
(CO2,5)



- Q. 4.4 Suppose that the temperature at a point, $P(x, y, z)$ in space is given by 3
(CO3,5)

$$T(x, y, z) = \frac{80}{(1 + x^2 + 2y^2 + 3z^2)},$$

where T is measured in degrees Celsius and x, y, z in meters. In which direction does the temperature increase fastest at the point $(1, 1, -2)$? What is the maximum rate of increase?

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