MGM University

Jawaharlal Nehru Engineering College,Chhatrapati Sambhajinagar.

Course : Single and multivariable Calculus Program: FY B.Tech

Academic Year 2023-24 Part-I Course Code: APS21BSL101

**Unit 3: Partial Differentiation and Its Applications**

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1. If-2. Find
2. Find if
3. Find the second order derivative of - 2.
4. Calculate
5. Show that the function is a solution of Laplace equation
6. Verify that the function satisfies the wave equation

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1. The base radius and height of a right circular cone are measured as 10 cm and 25 cm, respectively, with a possible error in measurement of as much as 0.1 cm in each. Use differentials to estimate the maximum error in the calculated volume of the cone.
2. The dimensions of a rectangular box are measured to be 75 cm, 60 cm, and 40 cm, and each measurement is correct to within 0.2 cm. Use differentials to estimate the largest possible error when the volume of the box is calculated from these measurements.
3. If , where Find when .
4. The pressure P (in kilopascals), volume V (in liters), and temperature T (in kelvins) of a mole of an ideal gas are related by the equation PV = 8.31T. Find the rate at which the pressure is changing when the temperature is 300 K and increasing at a rate of 0.1 K/s and the volume is 100 L and increasing at a rate of 0.2 L/s.
5. If where find
6. If where,find the value of
7. Show that the minimum value of + is
8. Show that the extreme value of
9. A rectangular box which is open at the top has a capacity of 256 cubic feet. Determine the dimensions of the box such that the least material is required for the construction of the box. Use Lagrange’s method of multipliers to obtain the solution.
10. Divide 24 into three parts such that the continued product of the first,square of the second and cube of the third may be maximum.
11. If . Find
12. If . Prove that
13. If Prove that =1
14. Find the velocity and acceleration of a particle moving along the curve:

Also find their magnitude.

1. A particle move along the curve Find the velocity and acceleration at time . Also find their magnitude at any time
2. Find the curl and divergence of following vector field.
3. Find the value of constant such that the scalar field defined by

=(2- is solenoidal.

1. Prove that =(6xy+ is irrotational vector.
2. Find the directional derivative of at (1,2,-1) in the direction of vector
3. Suppose that the temperature at a point in space is given by

where T is measured in degrees Celsius and x,y,z in meters. (a) In what direction does the temperature increase fastest at the point (1,1,-2)?

(b) What is the maximum rate of increase?