**GALGOTIAS UNIVERSITY**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**



|  |  |  |  |
| --- | --- | --- | --- |
| **SUBJECT** | Multi Variable Calculus | **PROGRAMME** | **B. Tech.** |
| **SUBJECT CODE** | BBS01T1001 | **BRANCH/SEMESTER** | **I** |
| **SECTION** | **24** | **FACULTY NAME** | Miss Sakshi Verma |
| **NAME STUDENT 1** | ABHINAV KUMAR CHOUDHARY | **ENROLLMENT NO STUDNET 1** | 21SCSE1011615 |
| **NAME STUDENT 2** | AMIT SINGH | **ENROLLMENT NO STUDNET 2** | 21SCSE1410106 |
| **NAME STUDENT 3** | AVIRAL GAURAV | **ENROLLMENT NO STUDNET 3** | 21SCSE1300029 |
| **NAME STUDENT 4** | DEEPANSH BHATIA | **ENROLLMENT NO STUDNET 4** | 21SCSE1011677 |
| **NAME STUDENT 5** | NEERAJ SINGH | **ENROLLMENT NO STUDNET 5** | 21SCSE1011675 |

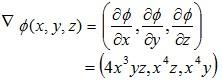
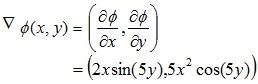
|  |
| --- |
| **QUESTION**  **REPORT ON GRADIENT OF SCALAR FUNCTION** |

**Gradient of a Scalar Field**

The gradient of a scalar field is a vector field and whose magnitude is the rate of change and which points in the direction of the greatest rate of increase of the scalar field. If the vector is resolved, its components represent the rate of change of the scalar field with respect to each directional component. Hence for a two-dimensional scalar field *∅* (x,y).

The maximum rate of increase of a scalar function with respect to space in a particular direction is called gradient of that scalar function.

It is a vector-valued function directed towards the direction of fastest increase of the function and with a magnitude equal to fastest increase in that direction

  
And for a three-dimensional scalar field *∅* (x, y, z)  
  
  
The gradient of a scalar field is the derivative of f in each direction. Note that the gradient of a scalar field is a vector field. An alternative notation is to use the *del* or *nabla* operator, ∇f = grad f.  
  
For a three dimensional scalar, its gradient is given by:  
  
Gradient is a vector that represents both the magnitude and the direction of the maximum space rate of increase of a scalar.  
  
*dV* = (∇*V*) ∙ *dl*, where *dl = ai ∙ dl*  
  
**In Cartesian**  
  
**In Cylindrical**  
  
**In Spherical**  
  
  
**Properties of gradient**  
·  We can change the vector field into a scalar field only if the given vector is differential. The given vector must be differential to apply the gradient phenomenon.  
·  The gradient of any scalar field shows its rate and direction of change in space.  
  
**Example 1:** For the scalar field *∅ (x,y) = 3x + 5y*,calculate gradient of *∅*.  
**Solution 1:** Given scalar field *∅ (x,y) = 3x + 5y*  
  
  
**Example 2:** For the scalar field *∅ (x,y) = x4yz*,calculate gradient of *∅*.  
**Solution:** Given scalar field *∅ (x,y) = x4yz*  
  
  
**Example 3:** For the scalar field *∅ (x,y) = x2sin5y*,calculate gradient of*∅*.  
**Solution:** Given scalar field *∅ (x,y) = x2sin5y*  


**THANK YOU**