

- Q.1 A Prove :div(curl f)=0 for  $f=(x^2yz, xy^2z, xyz^2)$  [7]  
 B Prove :  $\text{grad} \left( \frac{\phi}{\psi} \right) = \frac{\psi \text{grad}\phi - \phi \text{grad}\psi}{\psi^2}$  [7]  
 OR
- Q.1 A Prove :div( $f \times g$ ) =  $g \cdot \text{curl} f - f \cdot \text{curl} g$ . for  $f = (f_1, f_2, f_3)$  and  $g = (g_1, g_2, g_3)$ . [7]  
 B If  $f(x,y,z) = 3xy^2 + 2x^2yz$  and  $g(x,y,z) = 2x^2y - xy^2$ , find grad (f g) at point (2,1,-1). [7]
- Q.2 A Obtain formula of radius of curvature of curve :  $y = f(x)$ . [7]  
 B Obtain radius of curvature of curve :  $r = a(1 - \cos \theta)$ . [7]  
 OR
- Q.2 A Obtain formula of radius of curvature of curve :  $r = f(\theta)$  [7]  
 B Find the radius of curvature of  $2x^3 - 3x^2y + 4xy^2 - y^3 + 5x^2 - 7xy - 8y = 0$  at origin [7]
- Q.3 A State and prove Green's theorem. [10]  
 B Evaluate:  $\iiint_s dx dy dz$  Where  $s = [0,a] \times [0,b] \times [0,c]$ . [4]  
 OR
- Q.3 A State and prove Stoke's curl theorem [10]  
 B Evaluate :  $\int_0^1 \int_0^2 (x^2 + y^2) dx dy$ . [4]
- Q.4 A Find P.D.E of  $(1 + b^3)z = 8(x + by + a)^3$  [7]  
 B Find general solution of the P.D.E :  $y(x+z)p + (z^2 - 2xz - x^2)q = y(x-z)$ . [7]  
 OR
- Q.4 A Find P.D.E. of  $z = xy + f(x^3 - y^3)$ . [7]  
 B Find general solution of the P.D.E :  $2xyp + (x^2 + y^2)q = (x+y)z$ . [7]
- Q.5 A Classify the following PDEs : [7]  
 1)  $U_{xx} + 4U_{xy} + 4U_{yy} = 0$  2)  $U_{xx} + U_{yy} = U_{zz}$   
 B Solve : 1)  $(2D^2 + 5DD' + 2D'^2)Z = 0$  2)  $(D^3D'^2 + D^2D'^3)Z = 0$  [7]  
 OR
- Q.5 A Find the characteristics of  $4U_{xx} + 5U_{xy} + U_{yy} + U_x + U_y = 2$ . [7]  
 B Solve :  $(D^4 - 2D^3D' + 2DD'^3 - D'^4)Z = 0$  [7]