



( 2 )

- (b) Solve  $x^2p^2 + y^2q^2 = z^2$  and find the complete integral and singular integral.
3. (a) Apply Jacobi's method to find the complete integral of  $p_1^3 + p_2^2 + p_3 - 1 = 0$ .
- (b) Reduce the equation  $\frac{\partial^2 z}{\partial x^2} + x^2 \frac{\partial^2 z}{\partial y^2} = 0$  to canonical form.
4. (a) Derive the two-dimensional wave equation.
- (b) Obtain the solution of the wave equation  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$  using the method of separation of variables.
5. (a) Find the shortest distance between two points in a plane.
- (b) Find the equation of motion of one dimensional harmonic oscillator using Hamilton's principle.
6. Define the Hamiltonian. Derive the Hamilton's canonical equations of motion.
7. (a) Show that the transformation  $P = \frac{1}{2}(p^2 + q^2)$   
 $Q = \tan^{-1} \frac{q}{p}$  is canonical.

( 3 )

- (b) Find the relation between Poisson and Lagrange Brackets.
8. State and prove Liouville's Theorem.
9. (a) Find the attraction of uniform sphere at external and internal point.  
(b) State and prove Gauss Theorem.
10. Prove that a solid uniform hemisphere, of radius  $a$  exerts no resultant attraction at a point on its axis at a distance  $c$  from the centre given by the equation

$$12c^4 - 8a^3c - 3a^4 = 0.$$

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