Q1. A partial differential equation involves:

(A) Ordinary derivatives only

(B) Partial derivatives only

(C) Both ordinary and partial derivatives

(D) None of the above

Answer: (B)

Q2. The order of the PDE

$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^3 z}{\partial y^3} = 0$$

is:

(A) 2

(B) 3

(C) 1

(D) 0

Answer: (B)

Q3. The PDE

$$p^2 + q^2 = 1$$

represents a:

(A) Linear equation

(B) Nonlinear equation

(C) Homogeneous equation

(D) Compatible equation

Answer: (B)

Q4. If $z = f(x + y)$, then

$$\frac{\partial z}{\partial x} =$$

(A) $f'(x + y)$

(B) $f'(x - y)$

(C) $f'(x + y) + f'(x - y)$

(D) 0

Answer: (A)

Q5. A first order PDE can be expressed as:

$$F(x, y, z, p, q) = 0,$$

where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$. This is called:

(A) Lagrange's linear equation

(B) General first order PDE

(C) Jacobi's form

(D) Canonical form

Answer: (B)

Q6. The Cauchy problem for first order equations refers to:

(A) Finding a general solution

(B) Solving with given initial conditions

(C) Eliminating arbitrary constants

(D) None of these

Answer: (B)

Q7. In Cauchy's problem, the data are given along a:

(A) Point

(B) Curve

(C) Plane

(D) Surface

Answer: (B)

Q8. The general integral of a first order PDE contains:

(A) One arbitrary constant

(B) Two arbitrary constants

(C) One arbitrary function

(D) Two arbitrary functions

Answer: (C)

Q9. The complete integral of a PDE is the solution containing:

(A) No arbitrary constant

(B) One arbitrary function

(C) Two arbitrary constants

(D) Three arbitrary constants

Answer: (C)

Q10. The equation $p + q = 1$ is:

(A) Linear and homogeneous

(B) Linear and non-homogeneous

(C) Nonlinear

(D) None of these

Answer: (B)

Q11. The linear first order PDE of Lagrange's type is:

$$Pp + Qq = R$$

where P, Q, R are functions of:

(A) x, y, z

(B) p, q

(C) x, y

(D) x, y, z, p, q

Answer: (A)

Q12. The method used to solve $Pp + Qq = R$ is:

(A) Cauchy's method of characteristics

(B) Separation of variables

(C) Integration factor method

(D) None of these

Answer: (A)

Q13. The subsidiary equations corresponding to $Pp + Qq = R$ are:

$$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}.$$

These are called:

(A) Characteristic equations

(B) Auxiliary equations

(C) Integrating equations

(D) Ordinary equations

Answer: (A)

Q14. The compatible system of first order equations means:

(A) The equations have no solution

(B) The equations have at least one common solution

(C) The equations are linearly independent

(D) The equations are homogeneous

Answer: (B)

Q15. The characteristic curves are defined as:

(A) Curves along which the PDE becomes ODE

(B) Curves of constant z

(C) Orthogonal trajectories

(D) None of these

Answer: (A)

Q16. The PDE $p^2 + q^2 = 1$ represents:

(A) Plane

(B) Cone

(C) Cylinder

(D) Sphere

Answer: (D)

Q17. If $z = xy + f(x + y)$, then the PDE is:

(A) $p + q = 1$

(B) $p + q = 0$

(C) $p + q = 2$

(D) $p - q = 0$

Answer: (A)

Q18. The equation $z = f(x^2 + y^2)$ leads to:

$$p = \frac{\partial z}{\partial x} = 2x f'(x^2 + y^2)$$

Hence,

(A) $p^2 + q^2 = 4(x^2 + y^2)[f'(x^2 + y^2)]^2$
(B) $p^2 + q^2 = 1$
(C) $p^2 - q^2 = 0$
(D) $pq = 0$

Answer: (A)

Q19. The PDE whose complete integral is $z = ax + by + c$ is:

(A) $p = a,\ q = b$
(B) $\frac{\partial^2 z}{\partial x^2} = 0$
(C) $\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$
(D) None of these

Answer: (B)

Q20. The function $z = f(x + y) + g(x - y)$ satisfies:

(A) Laplace's equation
(B) Wave equation
(C) Heat equation
(D) Poisson's equation

Answer: (B)

Q21. A PDE is said to be nonlinear if:

(A) z appears linearly
(B) Highest derivative appears nonlinearly
(C) Coefficients are constants
(D) Order is one

Answer: (B)

Q22. The number of arbitrary constants in the complete integral of a first order PDE is:

(A) 1
(B) 2
(C) 3
(D) Infinite

Answer: (B)

Q23. The equation $p^2 + q^2 = z^2$ is:

(A) Linear
(B) Nonlinear
(C) Homogeneous
(D) Linear and homogeneous

Answer: (B)

Q24. The Cauchy's method of characteristics converts a PDE into:

(A) Integral equation

(B) Algebraic equation

(C) System of ODEs

(D) None of these

Answer: (C)

Q25. Jacobi's method is used to find:

(A) Singular solution

(B) Complete integral

(C) General solution

(D) Particular integral

Answer: (A)

Q26. The singular solution is obtained by:

(A) Eliminating arbitrary constants

(B) Eliminating arbitrary functions

(C) Differentiating with respect to constants and eliminating them

(D) None of these

Answer: (C)

Q27. The envelope of the family of surfaces represented by a complete integral gives:

(A) General solution

(B) Singular solution

(C) Particular solution

(D) Complementary solution

Answer: (B)

Q28. The compatibility condition for two first order PDEs ensures:

(A) A unique common solution exists

(B) No solution exists

(C) Infinite solutions exist

(D) The PDEs are linear

Answer: (A)

Q29. The auxiliary equations of Lagrange's equation are integrated to find:

(A) Two independent integrals

(B) One integral only

(C) Particular integral

(D) None of these

Answer: (A)

Q30. The general solution of $Pp + Qq = R$ is of the form:

(A) $f(u, v) = 0$

(B) $z = f(x, y)$

(C) $u + v = 0$

(D) $f(x, y, z) = 0$

Answer: (A)

Q31. The first order PDE which contains only one independent variable after using characteristics is called:

(A) Compatible system

(B) Reduced equation

(C) Complete integral

(D) Characteristic ODE

Answer: (D)

Q32. The order of a partial differential equation is determined by

A) Highest power of derivative

B) Highest order derivative present

C) Highest power of the dependent variable

D) Highest power of the independent variable

Answer: (B)

Q33. A compatible system of first-order partial differential equations implies

A) Equations are inconsistent

B) Equations are linearly independent

C) Equations are linearly dependent

D) A common solution exists

Answer: (D)

Q34. In Jacobi's method, the complete integral of a first-order partial differential equation contains

A) One arbitrary constant

B) Two arbitrary constants

C) As many constants as independent variables

D) Only one arbitrary function

Answer: (C)

Q35. A Clairaut's form of a first-order partial differential equation is

A) $z = px + qy + f(p, q)$

B) $z = f(x, y)$

C) $z = p + q$

D) $z^2 = p^2 + q^2$

Answer: (A)

Q36. The partial differential equation $u_{xx} + u_{yy} = 0$ is classified as

A) Elliptic

B) Hyperbolic

C) Parabolic

D) Circle

Answer: (A)

Q37. The vibrating membrane problem is governed by

A) Laplace equation

B) Wave equation in two dimensions

C) Diffusion equation

D) Poisson's equation

Answer: (B)

Q38. The order of a partial differential equation is determined by

A) The number of independent variables

B) The highest order derivative present

C) The degree of the dependent variable

D) The number of terms

Answer: (B)

Q39. The general form of a second-order PDE in two variables is

$$A\frac{\partial^2 z}{\partial x^2} + B\frac{\partial^2 z}{\partial x \partial y} + C\frac{\partial^2 z}{\partial y^2} + D\frac{\partial z}{\partial x} + E\frac{\partial z}{\partial y} + Fz = G,$$

where A, B, C, D, E, F, G are functions of

A) x, y

B) x, y, z

C) x, y, z, p, q

D) Only z

Answer: (A)

Q40. The equation

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$

represents:

(A) Laplace's equation

(B) Heat equation

(C) Wave equation

(D) Poisson's equation

Answer: (C)

Q41. The Laplace equation $u_{xx} + u_{yy} = 0$ is classified as

(A) Parabolic

(B) Hyperbolic

(C) Elliptic

(D) Nonlinear

Answer: (C)

Q42. The classification of a second-order PDE $Au_{xx} + Bu_{xy} + Cu_{yy} = 0$ depends on

(A) $A + B + C$

(B) $A^2 + B^2 + C^2$

(C) Discriminant $B^2 - 4AC$

(D) $A + C$

Answer: (C)

Q43. For a linear PDE with constant coefficients, the coefficients of derivatives are

(A) Functions of x, y

(B) Constants

(C) Functions of z

(D) Zero

Answer: (B)

Q44. In the method of separation of variables, the solution is assumed as

(A) Sum of functions of different variables

(B) Product of functions of different variables

(C) Difference of functions

(D) Exponential of functions

Answer: (B)

Q45. The solution of Laplace's equation by separation of variables leads to

(A) Two ordinary differential equations

(B) A nonlinear equation

(C) An integral equation

(D) A higher-order PDE

Answer: (A)

Q46. The Fourier transform method is mainly applied to

(A) Algebraic equations

(B) Linear PDEs with constant coefficients

(C) Nonlinear equations

(D) Integral equations only

Answer: (B)

Q47. The Laplace transform method is best suited for solving

(A) Linear PDEs with initial value problems

(B) Nonlinear PDEs

(C) Elliptic equations

(D) Periodic boundary problems

Answer: (A)

Q48. A nonlinear PDE is one in which

(A) The dependent variable appears linearly

(B) The coefficients of derivatives are constants

(C) The derivatives appear with powers or products

(D) The order is higher than one

Answer: (C)

Q49. The one-dimensional heat equation is
$$\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}.$$

Here k represents:

(A) Density

(B) Specific heat

(C) Thermal diffusivity

(D) Temperature

Answer: (C)

Q50. The general integral of a homogeneous linear PDE with constant coefficients is obtained using

(A) Direct integration

(B) Auxiliary equation and complementary function

(C) Method of separation of variables

(D) Fourier expansion

Answer: (B)