MULTIPLE CHOICE QUESTIONS

SEMESTER III - PARTIAL DIFFERENTIAL EQUATIONS

1. The partial differential equation corresponding to $z = f(x+it) + g(x-it)$ after eliminating the arbitrary function is

   A)$\frac{\partial z}{\partial x} + \frac{\partial z}{\partial t}$=0 B)$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial t^2} = -1$ C) $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial t^2} = 0$ D) $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial t^2} = 1$

2. The partial differential equation corresponding to $z = ax + by + ab$ eliminating the constants, where $\frac{\partial z}{\partial x} = p, \frac{\partial z}{\partial y} = q$ is

   A)$z = px + qy + pq$ B) $z = qx + py + pq$ C) $z = px - qy$ D)) $z = px + qy$

3. The partial differential equation corresponding to $z = xy + f(x^2 + y^2)$ is

   A)$xp + yq = y^2 + x^2$ B) $yp + xq = x^2 - y^2$ C)$xq - yp = x^2 - y^2$
   D)$yp - xq = y^2 - x^2$

4. The partial differential equation corresponding to $z = f\left(\frac{xy}{z}\right)$ is

   A)$py = qx$ $B)px = qy$ $C)px + qy = 0$ $D)\frac{p}{q} = xy$

5. The general integral of the linear partial differential equation $y^2p - xyq = x(z - 2y)$is

   A)$F(x^2 + y^2, y^2 - yz) = 0$ B) $F(xy, x^2 - y^2) = 0$ $C)F(y - z, (x - y)^2) = 0$
   $D)F(x^2 + y^2, y - 2z) = 0$

6. The general integral of the linear partial differential equation$(y + zx)p - (x + yz)q = x^2 - y^2$

   A)$F(x^2 + y^2 - z^2, xy) = 0$ $B)F(xy + z, x^2 - z^2) = 0$
   C)$F(xyz, xy + z) = 0$ $D)F(x^2 + y^2 - z^2, xy + z)) = 0$

7. The general integral of the linear partial differential equation $pz - qz = z^2 + (x + y)^2$ is

   A)$F(x + y, \log(x^2 + y^2 + z^2 + 2x) - 2x) = 0$ $B)$ $F\left(x - y, log(x^2 - 2y)\right) = 0$
   C)$F(xy, \log(x^2 + y^2 + z^2)) = 0$ $D)F(x + y, \log(x^2 + y^2 + z^2)) = 0$

8. The general integral of $yzp + xzq = xy$ is

   A)$F(x^2 + y^2, z^2 + y^2) = 0$ $B)F(x^2 - y^2, z^2 + y^2) = 0$ $C)F(x^2 + y^2, y^2 - z^2)$
   $D)F(x^2 - y^2, z^2 - y^2) = 0$

9. The integral of the Pfaffian differential equation$ydx + xdy + 2zdz = 0$ is

   A)$u(x, y, z) = xy + c$ $B)u(x, y, z) = xy + z^2 + c$
   $C)u(x, y, z) = xyz + c$ $D)u(x.y, z) = x^2 + y^2 + z^2 + c$

10. A necessary and sufficient condition that the Pfaffian differential equation $X.dr$=0 should be integrable is that

    A)$X.Curl\ X \neq 0$ $B)X.Curl\ X = 1$ $C)X.Curl\ X = 0$ $D)X.Curl\ X \neq 1$

11. The integral of $yzdx + 2xzdy - 3xydz = 0$

    A)$u = \frac{xy^2}{z}$ B)$u = \frac{xy^2}{z^3}$ C)$u = xyz$ $D)u = xy + z^2$

12. The Pfaffian differential equation$X.dr = P(x, y, z)dx + Q(x, y, z)dy + R(x, y, z)dz = 0$ is exact if and only if

    A)$Curl\ X \neq 0$ B) $Curl\ X = 0$ $C)Curl\ X = 1$ $D)None$

13. The partial differential equation $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = z\ \ is$

    A) linear B) semilinear C)quasilinear D) nonlinear

14. he solution of $a(p+q)=z$ is

A)$F(x+y,y+az)=0$ B)$F(y-x,ay)=0$ $C)F(x+y,z)=0$

$D)F(x-y,y-az)=0$

15. Given a surface $F(x,y,z)=0$. The system of orthogonal trajectories on the surface of given system of curves each of which lies on the surface and cuts every curve of the given system at

A) at an acute angle B) parallel to $F(x,y,z)=0$ C) right angle D)None

16. The integral curve satisfies the set of equations $\frac{dx}{x^2(y^3-z^3)}=\frac{dy}{y^2(z^3-x^3)}=\frac{dz}{z^2(x^3-y^3)}$ is

A)x^2-$y^2-z^2=c$ B)$-x^2+y^2-z^2=c$ C)$-\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)=c$ D)$\frac{1}{x^2}-\frac{1}{y^2}-\frac{1}{z}=c$

17. The orthogonal trajectory on the cylinder$y^2=z$ of the curves in which it is cut by the system of planes $x+z=c$ is

A)$\frac{y^2}{z}=c$ B) $\frac{x^2}{z}=c$ C) $\frac{y}{z^2}=c$ D) $\frac{y}{z}=c$

18. If X is a vector such that $X.Curl\ X=0$ and μ is an arbitrary function of x, y, z then

A) $X.Curl\ \mu X\neq 0$ B)) $\mu X.Curl\ X=0$ $C)$ $\mu X.Curl\ \mu X=0$ $D)$ $X.Curl\ \mu X=0$

19. If one integrating factor of a Pfaffian differential equation is given

A) we can find another integrating factor

B) we can find infinity of them

C) we cannot find any other integrating factor

D)we can find only finite number of integrating factors

20. A system of curves each of which lie on the given surface and cuts every curve of the given system at right angles are called

A) integral curves B) system of equations C) orthogonal trajectories D) None

21. A Pfaffian differential equation in two variables always possess

A) general integral B) integrating factor C) complete integral D) particular integral

22. A necessary and sufficient condition that there exists between two functions $u(x,y)$and $v(x,y)$a relation $F(u,v)=0$ not involving x and y explicitly is that

A)$\frac{\partial(u,v)}{\partial(x,y)}=0$ $B)$ $\frac{\partial(x,y)}{\partial(u,v)}=0$ $C)$ $\frac{\partial F(u,v)}{\partial(x,y)}$=0 D) $\frac{\partial(u,v)}{\partial(F(x,y)}=0$

23. A Pfaffian differential equation $(y+z)dx+dy+dx=0$ satisfies $X.Curl\ X=0$ then it's primitive is

$A)x+\log y+\log z=c$ $B)$ $x-\log(x+y+z)=c$

$C)x+log(y+z)=c$ $D)log(y+z)+y+z=c$

24. The primitive of the differential equation is $yzdx+xzdy+xydz=0$ is

$A)yz+xz+xy=c$ $B)y+x+z=c$ $C)yz+x+y=c$ $D)xyz=c$

25. The integral curves of the set of differential equations $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$ form a

A) 1-parameter family of curves in 2-space B)2-parameter family of curves in 3-space C. 1-parameter family of curves in 3-space D) None.

26. Find the general integral of the linear partial differential equation $xp+yq=z$

A. $\emptyset\left(\frac{x}{y},\frac{y}{z}\right)=0$

B. $\emptyset(x^2-z^2,\ x^3-y^3)=0$

C. $\emptyset(\frac{y}{z},\ x^2+y^2+z^2)=0$

D. $\emptyset(x+y+z,\ xyz)=0$

27. Which of the following is a linear partial differential equation

A. $p^2x^2 + q^2y^2 = 1$
B. $z = p^2 + q^2$
C. $pq = 4xyz$
D. $xzp + yzq = x$

28. Find the general integral of the linear partial differential equation
$p - q = \log(x + y)$
A. $\emptyset\left(xy, \frac{y}{z}\right) = 0$
B. $\emptyset(xy,\ x^2 + y^2 + z^2) = 0$
C. $\emptyset(x + y,\ x\log(x + y) - z) = 0$
D. $\emptyset(\frac{xy}{z},\ \frac{x-y}{z}) = 0$

29. Choose the Lagrange's subsidiary equation
A. $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$
B. $\frac{dx}{P} = \frac{dy}{Q}$
C. $\frac{dx}{P} + \frac{dy}{Q} = \frac{dz}{R}$
D. $\frac{dx}{P} - \frac{dy}{Q} = \frac{dz}{R}$

30. Choose the general form of Lagrange's Equation
A. $Pp + Qq = R$, where P, Q, R are functions of x, y, z
B. $P\,pq + Qq = R$, where P, Q, R are functions of x, y, z
C. $Pp + Qpq = R$, where P, Q, R are functions of x, y, z
D. $Pp^2 + Qq^2 = R$, where P, Q, R are functions of x, y, z

31. Find the complete integral of the partial differential equation of the type
$$F(p, q) = 0$$
A. $z = ax + c$
B. $z = ax + f(a)y + c$
C. $z = ay + c$
D. $z^2 = ax + f(a)y + c$

32. Find the complete integral of the equation $p^2 + q^2 = 1$
A. $z = ax + \sqrt{1 - a^2}\ y + c$
B. $z = ax + c$
C. $z = ax^2 + \sqrt{a}y + c$
D. $z^2 = ay^2 + \sqrt{a}y + c$

33. A complete integral of an equation in Clairaut type will be ………………

(A) $z = ax - by + f(a, b)$ (B) $z = ax + by - f(a, b)$

(C) $z = ax - by - f(a, b)$ (D) $z = ax + by + f(a, b)$

34. Find the complete integral of $z = px + qy + pq$
A. $z = ax + by$
B. $z^2 = ax + by + ab$
C. $z^2 = a^2x + b^2y$

D. $z = ax + by + f(a,b)$

35. Find the singular integral of $z = px + qy + p^2 - q^2$

A. $4z = y^2 - x^2$
B. $z = -xy$
C. $z = xy$
D. $z = x + y$

36. Obtain the complete integral of $z = \frac{1}{p} + \frac{1}{q}$

A. $4(1+a)z = (x + ay + b)^2$
B. $(z+a)^{\frac{3}{2}} = x + ay + b$
C. $az^2 = 2(1+a)(x + ay) + 2b$
D. $z = ax + x^3 + ay + b$

37. Write the direction ratios of the surface $z = \emptyset(x,y)$ at the point (x,y,z)

A. $\left(\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}, -1\right)$
B. $\left(\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}, 1\right)$
C. $\left(\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}\right)$
D. $\left(\frac{\partial z}{\partial x}, -1\right)$

38. Write the equation of the integral surface which pass through the point $\left(x(t), y(t), z(t)\right)$

A. $U(x(t), y(t), z(t)) = C_1, U(x(t), y(t), z(t)) = C_2$
B. $U(x(t), y(t), z(t)) = C_1, V(x(t), y(t), z(t)) = C_2$
C. $U(x(t), y(t), z(t)) = C_1$
D. $V(x(t), y(t), z(t)) = C_1$

39. If every solution of a first order partial differential equation $f(x,y,z,p,q) = 0$ is also a solution of the equation $g(x,y,z,p,q) = 0$, the equations are said to be ………………..

(A) separable (B) orthogonal (C) compatible (D) parallel

40. What is $\frac{\partial(f,g)}{\partial(p,q)}$?

(A) $f_p f_q + g_p g_q$ (B) $f_p f_q - g_p g_q$ (C) $f_p g_q + g_p f_q$ (D) $f_p g_q - g_p f_q$

41. What is $[f,g]$?

(A) $\frac{\partial(f,g)}{\partial(x,p)} + \frac{\partial(f,g)}{\partial(y,q)} + p\frac{\partial(f,g)}{\partial(z,p)} + q\frac{\partial(f,g)}{\partial(z,q)}$ (B) $\frac{\partial(f,g)}{\partial(x,p)} - \frac{\partial(f,g)}{\partial(y,q)} + p\frac{\partial(f,g)}{\partial(z,p)} - q\frac{\partial(f,g)}{\partial(z,q)}$

(C) $\frac{\partial(f,g)}{\partial(x,p)} + \frac{\partial(f,g)}{\partial(y,q)} - p\frac{\partial(f,g)}{\partial(z,p)} - q\frac{\partial(f,g)}{\partial(z,q)}$ (D) $\frac{\partial(f,g)}{\partial(x,p)} - \frac{\partial(f,g)}{\partial(y,q)} + p\frac{\partial(f,g)}{\partial(z,p)} + q\frac{\partial(f,g)}{\partial(z,q)}$

42. The condition that two first order partial differential equations are compatible is ……

(A) $\frac{\partial(f,g)}{\partial(p,q)} \neq 0,\ [f,g] = 0$ (B) $\frac{\partial(f,g)}{\partial(p,q)} \neq 0,\ [f,g] \neq 0$

(C) $\frac{\partial(f,g)}{\partial(p,q)} = 0,\ [f,g] = 0$ (D) $\frac{\partial(f,g)}{\partial(p,q)} = 0,\ [f,g] \neq 0$

43. The fundamental idea of Charpit's method is the introduction of how many partial differential equations of first order?

(A) four (B) two (C) three (D) one

44. In Charpit's method, a complete integral is given by ……………...

(A) $dz = p\ dy + q\ dx$ (B) $dz = p\ dy - q\ dx$

(C) $dz = p\ dx + q\ dy$ (D) $dz = p\ dx - q\ dy$

45. First order equation of the form $f(p,q) = 0$ has solution of the form …………..

(A) $z = ax + Q(a)y + b$ (B) $z = ax^2 + Q(a)y^2 + b$

(C) $z = ax + Q(a)y^2 + b$ (D) $z = ax^2 + Q(a)y + b$

46. A complete integral of the equation $pq = 1$ is ………………

(A) $z = ax^2 + \frac{1}{a}y + b$ (B) $z = ax + \frac{1}{a}y^2 + b$

(C) $z = ax^2 + \frac{1}{a}y^2 + b$ (D) $z = ax + \frac{1}{a}y + b$

47. Two surfaces are said to be circumscribe each other if they ………………

(A) intersect each other (B) are parallel

(C) are orthogonal (D) touch along a curve

48. A complete integral of the equation $z = p^2 - q^2$ is ………………

(A) $2\sqrt{z} = \frac{ax}{\sqrt{a^2-1}} + \frac{y}{\sqrt{a^2-1}} + b$ (B) $2\sqrt{z} = \frac{ax}{\sqrt{a^2-1}} + \frac{ay}{\sqrt{a^2-1}} + b$

(C) $2\sqrt{z} = \frac{ax^2}{\sqrt{a^2-1}} + \frac{y^2}{\sqrt{a^2-1}} + b$ (D) $2\sqrt{z} = \frac{ax^2}{\sqrt{a^2-1}} + \frac{ay^2}{\sqrt{a^2-1}} + b$

49. A complete integral of the equation $zpq = p + q$ is ………………

(A) $\frac{z^2}{2} = (a+1)x^2 + \left(\frac{a+1}{a}\right)xy + b$ (B) $\frac{z^2}{2} = (a+1)x + \left(\frac{a+1}{a}\right)y + b$

(C) $\frac{z^2}{2} = (a+1)x + \left(\frac{a+1}{a}\right)y^2 + b$ (D) $\frac{z^2}{2} = (a+1)x^2 + \left(\frac{a+1}{a}\right)y + b$

50. A complete integral of the equation $(p + q)(z - xp - yq) = 1$ is ………………

(A) $z = ax - by - \frac{1}{a+b}$ (B) $z = ax + by + \frac{1}{a+b}$

(C) $z = ax^2 - by - \frac{1}{a+b}$ (D) $z = ax^2 + by^2 + \frac{1}{a+b}$

51. A first order partial differential equation is said to be separable if it is of the form

A. $f(x, y, z, p, q) = 0$ B. $f(x, p, q) = g(y)$

C. $f(x, p, q) = g(z)$ D. $f(x, p) = g(y, q)$

52. Find the complete integral of the equation p + q = p q

A. $z = ax + \frac{a}{a-1} y + b$
B. $z = ax + \frac{a}{a+1} y + b$
C. $z = ax + y + b$
D. $z = ax + by + c$

53. Write the Clairaut's equation

A. $z = ax + by + f(p + q)$
B. $z = ax + by - f(p, q)$
C. $z = ax + by - f(p - q)$
D. $z = ax + by + f(p, q)$

54. If $\alpha_r D + \beta_r D' + \gamma_r$ is a factor of $F(D, D')$ and $\varphi_r(\varepsilon)$ is an arbitrary function of the single variable ε, then find the solution of $F(D, D')z = 0$ is

A. $u_r = e^{\frac{-\gamma_r x}{\alpha_r}} \varphi_r(\beta_r x - \alpha_r y)$, $\alpha_r \neq 0$.
B. $u_r = e^{\frac{-\gamma_r Y}{\beta_r}} \varphi_r(\beta_r + x)$, $\beta_r \neq 0$.
C. $u_r = e^{\frac{-\gamma_r x}{\alpha_r}} \varphi_r(\beta_r x + \alpha_r y)$, $\alpha_r \neq 0$
D. $u_r = e^{\frac{-\gamma_r Y}{\beta_r}} \varphi_r(\beta_r - x)$, $\beta_r \neq 0$.

55. If $\beta_r D' + \gamma_r$ is a factor of $F(D, D')$ and $\varphi_r(\varepsilon)$ is an arbitrary function of the single variable ε, then the solution is

A. $u_r = e^{\frac{-\gamma_r Y}{\beta_r}} \varphi_r(\beta_r + x)$, $\beta_r \neq 0$.
B. $u_r = e^{\frac{-\gamma_r Y}{\beta_r}} \varphi_r(\beta_r - x)$, $\beta_r \neq 0$.
C. $u_r = e^{\frac{-\gamma_r Y}{\beta_r}} \varphi_r(\beta_r / x)$, $\beta_r \neq 0$.
D. $u_r = e^{\frac{-\gamma_r Y}{\beta_r}} \varphi_r(\beta_r x)$, $\beta_r \neq 0$.

56. If u is the complementary function and z is a particular integral of F(D,D')z =f(x,y), find the general solution of the equation

A. uz
B. $u - z$

C. $u + z$
D. None of these

57. Find the complementary function of $z_{xx} - z_{yy} = x - y$
A. $\varphi_1(x-y) + \varphi_2(-x+y)$
B. $\varphi_1(x-y) + \varphi_2(-x-y)$
C. $\varphi_1(x-y) + \varphi_2(y)$
D. $\varphi_1(x-y) + \varphi_2(xy)$

58. Solve $(D^2 - 3DD' + 2D'^2)z = 0$
A. $\varphi_1(x-y) + \varphi_2(2x-y)$
B. $\varphi_1(x+y) + \varphi_2(2x+y)$
C. $\varphi_1(x-y) + \varphi_2(-x-y)$
D. $\varphi_1(x-y) + \varphi_2(x-2y)$

59. Solve $(D - D')^2 z = 0$
A. $\varphi_1(x-y) + \varphi_2(-x-y)$
B. $\varphi_1(x+y) + x\varphi_2(x+y)$
C. $\varphi_1(x-y) + x\,\varphi_2(x-y)$
D. $\varphi_1(x-y) + \varphi_2(2x-y)$

60. Solve [(D + 2D')(D-D'-1)]z = 0
A. $\varphi_1(x+y) + e^x\varphi_2(x+y)$
B. $\varphi_1(x+y) + x\varphi_2(2x+y)$
C. $\varphi_1(x+y) + x\varphi_2(x+y)$
D. $\varphi_1(2x-y) + e^x\varphi_2(x+y)$

61. If $z = f(x + ay) + g(x - ay)$, then write the differential equation corresponding to this solution
A. $r = t$
B. $r = a^2 - t$
C. $t = a^2 + t$
D. $t = a^2 r$

62. If $z = f(x + iy) + g(x - iy)$, then the differential equation corresponding to this solution
A. $r = t$
B. $r + t = 0$
C. $r = a\,t$
D. $r\,t = 0$

63. Solve by Jacobi's method z^2 = p q x y
A. $u = alogx + blogy + \sqrt{ab}$
B. $u = alogx + blogy + \sqrt{ab} + \log c$
C. $u = alogx - blogy + \sqrt{ab}\, logz + \log c$
D. $u = alogx + blogy + \sqrt{ab}\, logz + \log c$

64. Find the complete integral of the equation, $u_x + u_y + u_z = u_x u_y u_z$
A. $u = ax.by + \theta(a,b)z + c$
B. $u = ax + by + \theta(a,b)z + c$
C. $u = ax - by + \theta(a,b)z + c$
D. $u = ax + by - \theta(a,b)z + c$

65. The Jacobian $J = \frac{\partial(\varepsilon,\mu)}{\partial(x,y)}$ is

A. $\varepsilon_x\mu_x$
B. $\varepsilon_x\mu_{y-}\varepsilon_y\mu_x$
C. $\varepsilon_x\mu_{y+}\varepsilon_y\mu_x$
D. $\varepsilon_x\mu_{y-}\mu_x$

66. Form a partial differential equation by eliminating the arbitrary constants from the equation $z = ax^2 + by^2$

A. $z = p\,x + q\,y$
B. $2z = p\,x - q\,y$
C. $2z = p\,x + q\,y$
D. $z = p\,x - q\,y$

67. The partial differential equation, $z_{xx} = z_y$ is known as

A. Harmonic equation
B. Diffusion equation
C. Laplace equation
D. Wave equation

68. One dimensional wave equation is

A. $z_{xx} = a^2 z_{yy}$
B. $z_x = a^2 z_{yy}$
C. $z_y = a^2 z_{yy}$
D. $z_{xx} + a^2 z_{yy} = 0$

69. The partial differential equation $5\,z_{xx} + 6\,z_{yy} = x\,y$ is classified as

A. elliptic
B. parabolic
C. hyperbolic
D. none of the above

70. The partial differential equation x y(z_x) $= 5z_{yy}$ is classified as

A. Parabolic
B. elliptic
C. hyperbolic
D. none of the above

71. The partial differential equation $z_{xx} - 5z_{yy} = 0$ is classified as

A. Parabolic
B. hyperbolic
C. none of the above
D. elliptic

72. Consider the following partial differential equation $3z_{xx} + B\,z_{xy} + 3z_{yy} + 4z = 0$. For this equation to be classified as parabolic, the value of B must be

A. 3
B. 6
C. 2
D. 0

73. Consider the following partial differential equation $z_{xx} + B\,z_{xy} + z_{yy} = 0$. For this equation to be classified as elliptic, the value of B must be

A. 0
B. 1
C. -1
D. 2

74. Consider the following partial differential equation $z_{xx} + B\, z_{xy} - z_{yy} = 0$. For this equation to be classified as hyperbolic, the value of B must be
A. 0
B. 1
C. 2
D. 3

75. The complete solution of the partial differential equation $q(p - cosx) = cosy$
A. $z = ax + sinx + \frac{siny}{a}$ + b
B. $z = ax - sinx - \frac{siny}{a}$ + b
C. $z = ax + sinx - \frac{siny}{a}$ + b
D. $z = ax - sinx + \frac{siny}{a}$ + b

76. Which of the following represents a family of right circular cone
A. $x^2 - y^2 = cz^2$
B. $x^2 + y^2 + cz^2 = 0$
C. $x^2 + y = cz^2$
D. $x^2 + y^2 = cz^2$

77. Which of the following is the Laplace's equation
A. $\frac{\partial^2 z}{\partial x^2}$ -$\frac{\partial^2 z}{\partial x^2}$ + $\frac{\partial^2 z}{\partial x^2}$=1 B. $\frac{\partial^2 z}{\partial x^2}$ +$\frac{\partial^2 z}{\partial x^2}$ + $\frac{\partial^2 z}{\partial x^2}$=1 C. $\frac{\partial^2 z}{\partial x^2}$ -$\frac{\partial^2 z}{\partial x^2}$ + $\frac{\partial^2 z}{\partial x^2}$=0 D. $\frac{\partial^2 z}{\partial x^2}$ -$\frac{\partial^2 z}{\partial x^2}$ + $\frac{\partial^2 z}{\partial x^2}$=0

78. Which of the following is a solution of the Laplace's equation, if q is a constant and (x', y', z') are the coordinates of a fixed point,
A. $\frac{-q}{|\mathbf{r}-\mathbf{r}'|}$ B. $\frac{q}{|\mathbf{r}-\mathbf{r}'|}$ C. $\frac{q}{\sqrt{\mathbf{r}-\mathbf{r}'}}$ D. $\frac{-q}{\sqrt{\mathbf{r}-\mathbf{r}'}}$

79. If the function $\psi x, y, z)$ is a solution of Laplace's equation, the one - parameter system of surfaces $\psi(x, y, z) = c$ is called
A. Orthogonal trajectories B. family of surfaces C. family of equipotential surfaces D. None of these

80. A one -parameter family of surfaces $f(x, y, z) = c$ is a family of equipotential surfaces if
A. $\frac{\nabla^2 f}{|\text{grad}\, f|^2}$ is not a function of f alone
B. $\frac{\nabla^2 f}{|\text{grad}\, f|^2}$ is a function of f alone
C. $\frac{|\text{grad}\, f|^2}{\nabla^2 f}$ is a function of f alone
D. None of these

81. The formula $\psi = A \int e^{-\int x(f)df} df + B$ is to find
A. The potential function of a family of equipotential surfaces
B. Orthogonal Trajectories
C. Integral curves

D. None of these

82. If $Rr + Ss + Tt + U(rt - s^2) = V$, the Monge's equation when $U = 0$ is

A. $Rdpdy + Tdqdx = Vdxdy$
$Rdy^2 - Sdxdy + Tdx^2 = 0$

B. $Rdpdy + Tdqdx = Vdxdy$
$Rdy^2 - Sdxdy + Tdx^2 = 0$

C. $Rdpdy + Tdqdx = -Vdxdy$
$Rdy^2 + Sdxdy + Tdx^2 = 0$

D. $Rdpdy - Tdqdx = Vdxdy$
$Rdy^2 - Sdxdy - Tdx^2 = 0$

83. Laplace's equation in spherical coordinates r, θ, ϕ is

A. $\frac{\partial^2\psi}{\partial r^2} + \frac{2}{r}\frac{\partial\psi}{\partial r} + \frac{1}{r^2}\frac{\partial^2\psi}{\partial\theta^2} + \frac{\cot\theta}{r^2}\frac{\partial\psi}{\partial\theta} + \frac{1}{r^2\sin^2\theta}\frac{\partial^2\psi}{\partial\phi^2} = 0$

B. $\frac{\partial^2\psi}{\partial r^2} + \frac{r}{2}\frac{\partial\psi}{\partial r} + \frac{1}{r^2}\frac{\partial^2\psi}{\partial\theta^2} + \frac{\cot\theta}{r^2}\frac{\partial\psi}{\partial\theta} + \frac{1}{r^2\sin^2\theta}\frac{\partial^2\psi}{\partial\phi^2} = 0$

C. $\frac{\partial^2\psi}{\partial r^2} + 2r\frac{\partial\psi}{\partial r} + \frac{1}{r^2}\frac{\partial^2\psi}{\partial\theta^2} + \frac{\cot\theta}{r^2}\frac{\partial\psi}{\partial\theta} + \frac{1}{r^2\sin^2\theta}\frac{\partial^2\psi}{\partial\phi^2} = 0$

D. $\frac{\partial^2\psi}{\partial r^2} + \frac{2}{r}\frac{\partial\psi}{\partial r} + \frac{1}{r}\frac{\partial^2\psi}{\partial\theta^2} + \frac{\cot\theta}{r^2}\frac{\partial\psi}{\partial\theta} + \frac{1}{r^2\sin^2\theta}\frac{\partial^2\psi}{\partial\phi^2} = 0$

84. If $f(z) = U + i\,V$ is an analytic function , then the Cauchy -Riemann equations are

A. $\frac{\partial U}{\partial x} = \frac{-\partial V}{\partial y}$ & $\frac{\partial U}{\partial y} = \frac{-\partial V}{\partial x}$

B. $\frac{\partial U}{\partial x} = \frac{\partial V}{\partial y}$ & $\frac{\partial U}{\partial y} = \frac{-\partial V}{\partial x}$

C. $\frac{\partial U}{\partial x} = \frac{-\partial V}{\partial y}$ & $\frac{\partial U}{\partial y} = \frac{-\partial V}{\partial x}$

D. $\frac{\partial U}{\partial x} = \frac{\partial V}{\partial y}$ & $\frac{\partial U}{\partial y} = \frac{-\partial V}{\partial x}$

85. Which of the following is true:

A. Real part of an analytic function is harmonic, but imaginary poart is not.
B. Real part of an analytic function is not harmonic, but imaginary poart is harmonic.
C. The real part & the imaginary part of an analytic function are harmonic.
D. Neither the real part nor the imaginary part of an analytic function is harmonic

86. Which of the following is true:

A. $r\,cos\theta$ is a solution, but $r^{-2}cos\theta$ is not a solution of the Laplace's equation.
B. $r\,cos\theta$ is not a solution, but $r^{-2}cos\theta$ is a solution of the Laplace's equation.
C. $r\,cos\theta$ and $r^{-2}cos\theta$ are solutions of the Laplace's equation.
D. None of these

87. The method of finding the solution of a partial differential equation od second order by finding one or two first integrals is

A. Cauchy's method B. Jacobi's method C. Charpit's method D. Monge's method

88. Which of the following is true:

A. The derivative of an analytic function is not analytic
B. The derivative of an analytic function is sometimes analytic
C. The derivative of an analytic function is analytic
D. Cannot be determined

89. If $\phi = x + \frac{x}{x^2+y^2}$, the corresponding analytic function $\phi + i\psi$ is

A. $w = z - \frac{1}{z}$
B. $w = z + \frac{1}{z}$
C. $w = \frac{1}{z} - z$
D. $w = z + \frac{1}{2z}$

90. The partial differential equation $Rr + Ss + Tt + Pp + Qq + Zz = F$ is separable in the variables x, y,if

A. $\frac{1}{X}f(D)X = \text{Y}g(D')Y$ where $f\ (D), g(D')$ are quadratic functions of $D = \partial/\ \partial x$ and $D' = \partial/\ \partial y$ respectively
B. $\frac{1}{X}f(D)X = \frac{1}{Y}g(D')Y$ where $f\ (D), g(D')$ are quadratic functions of $D = \partial/\ \partial x$ and $D' = \partial/\ \partial y$ respectively
C. $\text{X}f(D)X = \frac{1}{Y}g(D')Y$ where $f\ (D), g(D')$ are quadratic functions of $D = \partial/\ \partial x$ and $D' = \partial/\ \partial y$ respectively
D. $\frac{1}{X}f(D)X = 1/Y^2\ g(D')Y$ where $f\ (D), g(D')$ are quadratic functions of $D = \partial/\ \partial x$ and $D' = \partial/\ \partial y$ respectively

91. A solution of the equation $q^2r - 2pqs + p^2t = 0$ is

A. $y - xf(z) = g(z)$
B. $xyf(z) = g(z)$
C. $\frac{y}{x}f(z) = g(z)$
D. $y + xf(z) = g(z)$

92. Solution of the equation r = t by Monge's method is

A. $z = \phi_1(x + y) + \phi_2(x - y)$
B. $z = \phi_1(x + y)$
C. $z = x\phi_1(x + y) + \phi_2(x - y)$
D. None of these

93. the two -dimensional harmonic in plane polar coordinates $r\ and\ \theta$ is

A. $\frac{\partial^2 V}{\partial r^2} - \frac{1}{r}\frac{\partial V}{\partial r} + \frac{1}{r^2}\frac{\partial^2 V}{\partial \theta^2} = 0$
B. $\frac{\partial^2 V}{\partial r^2} + \frac{1}{r}\frac{\partial V}{\partial r} - \frac{1}{r^2}\frac{\partial^2 V}{\partial \theta^2} = 0$
C. $\frac{\partial^2 V}{\partial r^2} + \frac{1}{r}\frac{\partial V}{\partial r} + \frac{1}{r^2}\frac{\partial^2 V}{\partial \theta^2} = 0$

D. $\frac{\partial^2 V}{\partial r^2} - \frac{1}{r}\frac{\partial V}{\partial r} - \frac{1}{r^2}\frac{\partial^2 V}{\partial \theta^2} = 0$

94. Which of the following is Bessel's equation

A. $\frac{d^2R}{d\rho^2} + \frac{1}{\rho}\frac{dR}{d\rho} + \left(m^2 - \frac{n^2}{\rho^2}\right)R = 0$

B. $\frac{d^2R}{d\rho^2} + \frac{1}{\rho}\frac{dR}{d\rho} + \left(m^2 + \frac{n^2}{\rho^2}\right)R = 0$

C. $\frac{d^2R}{d\rho^2} - \frac{1}{\rho}\frac{dR}{d\rho} + \left(m^2 - \frac{n^2}{\rho^2}\right)R = 0$

D. $\frac{d^2R}{d\rho^2} - \frac{1}{\rho}\frac{dR}{d\rho} + \left(m^2 + \frac{n^2}{\rho^2}\right)R = 0$

95. Which of the following is not a partial differential equation of second order

A. $r + 4s + t + rt - s^2 = 2$

B. $r = t$

C. $2xp + 3y\,q \;= 2$

D. $q^2r - 2pqs + p^2t = 0$

96. if a function z satisfies the differential equation $\frac{\partial^2 z}{\partial x^2}\frac{\partial z}{\partial y} = \frac{\partial^2 z}{\partial x\,\partial y}\frac{\partial z}{\partial x}$ it is of the form

A. $f\{x + g(y)\}$ B. $f\{\frac{g(x)}{y}\}$ C. $f\{x - g(y)\}$ D. $f\{xg(y)\}$

97. The surfaces $x^2 + y^2 + z^2 = cx^2$ forms a family of equipotential surfaces. Then the general form of the corresponding potential function,

A. $Cx(x + y + z) + B$

B. $Cx\,(x^2 + y^2 + z^2)^{\frac{1}{2}} + B$

C. $Cx\,(x^2 + y^2 + z^2)^{\frac{-3}{2}} + B$

D. $Cx\,(x^2 + y^2 + z^2)^{\frac{3}{2}} + B$

98. The surfaces $(x^2 + y^2)^2 - 2a^2(x^2 - y^2) + a^4 = c$ forms a family of equipotential surfaces. Then $\frac{\nabla^2 f}{|\nabla f|^2}$, if $f = (x^2 + y^2)^2 - 2a^2(x^2 - y^2) + a^4$, is

A. f B. $\frac{1}{f}$ C. $\frac{1}{f^2}$ D. f^2

99. The potential function for the family of surfaces $x^2 + y^2 = cz^2$ is

A. $A\log\tan\frac{1}{2}\theta + B$

B. $\mathrm{A}\tan\frac{1}{2}\theta + B$

C. $A\log\frac{1}{2}\theta + B$

D. $A\log\,\frac{tan\theta}{2} + B$

100. The solution of the equation $zrq^2 - 2pqs + tp^2 = pt - qs$

A. $y = g(z) + f(x - z)$

B. $y = g(z) + f(x + z)$

C. $y = g(x) + f(x + z)$

D. $y = g(xz) + f(x - z)$

SEMESTER III

PARTIAL DIFFERENTIAL EQUATIONS

ANSWER KEY

1.C	2.A	3.D	4.B	5.A	6.D	7.A
8.D	9.B	10. C	11. B	12.B	13. A	14. D
15. C	16. C	17. A	18. C	19. B	20. C	21 B
22. A	23. C	24. D	25.B	26. A	27. D	28. C
29. A	30. A	31. B	32. A	33. D	34. D	35. A
36. C	37. A	38. B	39. C	40. D	41. A	42. A
43. D	44. C	45. A	46. D	47. D	48.A	49. B
50.B	51. D	52.A	53. D	54. A	55. D	56. C
57. B	58. B	59. B	60. D	61. D	62. B	63. D
64. B	65. B	66. C	67. B	68. A	69. A	70. A
71. B	72. B	73. A	74. A	75. A	76. D	77. B
78. B	79. C	80. B	81. A	82. A	83. A	84. B
85. C	86. C	87. D	88. C	89. B	90. B	91. D
92. C	93. C	94. A	95. C	96. A	97. C	98. B
99. A	100.A					