SRM Institute of Science and Technology

Faculty of Engineering and Technology

Department of Mathematics

Question Bank- Applications of Partial Differential Equations(Unit-3)

1. The proper solution of the problems on vibration of string is

   (A) $y(x,t) = (Ae^{\lambda x} + Be^{-\lambda x})(Ce^{\lambda at} + De^{-\lambda at})$

   (B) $y(x,t) = (Ax + B)(Ct + D)$

   (C) $y(x,t) = (A\cos\lambda x + B\sin\lambda x)(C\cos\lambda at + D\sin\lambda at)$

   (D) $y(x,t) = (Ax + B)$

   ANSWER: C

2. The one dimensional wave equation is

   (A) $\frac{\partial u}{\partial t} = \alpha^2\frac{\partial^2 u}{\partial x^2}$

   (B) $\frac{\partial^2 y}{\partial t^2} = a^2\frac{\partial^2 y}{\partial x^2}$

   (C) $\frac{\partial y}{\partial t} = a\frac{\partial^2 y}{\partial x^2}$

   (D) $\frac{\partial^2 y}{\partial x^2} = a\frac{\partial^2 y}{\partial t^2}$

   ANSWER: B

3. In wave equation $\frac{\partial^2 y}{\partial t^2} = a^2\frac{\partial^2 y}{\partial x^2}, a^2$ stands for

   (A) $\frac{T}{m}$

   (B) $\frac{k}{c}$

   (C) $\frac{m}{T}$

   (D) $\frac{k}{m}$

   ANSWER: A

4. In heat equation $\frac{\partial u}{\partial t} = \alpha^2\frac{\partial^2 u}{\partial x^2}, \alpha^2$ stands for

   (A) $\frac{k}{\rho}$

   (B) $\frac{T}{m}$

   (C) $\frac{k}{\rho c}$

   (D) $\frac{k}{c}$

   ANSWER: C

5. The one dimensional heat equation in steady state is

(A) $\frac{\partial u}{\partial t} = 0$

(B) $\frac{\partial^2 u}{\partial t^2} = 0$

(C) $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$

(D) $\frac{\partial^2 u}{\partial x^2} = 0$

ANSWER: D

6. The proper solution of $u_t = \alpha^2 u_{xx}$

(A) $u = (Ax + B)C$

(B) $u = (A\cos\lambda x + B\sin\lambda x)e^{-\alpha^2\lambda^2 t}$

(C) $u = (Ae^{\lambda x} + Be^{-\lambda x})e^{\alpha^2\lambda^2 t}$

(D) $u = At + B$

ANSWER: B

7. The proper solution in steady state heat flow problems is

(A) $u = (Ae^{\lambda x} + Be^{-\lambda x})e^{\alpha^2\lambda^2 t}$

(B) $u = Ax + B$

(C) $u = (A\cos\lambda x + B\sin\lambda x)e^{-\alpha^2\lambda^2 t}$

(D) $u = (Ae^{\lambda x} + Be^{-\lambda x})(Ce^{\lambda at} + De^{-\lambda at})$

ANSWER: B

8. The one dimensional heat equation is

(A) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

(B) $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$

(C) $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$

(D) $\frac{\partial u}{\partial x} = \alpha^2 \frac{\partial^2 u}{\partial t^2}$

ANSWER: B

9. How many initial and boundary conditions are required to solve $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$

(A) Four

(B) Two

(C) Three

(D) Five

ANSWER: C

10. How many initial and boundary conditions are required to solve $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$

(A) Two

(B) Three

(C) Five

(D) Four

ANSWER: D

11. One dimensional wave equation is used to find

(A) Temperature

(B) Displacement

(C) Time

(D) Mass

ANSWER: B

12. One dimensional heat equation is used to find

(A) Density

(B) Temperature distribution (C) Time

(D) Displacement

ANSWER: B

13. Heat flows from ——— temperature

(A) Higher to Lower

(B) Uniform

(C) Lower to higher

(D) Stable

ANSWER: A

14. The tension T caused by stretching the string before fixing it at the end points is

(A) Large

(B) Decreasing

(C) Constant

(D) Zero

ANSWER: A

15. A string is stretched between two fixed points x = 0 and x = l. The initial conditions are

(A) $y(0, t) = 0, y(x, t) = 0$

(B) $y(x, 0) = 0, \frac{\partial y}{\partial t}(x, 0) = 0$

(C) $y(0, t) = 0, y(l, t) = 0$

(D) $\left(\frac{\partial y}{\partial x}\right)_{(0,t)} = 0, \left(\frac{\partial y}{\partial x}\right)_{(l,t)} = 0$

ANSWER: C

16. The amount of heat required to produce a given temperature change in a body is proportional to

(A) Weight of the body

(B) Mass of the body

(C) Density of the body

(D) Tension of the body

ANSWER: B

17. The general solution for the displacement $y(x, t)$ of the string of length l vibrating between fixed end points with initial velocity zero and initial displacement $f(x)$ is

(A) $\Sigma B_n \sin\left(\frac{n\pi x}{l}\right) \cos\left(\frac{n\pi at}{l}\right)$

(B) $\Sigma B_n \sin\left(\frac{n\pi x}{l}\right) \sin\left(\frac{n\pi at}{l}\right)$

(C) $\Sigma B_n \cos\left(\frac{n\pi x}{l}\right) \sin\left(\frac{n\pi at}{l}\right)$

(D) $\Sigma B_n \sin\left(\frac{n\pi x}{l}\right)$

ANSWER: A

18. The steady state temperature of a rod of length l whose ends are kept at 30° and 40° is

(A) $u = \frac{10x}{l} + 30$

(B) $u = \frac{20x}{l} + 30$

(C) $u = \frac{10x}{l} + 20$

(D) $u = \frac{10x}{l}$

ANSWER: A

19. When the ends of a rod is non-zero for one dimensional heat flow equation, the temperature function $u(x, t)$ is modified as the sum of steady state and transient

state temperatures. The transient part of the solution which

(A) Increases with increase of time

(B) Decreases with increase of time

(C) Increases with decrease of time

(D) Decreases with decrease of time

ANSWER: B

20. A rod of length l has its ends A and B kept at 0° and 100° respectively, until steady state conditions prevail. Then the initial condition is given by

(A) $u(x, 0) = ax + b + 100l$

(B) $u(x, 0) = \frac{100x}{l}$

(C) $u(x, 0) = 100xl$

(D) $u(x, 0) = (x + l)100$

ANSWER: B

21. The partial differential equations which satisfy certain initial and boundary conditions are called

(A) Boundary value problem

(B) initial value problem

(C) Convex problem

(D) Equilibrium problem

ANSWER: A

22. Classification of one dimensional heat equation is

(A) Elliptic

(B) parabolic

(C) Hyperbolic

(D) Deterministic

ANSWER: B

23. Classification of one dimensional wave equation is

(A) Elliptic

(B) parabolic

(C) Hyperbolic

(D) Deterministic

ANSWER: C

24. Elliptic, Parabolic and Hyperbolic are the classifications of

(A) A linear PDE of order 2

(B) A PDE of order 2

(C) A linear PDE of order 1

(D) A non-linear PDE of order 2

ANSWER: A

25. $B^2 - 4AC < 0$ of the linear PDE of order 2 is referred as

(A) Parabolic

(B) Elliptic

(C) Hyperbolic

(D) Deterministic

ANSWER: B

26. $B^2 - 4AC > 0$ of the linear PDE of order 2 is referred as

(A) Parabolic

(B) Elliptic

(C) Hyperbolic

(D) Deterministic

ANSWER: C

27. $B^2 - 4AC = 0$ of the linear PDE of order 2 is referred as

(A) Parabolic

(B) Elliptic

(C) Hyperbolic

(D) Deterministic

ANSWER: A

28. Classification of the PDE $f_{xx} + 3f_{xy} + 4f_{yy} + f_x - 3f_y = 0$ is

(A) Parabolic

(B) Elliptic

(C) Hyperbolic

(D) Deterministic

ANSWER: B

29. Classification of the PDE $2f_{xx} + f_{xy} - f_{yy} + f_x + 3f_y = 0$ is

(A) Parabolic

(B) Elliptic

(C) Hyperbolic

(D) Deterministic

ANSWER: C

30. If two ends of a bar of length l is insulated then what are the conditions to solve the heat flow equation?

(A) $u_x(0, t) = 0 = u_x(l, t)$

(B) $u_t(0, t) = 0 = u_t(l, t)$

(C) $u(0, t) = 0 = u(l, t)$

(D) $u_{xx}(0, t) = 0 = u_{xx}(l, t)$

ANSWER: A

31. Partial differential equation requires

(A) Exactly one independent variable

(B) More than one dependent variable

(C) two or more independent variables

(D) equal number of dependent and independent variables

ANSWER: B

32. The classification of partial differential equation is $5\frac{\partial^2 z}{\partial x^2} + 6\frac{\partial^2 z}{\partial y^2} = xy$

(A) Elliptic

(B) parabolic

(C) Hyperbolic

(D) Deterministic

ANSWER: A

33. The partial differential equation $\frac{\partial^2 z}{\partial x^2} - 5\frac{\partial^2 z}{\partial y^2} = 0$ is classified as

(A) Elliptic

(B) parabolic

(C) Hyperbolic

(D) Deterministic

ANSWER: C

34. When solving a 1-Dimensional wave equation using variable separable method, we get the solution if ———-

(A) k is positive

(B) k is negative

(C) k is 0

(D) k can be anything

ANSWER: B

35. The one dimensional heat equation can be solved using a variable separable method. The constant which appears in the solution should be ———-

(A) Positive

(B) Negative

(C) Zero

(D) Can be anything

ANSWER: B

36. A rod of 30cm length has its ends P and Q kept $20°C$ and $80°C$ respectively until steady state condition prevail. The temperature at each point end is suddenly reduced to $0°C$ and kept so. Find the conditions for solving the equation.

(A) $u(0,t) = 0 = u(30,t)$ and $u(x,0) = 20 + 60/10x$

(B) $u_x(0,t) = 0 = u_x(30,t)$ and $u(x,0) = 20 + 60/30x$

(C) $u_t(0,t) = 0 = u_t(30,t)$ and $u(x,0) = 20 + 60/10x$

(D) $u(0,t) = 0 = u(30,t)$ and $u(x,0) = 20 + 60/30x$

ANSWER: B