APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH DEGREE EXAMINATION

Civil Engineering

(Structural Engineering and Construction Management)

04 CE 6401 ANALYTICAL METHODS IN ENGINEERING

Time: 3 Hrs. Max.Marks:60

Part A

Answer All Questions

Each question carries 3 marks

1. If $\frac{d^4x}{dt^4} = m^4x$ then show that $x = c_1 \cos mt + c_2 \sin mt + c_3 \cosh mt + c_4 \sinh mt$.
2. Form a partial differential equation by eliminating arbitrary function f from $z = e^{ax+by} f(ax - by)$.
3. Solve $25r - 40s + 16t = 0$.
4. Write the general form of two dimensional wave equation.
5. Write the general condition for classify a second order partial differential equation.
6. Classify the equation $\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$.
7. Derive Leibmann's formula for solving Laplace equation.
8. Derive finite difference formula for solving one dimensional wave equation.

Part B

Each question carries 6 marks

9. Solve by the method of variation of parameters $y'' - 2y' + 2y = e^x \tan x$.

OR

10. The shape of a strut of length l subjected to an end thrust and lateral load w per unit length, when the ends are built in is given by, $EI\frac{d^2y}{dx^2} + Py = \frac{wx^2}{2} - \frac{wlx}{2} + M$,where M is the moment at the fixed end. Find y in terms of x, given that y=0, $\frac{dy}{dx} = 0$ at x=0 and $\frac{dy}{dx} = 0$ at x=l/2.
11. Find the integral surface of the partial differential equation $x(y^2 + z)p - y(x^2 + z)q = (x^2 - y^2)z$ which contains the straight line $x + y = 0, z = 1$.

OR

12. Show that the equations $xp = yq$ & $z(xp + yq) = 2xy$ are compatible and solve them.
13. Solve $zpq = p + q$

OR

14. Solve $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$.

P.T.O

15. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ within the rectangle

$0 \le x \le a; 0 \le y \le b;\ u(0,y) = 0; u(a,y) = 0; u(x,b) = 0; u(x,0) = x(a-x)$

OR

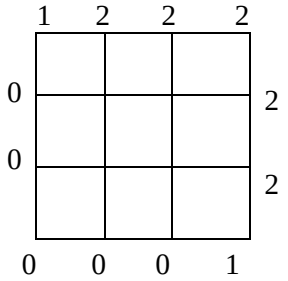
16. A tightly stretched string with fixed end points $x = 0, x = l$, is initially in a position given by $y = y_0 sin^3(\frac{\pi x}{l})$. If it is released from this position, find the displacement $y(x,t)$.

17. Classify the equation $x^2 u_{xx} + \left(1 - y^2\right) u_{yy} = 0$

OR

18. Solve $4\dfrac{\partial^2 u}{\partial x^2} = \dfrac{\partial^2 u}{dt^2}$ with the boundary conditions $u(0,t) = 0, u(4,t) = 0$ and the initial conditions, $u_t(x,0) = 0$ *and* $u(x,0) = x(4-x)$ taking h=1(for 4 time steps).

19. Find the values of u(x,y) satisfying $u_{xx} + u_{yy} = 0$ at the pivotal points of the square region ,with boundary values as shown



OR

20. Solve the boundary value problem, $u_{tt} = u_{xx}$ with conditions

$u(0,t) = u(1,t) = 0, u(x,0) = \dfrac{x(1-x)}{2}$ *and* $u_t(x,0) = 0$,taking h=k=0.1 for $0 \le t \le 0.4$.