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

Max. Marks : 60 Duration: 3 Hours

PART A

Answer All Questions

Each question carries 3 marks

1. Solve $\left(D^3 - 6D^2 + 11D - 6\right)y = 0$.
2. Find the integral curves of $\frac{dx}{x^2(y-z)} = \frac{dy}{y^2(z-x)} = \frac{dz}{z^2(x-y)}$
3. Solve $4r - 12s + 9t = 0$.
4. Derive solutions of Laplace's equation in two dimension.
5. Classify the equation $x^2\, u_{xx} + \left(1 - y^2\right)\, u_{yy} = 0$
6. Describe the rules for classifying a second order partial differential equation.
7. Derive Standard five point formula for solving Laplace equation.
8. Derive the solution of one dimensional wave equation by finite difference approximation.

PART B

Each question carries 6 marks

9. Solve $(D-2)^2\, y = 8\left(e^{2x} + \sin 2x + x^2\right)$.

OR

10. Using the method of variation of parameters, solve $\left(D^2 - 1\right)y = \frac{2}{1+e^x}$.

11. Find the integral surface of the equation $(2xy-1)p + (z-2x^2)q = 2(x-yz)$, which passes through the line $x = 1, y = 0$.

OR

12. Show that the equation $z = px + qy$ is compatible with any equation $f(x, y, z, p, q) = 0$ which is homogeneous in x,y,z.
13. Solve $zpq = p + q$

OR

14. Solve $\left(D^2 - 3DD' + 2D'^2\right)z = \sin(x-2y) + e^{x-y}$
15. A square plate is bounded by the lines $x = 0, y = 0, x = 20, y = 20$. Its faces are insulated. The temperature along the horizontal edge is given by $u(x, 20) = x(20-x), 0 < x < 20$, while other three edges are kept 0^oC. Find the steady state temperature in plate.

OR

16. A string of length *l* is initially at rest in equilibrium position and each of its points is given the velocity $(\frac{\partial u}{\partial t})_{t=0} = b sin^3(\frac{\pi x}{l})$.

17. Derive the expression for first and second order partial derivatives of a function $u(x, y)$ by finite difference approximation.

OR

18. Classify the equation $(1+x^2)\, u_{xx} + (5+2x^2)\, u_{xt} + (4+x^2) u_{tt} = 0$.

19. Solve the equation $u_{xx} + u_{yy} = 0$ subject to the conditions,

$u(0, y) = 0,\ 0 \le y \le 4;\ u(4, y) = 12 + y,\ 0 \le y \le 4;\ u(x,0) = 3x,\ 0 \le x \le 4;\ u(x,4) = x^2,\ 0 \le x \le 4.$

OR

20. Solve the equation $u_{tt} = u_{xx}$ subject to $u(0,t) = u(4,t) = 0\,; u(x,0) = 2x - 0.5x^2;\ u_t(x,0) = 0$,taking $h = 1$ and t up to1.5.