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$(D^4 - 5D^2 + 4)y = 0$.
2. Write a short note on compatible system of first order equations.
3. Solve $(D + 2D')(D - 3D')^2 z = 0$.
4. Derive solutions of Laplace's equation in two dimension.
5. Classify the equation $f_{xx} + 2f_{xy} + f_{yy} = 0$
6. Discuss the rules for classifying a second order partial differential equation.
7. Discuss Liebmann's iteration technique for solving Laplace equation numerically.
8. Derive the solution of one dimensional wave equation by finite difference approximation.

PART B

Each question carries 6 marks

9. Solve$(D^2 - 2D + 1)y = xe^x sinx$.

OR

10. Using the method of variation of parameters, solve $(D^2 - 2D + 2)y = e^x tanx$.

11. Find the integral surface of the equation $2y(z-3)p + (2x - z)q = y(2x - 3)$, which passes through the circle $x^2 + y^2 = 2x, z = 0$.

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 $2zx - px^2 - 2qxy + pq = 0$.

OR

14. Solve $(D^3 - 2D^2D')z = 2x^2y$.
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 string is stretched between the fixed points (0,0) and (L,0) and released at rest from the initial deflection given by $f(x) = \begin{cases} \frac{2kx}{L}, 0 < x < \frac{L}{2} \\ \frac{2k(L-x)}{L}, \frac{L}{2} < x < L \end{cases}$,Find the deflection of the string at ant time t.

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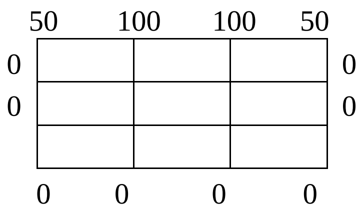
17. Derive the expression for first and second order partial derivatives of a function $u(x, y)$ by finite difference approximation.

OR

18. Classify the equation $y^2 u_{xx} - 2xyu_{xy} + x^2 u_{yy} + 2u_x - 3u = 0$.

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 equation $u_{tt} = 16u_{xx}$ subject to
$u(0, t) = u(4, t) = 0, u_t(x, 0) = 0,\ u(x, 0) = \ x^2(4 - x)$ taking $h = 1$ and t up to1.5.