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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION

Civil Engineering

(Geomechanics and Structures)

04 CE 6301 APPLIED MATHEMATICS FOR CIVIL ENGINEERS

Max. Marks : 60 Duration: 3 Hours

PART A

1. Show that $P_n(-1)=(-1)^n$
2. Find the inverse Laplace transform of $\frac{4s+5}{(s+2)(s-1)^2}$.
3. Write the terms contained in S=$a_{ij}\, x^i x^j$ taking n=3.
4. Show that y(x) = 2-x is a solution of the integral equation $\int_0^x e^{x-t}\ y(t)dt = e^x + x - 1$
5. Using D'Alembert's method, find the deflection of a vibrating string of unit length having fixed ends , with initial velocity zero and initial deflection $f(x) = k(\sin x - \sin 2x)$.
6. Solve the partial differential equation r = t.
7. Find the approximate value of $\int_0^1 \frac{sinx}{x} dx$ using three-point rule.
8. Apply Guass two-point formula to evaluate $\int_0^1 \frac{1}{1+x^2}\ dx$.

$(8 \times 3 = 24\, marks)$

PART B

9. a) Derive Rodrigue's formula.

OR

b) Explain the Orthogonality property for Bessel polynomials.

10. a) Solve by the method of transforms $t\, y'' + 2y' + ty = cost$ given y(0)=1.

OR

b) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ (x>0, t>0) subject to the conditions

$i)\ u = 0, when\ x = 0, t = 0$

$ii)u = \begin{cases} 1, 0 < x < 1 \\ 0, x \geq 1 \end{cases}$

iii)u(x,t) is bounded

11. a) A co-varient tensor has components 2x-z, x^2y, yz in Cartesian co-ordinate system. Find its components in cylindrical co-ordinates.

OR

b) Show that $a_{ij}A^{kj} = \Delta\, \delta_i^k$ where Δ is a determinant of order three and A^{ij} are cofactors of a_{ij}.

12. a) Find the integral equation corresponding to the boundary value problem y''+xy=1, given that y(0)= y'(0)=0.

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OR

b) Using the method of successive approximations solve the integral equation

$$y(x) = 1 + \tau \int_0^1 (1 - 3xt) y(t) dt.$$

13. a) Derive D'Alembert's solution of wave equation.

OR

b) Solve the partial differential equation $y^2 r - 2ys + t = p + 6y$.

14. a) Solve the equations $x^2 + y^2 = 16$ *and* $x^2 - y^2 = 4$, start with the approximate solution $(2\sqrt{2},\ 2\sqrt{2})$.

OR

b) Solve the partial differential equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square with sides x=0=y, x=3=y with u=0 on the boundary and mesh length=1.

$(6 \times 6 = 36\ marks)$