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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

Answer all questions.

Each question carries 3 marks

1. Write the Rodrigue's formula and hence obtain $P_2(x)$.
2. Find the Fourier transform of $f(x)=\begin{cases} 1 \text{ for } |x|<1 \\ 0 \text{ for } |x|>1 \end{cases}$.
3. Show that kronecker delta is a mixed tensor of order two.
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 $f(x) = asin^2\,\pi x$
6. Obtain Monge's subsidiary equations to solve a partial differential equation of the form Rr+sS+Tt=V.
7. Find the approximate value of $\int_0^1 \frac{sinx}{x}\,dx$ using three-point rule.
8. Apply Gauss three-point formula to evaluate $\int_{0.2}^{1.5} e^{-t^2}$

PART B

Each question carries 6 marks

9. Derive the recurrence formulae

$$J_n(x) = \frac{x}{2n}[\,J_{n-1}(x) + J_{n+1}(x)\,]$$

OR

10. State and prove the Orthogonality property for Bessel functions.

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

OR

12. 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

13. A co-varient tensor has components xy, $2y-z^2$, xz in Cartesian co-ordinate system. Find its components in spherical co-ordinates.

OR

14. 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}.

15. Find the integral equation corresponding to the boundary value problem y"(x)+ ƛy(x) =0, given that y(0)= y(1)=0.

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OR

16. Using the method of successive approximations solve the integral equation

$$y(x) = 1 + ƛ \int_0^1 xty(t)dt.$$

17. Solve the Laplace eqation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to the conditions u(0,y) = u(l,y)=u(x,0) = 0 and u(x,a) = sin $\frac{n\pi x}{l}$

OR

18. Solve the partial differential equation r = a^2 t.

19. Solve the equations $x^2 + y^2 = 11\; and\; y^2 + x = 7$, start with the approximate solution (3.5, −1.8).

OR

20. Solve $\nabla^2 u = 0$ under the conditions (h=1, k=1) u(0,y)=0, u(4,y)=12+y for 0≤y≤4, u(x,0)=3x, u(x,4)=x^2 for $0 \leq x \leq 4$.