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. Show that $P_n(-1) = (-1)^n$
2. Find the Fourier cosine transform of f(x)= $\begin{cases} x & for\ 0 < x < 1 \\ 2 - x & for\ 1 < x < 2 \\ 0 & for\ x > 2 \end{cases}$
3. Define contraction of tensors.
4. Define Fredholm and Volterra integral equation.
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 $f(x) = a\,(x - x^2)$
6. Solve the partial differential equation $r = t$.
7. Give Newton cote's open type integration rules.
8. Apply Guass two-point formula to evaluate $\int_0^{\frac{\pi}{2}} sint\ dt$.

PART B

Each question carries 6 marks

9. Express $x^3 + 2x^2 - x - 3$ in terms of Legendre polynomials.

OR

10. Derive generating function for $J_n(x)$

11. Solve the differential equation using Laplace Transform $D^2x+9x= \cos 2t$. if x(0)=1, x($\pi/2$)= -1 where D denote the derivative $\frac{d}{dt}$.

OR

12. Solve $\frac{\partial u}{\partial t} = 2\frac{\partial^2 u}{\partial x^2}$ if u(0,t)=0, u(x,0)=e^{-x} (x>0), u(x,t) is bounded where x>0, t>0.

13. A co-varient tensor has components 2x-z, x^2y, yz in Cartesian co-ordinate system. Find its components in spherical co-ordinates.
(8)

OR

14. Show that any inner product of the tensors A_r^p and B_t^{qs} is a tensor of rank three.

15. Solve the integral equation $\frac{dy}{dx} = 3\int_0^x cos2(x-t)y(t)dt + 2\ given\ y(0) = 1.$

OR

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

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

17. Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$.

OR

18. An infinitely long plane uniform plate is bounded by two parallel edges and an end at right angles to them. The breadth is π; this end is maintained at a temperature u_0 at all points and other edges are at zero temperature. Determine the temperature at any point of the plate in the steady-state.

19. Solve the following equations by Guass-elimination method

$$x - y + z = 1, -3x + 2y - 3z = -6,\ 2x - 5y + 4z = 5$$

x $+$ $bbbv2$,

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 $0 \le x \le 4$.