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B.Tech.(Aerospace Engg.) (2012 Onwards)/B.Tech.(ANE) (Sem.–4)

NUMERICAL ANALYSIS

Subject Code : ANE-204

M.Code : 60512

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

a) Evaluate the sum $S=\sqrt{3}+\sqrt{5}+\sqrt{7}$ to four significant digits and find its absolute and relative errors.

b) Write the Newton-Cote's quadrature formula.

c) Using Euler's method, find y (1), given that $y' = x + y$ and y (0) = 1.

d) Write the normal equations for fitting a straight line to the data using a method of least squares.

e) Find a root of $x^3 - x - 1 = 0$ using a bisection method correct to two decimal places.

f) Evaluate $\int_5^{12} \frac{dx}{x}$ by Gauss quadrature formula.

g) Using Taylor's series method find y (0.2) for $y' = 2y + 3e^x$, y (0) = 0.

h) What is the condition of convergence of fixed point iteration method?

i) Write a short note on finite difference method.

j) Classify the partial differential equation :

$$y^2 u_{xx} - 2\,xyu_{xy} + x^2\,u_{yy} + 2u_x - 3u = 0$$

SECTION-B

2. Find a root of $xe^x = \cos x$ using Regula-falsi method correct to four decimal places.

3. Solve the following system of equation using the Gauss-Seidel iteration method :

$$6x + 3y + 1 = 9$$

$$2x - 5y + 2z = -5$$

$$3x + 2y + 8z = -4$$

4. Estimate the values of $f(22)$ and $f(42)$ from the following available data :

x :	20	25	30	35	40	45
$f(x)$:	354	332	291	260	231	204

5. Use Runge-Kutta method to approximate y when $x = 1.2$. given that $y = 1.2$ when $x = 1$ and $\frac{dy}{dx} = 3x + y^2$.

6. Evaluate $\int_0^{\pi/2} \sin x \, dx$, using Simpson's 1/3 rule.

SECTION-C

7. Use the power method to find the largest eigen value and the associated eigen vectors of the matrix $A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$ starting with $[0, 0, 1]^t$ as initial eigen vector.

8. For IVP $y' = x - y^2$, $y(0) = 1$, estimate $y(0.8)$ using the Milne's predictor-corrector method with $h = 0.2$.

9. Solve the 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 equal to one.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.