B.Tech. 4th Semester (AUE) F-Scheme Examination,
May–2018

ENGINEERING ANALYSIS & NUMERICAL METHODS

Paper–AUE–202-F

Time allowed : 3 hours] *[Maximum marks : 100*

Note : ***Question No. 1 is compulsory.*** *Attempt total* ***five*** *questions with selecting* ***one*** *question from each section. All questions carry equal marks.*

1. (a) What is a divided difference table ? How is it useful ?

   (b) Define forward differences and backward differences.

   (c) What are direct methods and iterative method to Solve the system of linear equations ?

   (d) What are the limitations of Taylor's series method for solving ordinary differential equations ?

(e) Define Jacobi's iteration method of linear equation.

(f) How are the partial differential equations classified ? Give an example for each type.

(g) Using Euler's method, find approximate value of y when x = 1 of $\frac{dy}{dx} = x + y$, y(0) = 1 (take h = 0.2)

(h) State Trapezoidal Rule.

Section–A

2. (a) Solve the equations :

$10x - 2y - 3z = 205;$

$-2x + 10y - 2z = 154;$

$-2x - y + 10z = 120$

by using iterative method.

(b) Solve the equations :

$3x + 2y + 7z = 4$

$2x + 3y + z = 5$

$3x + 4y + z = 7$

by Gauss Jordan method.

3. (a) Determine the largest eigen value and the corresponding eigen vector of the matrix.

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$

(b) Using Jacobi's Method, find all the eigen value and the eigen vector of the matrix.

$$A = \begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 5 \end{bmatrix}$$

Section–B

4. (a) Given that

x :	150	152	154	156
$y = \sqrt{x}$:	12.247	12.329	12.410	12.490

Evaluate $\sqrt{155}$ using Lagrange's interpolation formula.

(b) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial^2 x}$ subject to the conditions $u(x, 0) = \sin \pi x$, $0 \leq x \leq 1$; $u(0, t) = u(1, t) = 0$, using (a) Schmidt Method. Carryout computations for two levels, taking $h = \frac{1}{3}$, $k = 1/36$.

5. (a) Find the cubic polynomial which takes the following values :

x :	0	1	2	3
f(x):	1	2	1	10

Hence or otherwise evaluate f(4).

(b) Use Stirling's formula to evaluate f (1.22), given

x:	1.0	1.1	1.2	1.3	1.4
f(x):	0.841	0.891	0.932	0.963	0.985

Section–C

6. (a) Find the first and second derivatives of f (x) at 1.5 if

x:	1.5	2.0	2.5	3.0	3.5	4.0
f(x):	3.375	7.000	13.625	24.000	38.875	59.000

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using

(i) Trapezoidal rule taking $h = \frac{1}{4}$

(ii) Simpson's rule taking $h = \frac{1}{6}$

7. (a) Find $I = \int_0^1 (1+x^2)\, dx$, by Gauss formula.

(b) Using trapezoidal rule to evaluate the integral

$$\int_1^2 \cdot \int_1^2 \frac{dx\,dy}{x+y},$$

taking four sub-intervals.

Section–D

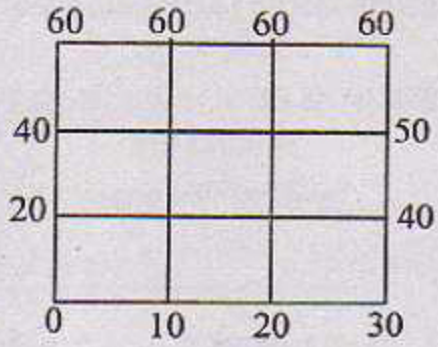
8. (a) Using modified Euler's method, find y for $x = 0.1$ and 0.2 Given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$.

(b) Using modified Euler's method, obtain a solution of the equation $\frac{dy}{dx} = x + |\sqrt{y}|$, with initial conditions $y = 1$ at $x = 0$, for the range $0 \leq x \leq 0.6$ in steps of 0.2.

9. Solve the elliptic equation

$$u_{xx} + u_{yy} = 0$$

for the following square mesh with boundary values as shown -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