

Mid-West University
Examinations Management Office
End Semester Examinations 2081

Bachelor level/ B.E. Civil/ 4th Semester

Full Marks: 50

Time: 3 hours

Pass Marks: 25

Subject: Numerical Methods (SH302/CO441)

- Attempt all the questions.
- Figures in the margin indicate full marks.
- Assume suitable values, with a stipulation, if necessary.
- Candidates are required to answer the questions in their own words as far as possible.

1. Explain trial and error method with example. [4]
2. a) Find the root of the equation $x^2 + \tan x + e^x = 0$ using bisection method correct to 3 decimal places. [4]
b) Use Secant method to compute the root of $e^{\cos x} - \sin x = 1$ correct up to 3 decimal places. [3]
3. a) Using LU Decomposition method, solve the following set of equations. [4]
 $2x + 3y + 10z = 6$, $-x + 4y + 2z = 20$, $5x + 2y + z + 12 = 0$
b) Obtain by power method, the numerically dominant eigenvalue and corresponding eigenvector [4]
of the matrix. $\begin{bmatrix} 4 & 6 & 0 \\ 0 & 5 & 3 \\ 4 & 0 & 3 \end{bmatrix}$
4. a) From the following data, find the value at $x = 25$ using Bessel's formula. [4]

x	20	24	28	32
f(x)	24	32	35	45

b) For the following data set, fit an exponential equation of the form $y = ae^{bx}$. [4]

x	5	4	3	2	1
y	1	2	3	4	5
5. a) Evaluate $\int_0^{\pi/2} \sqrt{\sin(x)} dx$ using Simpson's 1/3 and 3/8 rule taking $n = 6$. [4]
b) Using Romberg integration rule, compute $\int_0^{\pi} \sqrt{\left(\frac{\cos(x)}{1+\sin(x)}\right)} dx$. [4]
6. Given $dy/dx = (2x + e^x) / (x^2 + xe^x)$, $y(1) = 0$; evaluate $y(1.4)$ using Euler's method with step size of 0.1. [5]
7. Solve the Poisson's equation $\nabla^2 f = -81xy$ over the domain $0 \leq x \leq 1$ and $0 \leq y \leq 1$ with $f(0, y) = 0$, $f(x, 0) = 0$, $f(1, y) = 100$, $f(x, 1) = 100$ and $h = 0.25$. [4]
8. Write down algorithm, flowchart and code for Newton's method. [6]

The End