

JK Lakshmipat University, Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), November, 2017
M. Tech (ME), Semester I

Roll No.....

TEMTECH 105: Numerical Methods in Engineering

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write or mark anywhere other than your roll number on question paper.
2. Use of calculator is permitted.

Q.1 Choose the correct answer for the following problems (10 questions @ 1 mark) 10

- i. The number of strips for Simpson's $3/8$ formula should be multiple of;
(a) 0 (b) 1 (c) 2 (d) 3
- ii. The modification of Jacobi Method is;
(a) Gauss Jordan Method (b) Jacobi Method
(c) Gauss Seidel Method (d) LU Factorization Method
- iii. Milne's Corrector formula is;
(a) Predictor Corrector method (b) Series approximation method
(c) Interpolation method (d) None of the above
- iv. Numerical differentiation is;
(a) Differentiation of interpolating polynomial
(b) Rate of change at a given point in the data
(c) (a) and (b) (d) None of the above
- v. Trapezoidal rule can be applied if the number of equal sub-intervals of the interval of an integral is;
(a) odd (b) even (c) both (a) and (b) (d) none of these
- vi. Gauss Jordan elimination method converts A into matrix.
- vii. Using Euler's method, the value of $y(0.1)$ for $y' = x - y$; $y(0) = 1$ is
- viii. Gauss-Seidel method is an elimination method to solve system of linear equations. (True/False)
- ix. Triangularization method is an iterative method. (True/False)
- x. SOR method is used to solve partial differential equations. (True/False)

Q.2 Solve the following problems (4 questions @ 2.5 marks) 10

- i. Write down the difference between iterative methods and elimination methods to solve the system of linear simultaneous equations. Also write down the names of two of each such method.
- ii. Solve the boundary-value problem $y'' - y = 0$ and determine $y(0.5)$, $y(1.0)$ and $y(1.5)$, given $y(0) = 0$ and $y(2) = 3.62686$.
- iii. Describe various kinds of partial differential equations along with example of each kind.
- iv. Explain the difference between iterative method and direct method.

Q.3A Explain the householders' method to reduce a given matrix into tridiagonal form. 05

Q.3B Factorize the following matrix into Lower-Upper Triangular matrices. 05

$$\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$$

Q.4A Derive Simpson's 1/3 rule using the method of undetermined coefficients. 05

Q.4B Explain the difference between linear and non-linear second order differential equations and the significance of numerical methods in solving these equations. 05

Q.5A Explain power method by taking a suitable example. 05

Q.5B Given $\frac{dy}{dx} = x + y$, $y(0) = 1$, $h = 0.2$, find $y(0.2)$ and $y(0.4)$ using Modified Method of Euler. 05

Q.6A Evaluate $\int_0^8 \frac{1}{1+x} dx$ using Romberg's integration method. 10

OR

Q.6B Evaluate $\int_0^1 \frac{1}{1+2x} dx$ by using Simpson's 1/3 and Simpson's 3/8 rule. 10

Q.7A Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 6$, from the following data 10

x	0	1	2	3	4	5	6
f(x)	6.9897	7.4036	7.7815	8.1291	8.4510	8.7506	9.0309

Q.7B Using the shooting method, solve the first boundary value problem: 10
 $u'' = u + 1$, $0 < x < 1$; given $u(0) = 0$, $u(1) = e - 1$.

OR

Q.7B Find all the eigenvalues and the corresponding eigenvectors of the matrix 10

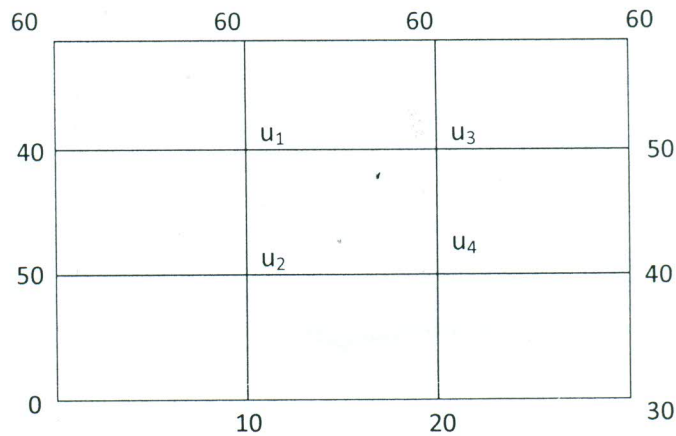
$$A = \begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$$

Q.8 Evaluate the double integral $I = \int_1^2 \int_1^2 \frac{dxdy}{x+y}$ using Trapezoidal rule. ($h = k = 0.25$) 10

OR

Q.8 Use Runge-Kutta fourth order method to solve $\frac{dy}{dx} = x + y^2$, $y(0) = 1$, $h = 0.2$ for $x = 0.2$. 10

- Q.9 Given the values of $u(x, y)$ on the boundary of the square in the figure given below, 10
 evaluate the function $u(x, y)$ satisfying Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ on the pivotal
 points of this figure upto two iterations using Gauss Siedel iteration method.



OR

- Q.9 Solve the system of equations $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$ up 10
 to three iterations by using Jacobi's Method starting with $(x_0, y_0, z_0) = (0, 0, 0)$.