Registration No:										

Total Number of Pages: 02 **M.TECH**

P2HTCC08

2nd Semester Regular Examination 2016-17

NUMERICAL ANALYSIS

BRANCH: HEAT POWER & THERMAL ENGINEERING, MACHINE DESIGN

Time: 3 Hours

Max marks: 100

Q.CODE: Z833

Answer Question No.1 which is compulsory and any four from the rest.

The figures in the right hand margin indicate marks.

1 **Answer the following questions:** (2x10)

a) Define condition of a polynomial.

b) Define two ways to reduce the singularity of an integral.

c) Define row norm of a matrix.

d) What is the order of accuracy of a cubic polynomial at the nodal points and why?

e) Define the condition of convergence for Newton-Raphson method.

f) What is the order of accuracy for global Simpson's rule?

g) What is the difference between LU-decomposition and Cholesky scheme?

h) What is the condition of a differential equation to be elliptic?

i) Define eigen value of a matrix?

j) Write the formula for discrete Fourier transform.

2 a) From the following table of values $y = ln(x)$, calculate $ln(0.45)$. (10)

x	0.30	0.40	0.50	0.60	0.70
y	-1.203973	-0.916291	-0.693147	-0.510826	-0.356675

b) Find the smallest positive root of $e^{-x} = sinx$, correct to three decimal places. (10)

3 a)

x	0.20	0.22	0.24	0.26	0.28	0.30
y	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

(10)

Calculate $\frac{d^2y}{dx^2}$ at $x = 0.20$.

b) (10)

Evaluate $I = \int_0^1 e^{-x^2}\,dx$ by two-point Gaussian quadrature formula.

4 a) Solve by using fourth order Runge-Kutta method for systems of the IVP. (10)
$\frac{d^2y}{dx^2} + 0.8\sin y = 0, x = 0, y = 0.2, \frac{dy}{dx} = 0.$ Taking step length, h = 0.25, compute first three steps of the solution.

b) Solve by Gaussian-Jordan elimination with partial pivoting condensation method correct to three decimal places. (10)

$$x_2 + 8x_3 + 5x_4 = 26,$$
$$x_1 + 4x_2 + 13x_3 = 25,$$
$$2x_1 + 8x_2 + x_3 + x_4 = 17,$$
$$6x_1 + 7x_2 + 7x_4 = 18$$

5 a) Explain the method of LU-decomposition of a 3x3 matrix. (10)

b) Calculate the truncation error of an equation $\frac{\partial u}{\partial t} = c\frac{\partial^2 u}{\partial x^2}$ using explicit scheme. (10)

6 a) Derive the discretisation of $\partial u/\partial x$ and $\partial^2 u/\partial x^2$ using central difference method. What is the order of accuracy in each case? (10)

b) Write short notes on: (i) Fourier spectral numerical differentiation (ii) Von-Neumann stability analysis. (10)

7 a) Compute by modified Euler explicit method for first two steps of the solution of the following IVPs taking h = 0.2. $x^2y' = e^y - x, x > 0, y(1) = 0.$ (10)

b) Write the procedure to compute: (i) Discrete Transform Method, (ii) Alternating Direction Implicit Method. (10)