Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech
FESM 6302

Sixth Semester Regular Examination – 2015

NUMERICAL METHODS

BRANCH : CHEM

QUESTION CODE : J 483

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
   (a) Explain peicewise interpolation.
   (b) Define Hermite function.
   (c) Explain Romberg integration.
   (d) What is the central difference formula to find $f'(x)$, $f''(x)$, $f'''(x)$, $f^{iv}(x)$.
   (e) What is difference between Fast Fourier transform and discrete Fourier transform ?
   (f) Define Accelerating convergence.
   (g) What is predictor-corrector method ?
   (h) Check the nature of the following partial differential equation
   $2u_{xx} + 5u_{xy} - 3u_{yy} + 4u_x + 5 = 0$
   (i) Explain wave equation with initial and boundary conditions.
   (j) Explain stability of a numerical method.

2. (a) Find a Hermite interpolating polynomial for the following data points

x	0.4	0.5	0.7	0.8
F(x)	−0.9162	−0.6931	−0.3566	−0.2231
F'(x)	2.50	2.00	1.43	1.25

   (b) Find the piecewise quadratic polynomial for the following data points (1,3),(0.,-2),(1,- 4),(2,6). 5

5

X	2	5	8	11
Y	5	9	14	17

P.T.O.

3. (a) Using Romberg integration , Evaluate $I = \int_0^2 \frac{e^x \cos x}{1+x^2} dx$. 5

(b) Estimate the value of $f'(\Pi/2)$ for $f(x)=\cos x/x$, using Richardson's extrapolation method taking central difference formula as base method. 5

4. (a) Find the smallest eigen value of the matrix $\begin{bmatrix} 1 & 2 & 6 \\ 2 & 5 & 15 \\ 6 & 15 & 46 \end{bmatrix}$. 5

(b) Find the eigen value of matrix A closest to the eigen value $\lambda = 10$ of the

matrix $A = \begin{bmatrix} 20 & 9 & 1 \\ 8 & 8 & 6 \\ 4 & 5 & 10 \end{bmatrix}$ 5

5. (a) Explain the steps of QR method giving an example. 5

(b) Find the Fourier approximating polynomial of the following data : 5

x	0	$\Pi/2$	Π	$3\Pi/2$	2Π
y	0	1/4	1/2	3/4	1

6. (a) Using Adam Moulton 3rd order, find y(1) of the initial value problem 5
$dy/dx = y - \sin x\, y$, $y(0) = 0.4$.

(b) Using Milne's–Simpson's method, solve the initial value problem 5

$\frac{dy}{dx} = \frac{y}{x^2} + 1, y(0) = 1$ in the interval [0,1] .

7. Using implicit method, solve the heat equation $u_t - u_{xx} = 0$, for $0 < x < 1$, $t > 0$. The initial conditions are $u(x,0) = x^3$, for $0 < x < 1$ with boundary conditions are $u(0,t) = 0$, $u(1,t) = 1$, for $t > 0$ for 3 time step. 10

8. Explain wave equation. Derive the iterative scheme for solution of wave equation using 10

(i) explicit method,

(ii) implicit method.