Registration No. :

B. Tech

FESM 6302

Sixth Semester Back Examination – 2015
ADVANCE NUMERICAL METHODS
BRANCH : CHEM
QUESTION CODE : M 394
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) Find a piecewise linear interpolating polynomial of the following data :

x	1	2	3	4
y	2	4	8	16

   (b) Write the central difference formula to find higher derivatives.

   (c) Explain Richardson's extrapolation.

   (d) Explain inverse power method.

   (e) What is difference between Fast Fourier transform and discrete Fourier transform ?

   (f) Define Accelerating convergence.

   (g) What is an explicit method and implicit method in solving the ordinary differential equation ?

   (h) Write the formula for Milne-Simphon predictor- corrector method.

   (i) Check the nature of the following partial differential equation.
   $2u_{xx} + 5u_{xy} - 3u_{yy} + 4u_x + 5 = 0$

   (j) Explain wave equation with initial and boundary conditions.

2. (a) Find a Hermite interpolating polynomial for the following data points :   5

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 population of the year 1900 using piecewise quadratic interpolation of the following data :   5

year	1891	1901	1911	1921	1931
Population in crore	26	35	42	48	55

P.T.O.

3. (a) Find $f'(x)$ at $x=3$ of the following data values :

x	0	1	2	3	4	5
y	3	5	8	10	13	16

Using central difference and also using Richardson's extrapolation. 5

(b) Using Romberg integration, evaluate $I = \int_0^1 \frac{\log(x+1)}{\sqrt{x(1-x)}}dx$. 5

4. (a) Find eigen value of the following matrix using Rayleigh Quotient method : 5

$$A \begin{bmatrix} 2 & 2 & 1 \\ -5 & 9 & -3 \\ -4 & 4 & 1 \end{bmatrix}$$

(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 Bashforth 2nd order, find $y(1)$ of the initial value problem $dy/dx = y - x^2$, $y(0) = 0.4$. 5

(b) Using ABM 3rd order method, solve the initial value problem $\frac{dy}{dx} = \frac{y}{x^2} + 1$, $y(0) = 1$ in the interval $[0,1]$. 5

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

8. Explain wave equation. Derive the iterative scheme for solution of wave equation using (i) explicit method, (ii) implicit method. 10

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