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

Total number of printed pages – 3

B. Tech

FESM 6302

Fifth Semester Back Examination – 2014

ADVANCE NUMERICAL METHODS

BRANCH (S) : CIVIL, MECH, MM

QUESTION CODE : L288

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) Write the formula for $\frac{\delta^2 y}{\delta x^2}$ at $x = x_n$ using backward difference operator.

(b) Set up a finite difference scheme for the boundary value problem $u'' = u$, $u'(1) = a$ and $u'(3) = b$ with h = 0.5 central differences.

(c) What is the advantage of Inverse power method over Power method ?

(d) Write the difference formula for $\frac{\partial u}{\partial x}$ in terms of difference quotients.

e) Solve : $u_{n+1} - 3u_n$ given $u_0 = 2$.

(f) Write the diagonal five point formula to solve the equation :

$$u_{xx} + u_{yy} = 0.$$

(g) Define Rayleigh's Quotient.

(h) Compare Milne's predictor-corrector and Adam-Bashforth predictor-corrector methods for solving ordinary differential equations.

P.T.O.

(i) For what value of λ, the explicit method of solving the hyperbolic equation $\frac{\delta^2 u}{\delta x^2} = \frac{1}{C^2}\frac{\delta^2 u}{\delta t^2}$ is stable, where $\lambda = \frac{C\Delta t}{\Delta x}$?

(j) Write the Crank Nicholson difference scheme to solve $u_{xx} = au_t$ with $u(0, t) = T_0$, $u(l, t) = T_l$ and the initial condition as $u(x, 0) = f(x)$.

2. Obtain the cubic spline approximation for the function $y = f(x)$ from the following data, given by $y_0'' = y_2'' = 0$: 10

x :	-1	0	1	2
y :	0	1	2	18

3. Find the values of $f''(0.2)$, $f''(0.6)$ and $f''(1.0)$ from the following data using appropriate initial values based on finite differences and Richardson's extrapolation method: 10

x :	0.2	0.4	0.6	0.8	1.0
y :	0.12	0.49	1.12	2.02	3.20

4. Evaluate the following by using trpezoidal rule with $h = \frac{1}{2,1}, \frac{1}{4}, \frac{1}{8}$ and then Romberg's method: 10

$$I = \int_1^2 e^{\sqrt{x}}\, dx.$$

5. Find all the eigen values and eigen vectors of the following matrx : 10

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

6. Given that $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $u(0, t) = 0$, $u(4, t) = 0$ and $u(x, 0) = \frac{x}{3}(16 - x^2)$, find $u(i, j)$, $i = 1, 2, 3$; $j = 1, 2, 3$ by Crank-Nicolson's method. 10

7. Evaluate $y(0.9)$ using Adam-Bashforth's predictor-corrector method, given that $\frac{dy}{dx} = xy^{\frac{1}{3}}$, $y(1) = 1$, $y(1.1) = 1.10681$, $y(1.2) = 1.22787$ and $y(1.3) = 1.36412$. 10

8. Write short notes on any **two** : 5×2

(a) Discrete Fourier Transformation

(b) Fast Fourier Transformation

(c) Mixed Radix Fast Fourier Transformation.