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Total Number of Pages: 2

6th Semester Regular / Back Examination 2015-16
ADVANCE NUMERICAL METHODS
BRANCH: CHEM
Time: 3 Hours
Max Marks: 70
Q.CODE: W572
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**
  a) What is Richardson's Extrapolation?
  b) Find the piecewise quadratic interpolating polynomial for the following data

x	-2	-1	1	3	4
f(x)	25	21	18	27	30

  c) Find the value of $f''(0.5)$ of the following data

c	0.3	0.5	0.7	0.9
f(x)	0.15	0.185	0.267	0.314

  d) Find the cubic polynomial that fits $y(x) = x^4$ at x=0,2,3.
  e) What is difference between interpolation and curve fitting?
  f) What is Shifted power method?
  g) Evaluate $\int_0^2 e^x dx$ using the Simpson's rule with h=1/2 and compare with exact solution.
  h) Write the truncation error in the Adams-Bashforth methods .
  i) What is Discrete Fourier Transforms?
  j) Explain the implicit method ..

Q2 a) Obtain the cubic spline fit for the data under the end conditions $f''(0) = f''(3) = 0$. **(5)**

x	0	1	2	3
f(x)	1	2	33	244

  b) Using the following data table estimate the value of $f(-0.5) and f(0.5)$ using piecewise cubic Hermit interpolation **(5)**

x	$f(x)$	$f'(x)$
-1	1	-5
0	1	1
1	3	7

Q3 a) Derive the formula for the first derivative of $y = f(x)$ of $O(h^2)$ using (i) forward difference approximations and (ii) backward difference approximations **(5)**

b) When $f(x) = \sin(x)$, estimate $f'\left(\frac{\pi}{4}\right)$ with $h = \frac{\pi}{12}$ suing the above formula. Obtain the bunds on the truncation error. **(5)**

Q4 Find the Eigen values of matrix using QR method. **(10)**

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

Q5 a) The following table of values is given : **(5)**

x	-1	1	2	3	4	5	7
f(x)	1	1	16	81	256	625	2401

Find f'(3) using Richardson extrapolation

b) Compute $\int_{0.1}^{0.2} \frac{x^2}{Cosx} dx$ using Romberg Method. **(5)**

Q6 Solve the initial value problem with h=0.2 in the interval [0, 0.4]

$$\frac{dy}{dx} = -2xy^2, y(0) = 1$$

a) Using Adam's Predictor-corrector method **(5)**
b) Using Milne predictor-corrector method. **(5)**

Q7 The vibrating string problem follows the following differential equation $u_{tt} = u_{xx}$ with boundary conditions $u(0,1) = u(1,t) = 0;\ u(x,0) = \sin \pi x\ ,u_t = 0;$

a) Discretize the above equation using finite difference method. **(5)**
b) Find the solution of this vibrating problem with h=0.2, k=.1 for t=0.3. **(5)**

Q8 Write short notes on any two: **(5 x 2)**
a) Matrix form of FFT and Mixed-Radix FFT
b) Basic QR method and Better QR method
c) Crank-Nicolson method
d) Finite Element method