6th Semester Regular / Back Examination 2016-17
ADVANCE NUMERICAL METHODS
BRANCH: CHEM
Time: 3 Hours
Max Marks: 70
Q.CODE: Z866
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) 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

   b) What is Richardson's Extrapolation?
   c) Find the piecewise quadratic interpolating polynomial for the following data

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

   d) Find the cubic polynomial that fits $y(x) = 2x^3$ at x=0,3,5.
   e) Evaluate $\int_0^2 xe^{x^2} dx$ using the Simpson's rule with h=1/4 and compare with exact solution.
   f) What is Rayleigh Quotient method?
   g) What do you mean by curve fitting?
   h) Explain the Crank-Nicolson method .
   i) What is Fast Fourier Transforms?
   j) Write the truncation error in the Adams- <u>moulton</u> method..

Q2 **a)** Derive the formula for the first derivative of $y = f(x) of \ O(h^2)$ using (i)   **(5)**
               forward difference approximations and (ii) backward difference
               approximations
        b) When $f(x) = \cos(2x)$, estimate $f'\left(\frac{\pi}{4}\right) with \ h = \frac{\pi}{12}$ suing the above   **(5)**
               formula. Obtain the bounds on the truncation error.

Q3 **a)** Obtain the cubic spline fit for the data under the end conditions   **(5)**
               $f''(0) = f''(6) = 0$.

x	0	2	4	6
f(x)	3	5	21	53

        b) Using the following data table estimate the value of $f(-0.3) and \ f(0.5)$ **(5)**
               using piecewise cubic Hermit interpolation

x	$f(x)$	$f'(x)$
-1	2	-4
0	3	3
1	8	5

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

$$A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}$$

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

x	-1	1	2	3	4	5	7
f(x)	3	5	21	40	70	125	200

Find f'(3) using Richardson extrapolation

b)   Compute $\int_{0.1}^{0.2} x^2 e^{x^3} \, dx$ using Romberg Method.   **(5)**

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

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

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

Q7   The heat conduction problem follows the following differential equation

$u_t = u_{xx}$ with boundary conditions $u(0,1) = u(1,t) = 0; \, u(x,0) = 100$

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