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

Total Number of Pages : 02 **B.Tech**
PCE6I101

6th Semester Regular / Back Examination 2018-19
NUMERICAL METHODS & MATLAB
BRANCH : CHEM
Max Marks : 100
Time : 3 Hours
Q.CODE : F993

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) What is difference between Interpolation and Extrapolation?
b) What is spline function?
c) Define piecewise Interpolation and explain its importance.
d) The Newton Raphson method is used to find roots of equation f(x) =x-cosπx. If the initial guess for the root is 0.5.Then the value of x after first iteration.
e) Define elliptic, parabolic and hyperbolic type of partial differential equation.
f) Write the formula for Crank- Nicolson method.
g) State second and third order Adams- Bashforth method.
h) Write the stability condition for explicit method and implicit method in wave equation.
i) Define discrete fourier transform and algebraic form of FFT.
j) Define Rayleigh's Quotient.

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Find piecewise linear & Quadratic Interpolation of the given data & also find Y (1.5) and Y (3.5) for both the cases.

X= 1	2	3	4
Y= 2	4	8	16

b) Estimate the natural logarithm of 2 using linear Interpolation. First perform the computation by Interpolating between ln1=0 and ln6=1.791759.Then repeat the procedure but use a smaller interval from ln1 to ln4=1.386294.Note the true value of ln2 is 0.6931472.
c) Evaluate $\int_0^2 \frac{dx}{x^2+4}$ using Romberg's method. Hence, obtain an approximate value of π.
d) Find $y'(1.5)$ using forward, backward and central difference formula for a given data as x= [0.5, 1, 1.5, 2, 2.5], y= [1.414, 2, 2.828, 4, 5.657]
e) Find the smallest eigen value of the matrix $\begin{bmatrix} 1 & 2 & 6 \\ 2 & 5 & 15 \\ 6 & 15 & 46 \end{bmatrix}$.
f) Write the different steps of QR factorization to find the eigen value of a matrix.
g) Find the interpolating polynomial using piecewise cubic Hermite interpolation of the following data.

x	$f(x)$	$f'(x)$
-1	-5	0
1	7	12
2	76	198

h) Calculate 2nd and 3rd order derivative of f(2) using Taylor's polynomial approximation for following data points.
x= [0, 1, 2, 3, 4, 5], y= [0, 0.33, 2.67, 9, 21.33, 41.67]
i) Find y(2), given $\frac{dy}{dx} = \frac{1}{2}(x+y)^2$ with y(0)=2, y(0.5)= 2.636, y(1)= 3.595 and y(1.5)= 4.968 by using Adams-Bashforth-Moulton predictor-corrector method.

j) Find y(2), given $\frac{dy}{dx} = \frac{1}{2}(x + y)^2$ with y(0)=2, y(0.5)= 2.636, y(1)= 3.595 and y(1.5)= 4.968 by using Milne-Simpson Predictor-corrector method.

k) Write short notes on (a) Quadratic splines interpolation and (b) Cubic splines interpolation.

l) Write a short notes on (a) Richardson extrapolation and (b) Romberg Algorithm for Numerical Integration.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Solve the following parabolic partial differential equation. **(16)**

$$4\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

Subject to initial condition as
u(x, 0)= cosπx, 0 < x < 2
and u(x, 0) = 0, otherwise
and boundary condition as
(u(0, t) = u(2, t) = 0
For $0 \leq x \leq 2$, $0 < t < 2$, take h= k = 0.5

Q4 Solve the differential equation $\frac{dy}{dx} = 1 + y^2$, using Adam-Moulton method of order-2. Take y(1)=1 and find y(1.4)? **(16)**

Q5 Obtain the piecewise quadratic interpolating polynomials and qubic interpolating polynomials for the function f(x) defined by the data. **(8+8)**

x	-3	-2	-1	1	3	6	7
f(x)	369	222	171	165	207	990	1779

Hence, find an approximate value of f(6.5) for both the interpolation.

Q6 Using basic power method find largest eigen value and corresponding eigen vector of the following matrix including error term. **(16)**

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