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

Total Number of Pages : 02 **B.Tech**
FESM6302

6th Semester Back Examination 2018-19
ADVANCED NUMERICAL METHODS
BRANCH : CHEM
Time : 3 Hours
Max Marks : 70
Q.CODE : F670

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) State the guidelines for the choice of interpolation.
b) What are the types of Cubic spline? Explain.
c) Describe Richardson Extrapolation in derivative computation.
d) State three-point formula for numerical differentiation .How is it different from the two-point formula?
e) State the difference between numerical integration and analytic integration.
f) What is meant by multi - step method in the context of ordinary differential equation?
g) Write a short note on predictor-corrector method
h) Determine the eigenvalue of A^{-1} when λ is an eigen value of the matrix A.
i) Explain inverse power method.
j) State the condition for hyperbolic partial differential equation with some popular hyperbolic partial differential equations.

Q2 **a)** Design the Cubic spline approximation for the function defined by the data : **(5)**

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

with $f''(0) = 0, f''(3) = 0$. Hence find an estimate of $f(2.5)$.

b) Justify that Hermite interpolating polynomial is unique. **(5)**

Q3 **a)** Find the polynomial and the bound for the error in case of linear interpolation if $f(x) = e^x$ and with nodes 0 and 0.2 . **(5)**

b) Find the approximate values of $f(0.8)$ and $f''(0.8)$ using quadratic interpolation given the following datas: **(5)**

x	0.4	0.6	0.8
$f(x)$	0.0256	0.1296	0.4096

Q4 **a)** Evaluate approximately the integral **(5)**

$$I = \int_{-1}^{1} e^{-x^2} \cos x \, dx$$

using Gauss-Legendre three point integration rule.

b) Find the approximate value of the integral $I = \int_0^1 \frac{dx}{1+x}$ correct unto 3 decimal places by using Romberg integration. **(5)**

Q5 **a)** Use the Runge-Kutta method of order four with h=0.2, and $t_i = 0.2i$ to obtain approximation to the solution of the initial value problem $y' = y - t^2 + 1$, $0 \le t \le 2$, $y(0) = 0.5$. Perform two steps. **(5)**

b) Find the largest eigenvalue in modulus and the corresponding eigen vector of the matrix **(5)**

$$A = \begin{bmatrix} -15 & 4 & 3 \\ 10 & -12 & 6 \\ 20 & -4 & 2 \end{bmatrix}$$

using Power method.

Q6 Describe Adam's-Bashforth method. Using Adams-Bashforth fourth-order method determine $y(4.4)$ given that $5xy' = 2 - y^2, y(4) = 1$ with $h = 0.1$ .Obtain the starting values from Euler's method. **(10)**

Q7 Find the approximate solution to the following parabolic partial differential equation by Forward difference method. **(10)**

$$u_t - u_{xx} = 0 \quad 0 < x < 1, \quad 0 \le t$$

with boundary conditions $u(0,t) = u(1,t) = 0$, $0 < t$

and initial conditions $u(x,0) = \sin(\pi x)$, $0 \le x \le 1$.

Use $h = 0.1$ and $k = 0.01$.

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Richardson extrapolation in derivative computation.

b) Romberg algorithm for numerical integration.

c) Shifted power method for computing eigenvalue and eigenvector of a matrix.