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

Total Number of Pages : 02 **M.Tech.**
P2PRCC14

2nd Semester Back Examination 2017-18
ADVANCED NUMERICAL METHODS
BRANCH : ELECTRI & ELECTRO ENGG (POWER SYSTEM ENGG), ELECTRICAL ENGG., ELECTRICAL POWER SYSTEM, GEOTECHNICAL ENGG, POWER SYSTEM ENGG, POWER SYSTEMS, SOIL MECHANICS, SOIL MECHANICS & FOUNDATION ENGG, STRUCTURAL & FOUNDATION ENGG, STRUCTURAL ENGG, TRANSPORTATION ENGG, WATER RESOURCE ENGG, WATER RESOURCE ENGG AND MANAGEMENT
Time : 3 Hours
Max Marks : 100
Q.CODE : C1085
Answer Question No.1 which is compulsory and any four from the rest.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Q1 **Answer the following questions: *Short answer type:*** **(2 x 10)**

a) What are the basic sources of errors and how it is propagated?
b) What is meant by implicit Runge-Kutta method?
c) Discuss the geometrical interpretation of Euler's method and its characteristics.
d) What are the differences between Newtonian quadrature method and Gaussian quadrature method?
e) Find a piecewise linear interpolating polynomial of the following data

x	1	2	4	8
y	3	7	21	73

f) What is a harmonic equation?
g) Describe the working principle of predictor-corrector method in the context of iterative method.
h) Using quadratic interpolation find the derivative $f'(2.0)$ using the following data:

x	2.0	2.2	2.6
$f(x)$	0.69315	0.78846	0.95551

i) Explain inverse power method.
j) Write the stability condition of implicit method to solve wave equation.

Q2 **a)** Use the data points (0, 1), (1, e), (2, e^2) and (3, e^3) to form a natural spline that approximates $f(x) = e^x$. **(10)**

b) Find the Lagrange polynomial for $f(x) = \frac{1}{x}$ on [2,4] using the nodes 2, 2.75 and 4. Also determine the error form for this polynomials and maximum error when the polynomial is used to approximate $f(x)$ for $x \in [2,4]$. **(10)**

Q3 **a)** Evaluate the integral I = $\int_1^3 (x^6 - x^2 \sin(2x))dx$ using Gauss quadrature method with $n = 3$.. **(10)**

b) Evaluate the multiple integral $\int_{x=0}^{x=1} \int_{y=0}^{y=x^2+x} xydxdy$ with variable limits. **(10)**

Q4 **a)** Find $H_5(x)$, the Hermite polynomial that agrees with the data **(10)**

x	$f(x) = e^x$
0	1.0000000
1	2.7182818
2	7.3890561

to find an approximation of $H_5(0.25)$.

b) Solve the boundary value problem $u'' = u + x$, $u(0) = 0$, $u(1) = 0$ with $h = \frac{1}{4}$by using the Second order method. **(10)**

Q5 **a)** Find the largest Eigen value of the matrix $\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$.Perform three Iterations. **(10)**

b) Find the Eigen values using QR methodfor the matrix **(10)**

$\begin{bmatrix} -2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$.Perform three Iterations.

Q6 **a)** Using finite difference method , solve the following boundary value problem: **(10)**
$y'' = xy' - y - x^2$ subject to $y(0) = -2$ and $y(1) = 1$ with $h = 0.25$.

b) Solve the boundary value problem $\frac{d^2y}{dx^2} = \frac{2}{1+x}y^2$ subject to $y(0) = 1$ and$y(1) = 0.5$ (assume $h = 0.25$) . **(10)**

Q7 **a)** Using implicit Crank-Nicolson method solve the heat equation **(10)**
$u_t - u_{xx} = 0$ subject to the initial conditions $u(x, 0) = 0$ and boundary conditions: $u(0, t) = 0$ and $u(1, t) = t$,where $0 \le x \le 1$ and $t > 0$.(Use $h = \frac{1}{2}$and $k = \frac{1}{8}$).

b) Solve theequation16$u_{xx} = u_{tt}$given that $u(0, t) = 0$ and $u(5, t) = 0, u(x, 0) = x^2(x - 5)$ and $u_t(x, 0) = 0$ by taking h = 1 and upto 5 times steps. **(10)**