P-835

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Seat No.	

S.E. (Mechanical Engineering) (Semester - IV)
Examination, April - 2016
APPLIED NUMERICAL METHODS
Sub. Code : 63360

Day and Date : Sunday, 17-04-2016 **Total Marks : 100**

Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Make suitable assumptions/data if required and state clearly.**
3) **Draw neat sketches wherever necessary.**
4) **Figures to the right indicate full marks.**
5) **Use of calculator is allowed.**

Q1) a) Explain approximate error with an example. **[5]**

b) Solve any two **[2 × 5 = 10]**

i) Find an approximate root of the equation $x\log_{10} x = 1.2$ which lies between 2 and 3 using False position method.

ii) Find the root of the equation $x^3 + 2x^2 + 10x - 20 = 0$ using Muller's method.

(Take $x_0 = 0, x_1 = 1, x_2 = 2$).

iii) Evaluate $\sqrt{12}$ to four decimal places by Newton Raphson method.

Q2) a) Solve the following equations by Gauss - Elimination method. **[5]**

$$2x + 3y - z = 5$$
$$4x + 4y - 3z = 3$$
$$2x - 3y + 2z = 2$$

P.T.O.

b) Solve any two [2 × 5 = 10]

i) Solve the following equations by Gauss-Jordon method.

$x+2y-3z=4$

$12x+4y-6z=18$

$x-2y+5z=4$

ii) Solve the system of equations using LU Decomposition.

$x+5y+z=14$

$2x+y+3z=13$

$3x+y+4z=17$

iii) Solve the following equations by Gauss - Seidal method.

$6x+15y+2z=72$

$x+y+54z=110$

$27x+6y-z=85$

Q3) Solve any four: [4 × 5 =20]

a) The pressure and volume of gas are related by the equation $PV^{\lambda} = K$ (λ and K are constants). Fit this equation for the following data using principles of least squares

P	:	0.5	1	1.5	2.0	2.5	3.0
V	:	1.62	1.00	0.75	0.62	0.52	0.46

b) Using Lagrange's interpolation formula, find $y(10)$ from the following table

x	:	5	6	9	11
y	:	12	13	14	16

c) Find the mean, median, mode and standard deviation of following:

15, 21, 21, 21, 25, 30, 35.

d) Using Newtons divided difference formula find f(6)

x	:	1	2	7	8
y	:	1	5	5	4

e) State and prove addition and multiplication law of probability.

Q4) Solve any three: **[3 × 5 = 15]**

a) Evaluate the integral $I = \int_{-3}^{3} x^4 \, dx$ using Simpsons 1/3rd Rule.

b) Use Romberg's method to evaluate $\int_{0}^{1.2} \frac{dx}{(1+x)}$ take $h = 0.6$, 0.3, and 0.15.

c) Evaluate $\int_{2}^{6} (3x^2 + 2x + 3) dx$ by Gaussian Quadrature.

d) A jet fighter position on an aircraft carriers runway was timed during landing

t(sec):	1.0	1.1	1.2	1.3	1.4	1.5	1.6
X(m):	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Where X is the distance from the end of the carrier. Estimate velocity and acceleration at t = 1.1 sec.

Q5) Solve any three **[3 × 5 = 15]**

a) Using Runge Kutta method of fourth order find y at $x = 0.8$ if $y' = y - x^2$ Given $y(0.6) = 1.7379$ take $h = 0.1$.

b) Find the eigen values and corresponding eigen vectors of $\begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$ by both power method and polynomial method.

c) Given the boundary value problem $\frac{d^2y}{dx^2} = 6x + 4$; $y(0) = 2$, $y(1) = 5$ obtain its solution in the range $0 \le x \le 1$ with $h = 0.25$ using finite difference method.

d) Solve $\frac{dy}{dx} = 1 + xy$; given $y(0) = 2$. Obtain the values of $y(0.1)$, $y(0.2)$ and $y(0.3)$ using Picard's method.

Q6) a) Solve $U_{xx} + U_{yy} = 0$ in the square region bounded by $x = 0$, $x = 4$, $y = 0$, $y = 4$ and with boundary conditions:

$u(0,y) = 0$; $u(4,y) = 12 + y$; $u(x,0) = 3x$; $u(x,4) = x^2$

by Liebmann's method. Take $\Delta x = 1$, $\Delta y = 1$. Perform two iterations. **[10]**

b) Classify the following partial differential equations: **[5]**

i) $U_{xx} + 2U_{xy} + U_{yy} = 0$.

ii) $xU_{xx} + yU_{yy} = 0$; $x > 0$, $y > 0$.

iii) $U_{xx} - 2U_{xy} = 0$.

c) Explain explicit method with a neat sketch. **[5]**