S-2437

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Seat No.	

S.E. (Mechanical Engineering) (Semester - IV) Examination, November - 2015
APPLIED NUMERICAL METHODS
Sub. Code : 63360

Day and Date : Monday, 30 - 11 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 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 accuracy and precision with the help of a neat sketch. **[5]**

b) Solve any two: **[2 × 5 = 10]**

i) Find the root of the equation $x^3 - 4x - 9 = 0$ using false position method up to two decimal places.

ii) Using Newton Raphson method, find the real root of $3x - \cos x - 1 = 0$.

iii) Use Muller's method to find a root of the equation $x^3 - 3x - 7 = 0$, where the root lies between 2 and 3.

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

$2x + 6y + z = 7$

$x + 2y - z = -1$

$5x + 7y - 4z = 9$

P.T.O.

b) Solve any two: [2 × 5 = 10]

i) Solve the system of equations using LU Decomposition.

$2x + 3y + z = 9$

$x + 2y + 3z = 6$

$3x + y + 2z = 8$

ii) Solve by Gauss Elimination method.

$3x + 4y + 5z = 18$

$2x - y + 8z = 13$

$5x - 2y + 7z = 20$

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

$8x + 2y - 2z = 8$

$x - 8y + 3z = -4$

$2x + y + 9z = 12$

Q3) a) Find $f(x)$ as a polynomial in x and hence $f(6)$ for the following data by Newton's divided difference formula. **[5]**

x :	1	2	7	8
$f(x)$:	1	5	5	4

b) Solve any two: [2 × 5 = 10]

i) The following table gives experimental data for force (N) and velocity (m/s) for an object suspended in a wind tunnel.

Velocity (m/s) :	10	20	30	40	50	60	70	80
Force (N) :	24	68	378	552	608	1218	831	1452

Use the linear least-squares regression to determine the coefficients a and b in the fucntion $y = a + bx$ that best fits the data.

ii) Fit a normal curve to the following data:

Length of line cm :	8.60	8.59	8.58	8.57	8.56	8.55	8.54	8.53	8.52
Frequency :	2	3	4	9	10	8	4	1	1

iii) Use Lagrange's formula to find $y(10)$, Given

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

Q4) Solve any three: **[3 × 5 = 15]**

a) Evaluate the integral $I = \int_0^6 1/(1+x)dx$ using Simpsons 3/8th Rule. Take $n = 6$.

b) Evaluate $\int_0^1 (1/(x^2+1))dx$ by Gaussian Quadrature.

c) Use Romberg's method to evaluate $\int_0^1 (dx/(1+x))$ take $h = 0.5, 0.25$ and 0.125.

d) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of time 't' (seconds). Calculate the angular velocity of the rod at $t = 0.6$ second

t	0	0.2	0.4	0.6	0.8	1.0
Θ	0	0.12	0.49	1.12	2.02	3.20

Q5) Solve any three: **[3 × 5 = 15]**

a) Given $\dfrac{dy}{dx} = \dfrac{y-x}{y+x}$

with $y(0) = 1$. Find $y(0.1)$ using modified Euler's method.

b) Using Euler's method, find an approximate value of y when $x = 1$, in five steps given that:

$$\frac{dy}{dx} = x + y$$

$y(0) = 1$

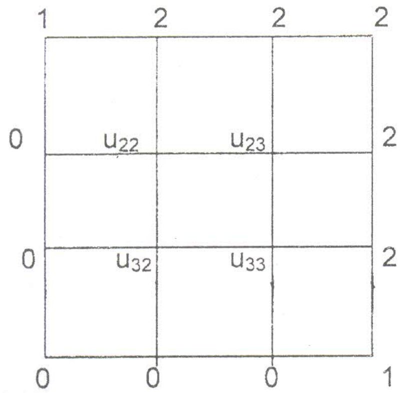
c) Solve the equation $\frac{dy}{dx} = x*x + y*y$

Given $y(0) = 1$. Obtain the values of $y(0.1)$ using Picard's method.

d) Find the largest Eigen value and the corresponding Eigen vectors of

$$\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

Q6) a) Solve $U_{xx} + U_{yy} = 0$ in the square region with boundary values as shown in figure. **[10]**



Perform two iterations:

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

i) $\Phi_{xx} + \Phi_{yy} = 0$

ii) $xU_{xx} + yU_{yy} + 4y^2U_x = 0$

c) Use explicit method to solve for the temperature distribution of a long thin rod with a length of 10 cm and following values $\Delta x = 2\text{cm}, \Delta t = 0.1$ second, and $\lambda = 0.0203$ at time $t = 0.1$ second, 0.2second. at $t = 0$ the temperature of rod is zero and the boundary condition are fixed for all times at T(0) = 100°C and T(10) = 50°C. **[5]**

d) Explain Crank Nicholson method. **[5]**