Reg. No. | | | | | | | | | | | |

Question Paper Code : 91311

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016
Sixth/Fifth Semester

Computer Science and Engineering

080230029/080320009 – NUMERICAL METHODS

(Common to Chemical Engineering)

(Regulations 2008)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. State the condition for the convergence of iteration method.

2. What is the order of convergence of Newton-Raphson method ?

3. Find $\Delta^n e^{ax}$.

4. Form the divided difference table for the data (1, 22), (2, 30), (4, 82) and (7, 106).

5. Write down the trapezoidal rule to evaluate $\int_1^6 f(x)\,dx$ with h = 0.5.

6. Use two point quadrature formula to solve $\int_{-1}^{1} \frac{dx}{1+x^2}$.

7. Comment on the accuracy of Euler's method.

8. What is an initial-value problem ? How is it different from a boundary-value problem ?

9. State the general rule for the classification of second order equations.

10. What is wave equation ?

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Find the real root of the equation $x = \frac{1}{2} + \sin x$ by iteration method. **(8)**

(ii) Using Gauss-Jordan method, find the inverse of the matrix $\begin{pmatrix} 2 & 4 & 3 \\ 0 & 1 & 1 \\ 2 & 3 & -1 \end{pmatrix}$. **(8)**

OR

(b) (i) Solve the system of equations by Gausss-Seidel method correct to three decimal places. **(8)**

$x + y + 54z = 100$

$27x + 6y - z = 85$

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

(ii) Using power method, find the dominant eigen value and eigen vector of the matrix $\begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$. **(8)**

12. (a) The table gives the distance in nautical miles of visible horizon for the given heights in feet above the earth's surface.

Height (x) :	100	150	200	250	300	350	400
Distance (y) :	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the value of y when

(i) x = 218 ft

(ii) x = 410 ft. **(16)**

OR

(b) (i) Find the cubic polynomial which takes the following values :

x :	0	1	2	3
$f(x)$:	1	2	1	10

Evaluate $f(4)$. **(8)**

(ii) In the table below, the values of y are consecutive terms of a series of which 23.6 is the 6^{th} term. Find the first and tenth terms of the series. **(8)**

x :	3	4	5	6	7	8	9
y :	4.8	8.4	14.5	23.6	36.2	52.8	73.9

13. (a) (i) Find $f(x)$ from the given data and hence find $f'(6)$: **(8)**

x :	0	2	3	4	7	9
$f(x)$:	4	26	58	112	466	922

(ii) Evaluate $\int_{1}^{3} \frac{\sin x}{x} dx$ using Simpson's $\frac{1}{3}$ rule by taking 10 intervals. **(8)**

OR

(b) (i) A river is 45 meter wide. The depth d in meters at a distance x meters from one bank is given in the following data :

x	0	5	10	15	20	25	30	35	40	45
d	0	3	6	8	7	7	6	4	3	0

Find the cross – section of the river by Simpon's 3/8 rule. **(8)**

(ii) Evaluate $I = \int_{1}^{3}\int_{1}^{2} \frac{dx\, dy}{xy}$ using trapezoidal rule with $h = k = 0.5$. **(8)**

14. (a) (i) Find y(0.1) and y(0.2) correct to four decimal places by Runge-Kutta method given $\frac{dy}{dx} = y - x$, $y(0) = 2$. **(8)**

(ii) Given $\frac{dy}{dx} = x^2 (1 + y)$, $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.5485$, $y(1.3) = 1.9789$ find y(1.4) by Adam's Predictor-Corrector method. **(8)**

OR

(b) (i) Using Modified Euler's method, compute y at $x = 0.1$ and 0.2 given that $\frac{dy}{dx} = x + y^2$, $y(0) = 1$. **(8)**

(ii) Using Milne's method find y(4.4) for $5xy' + y^2 - 2 = 0$ given $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$, $y(4.3) = 1.143$. **(8)**

15. (a) (i) Evaluate the pivotal values of the equation $u_{tt} = 16u_{xx}$, taking h = 1 and k = 0.25 upto t = 1.25. The boundary conditions are u(0, t) = u(5, t) = 0, $u_t(x, 0) = 0$ and $u(x, 0) = x^2(5 - x)$. **(8)**

(ii) Solve the Laplace's equation $u_{xx} + u_{yy} = 0$, $0 < x, y < 1$ with boundary condition $u(x, 0) = x^2$, $u(x, 1) = 1$, $0 \le x \le 1$ and $u(0, y) = y^2$, $u(1, y) = 1$, $0 \le y \le 1$ taking $\Delta x = \frac{1}{3} = \Delta y$. **(8)**

OR

(b) (i) Using finite difference method solve $\frac{d^2y}{dx^2} = y$ in (0, 2) given y(0) = 0, y(2) = 3.63 subdividing the range of x into 4 equal parts. **(8)**

(ii) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = \sin \pi x$, $0 \le x \le 1$; u (0, t) = u (1,t) = 0, using Crank-Nicolson method. Carryout computations for two levels, taking h = 1/3, k = 1/36. **(8)**