Total No. of printed pages = 3

EI 1815 OE 12

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Roll No. of candidate | | | | | | | | | | |

2022

B.Tech. 5th Semester End-Term Examination

IE

COMPUTER ORIENTED NUMERICAL METHODS

(New Regulation and New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *six* from the rest.

1. (a) Convert the following binary numbers to decimal numbers $(2 \times 1 = 2)$

   (i) $(100.1101)_2$

   (ii) $-(1110.0011)_2$

   (b) Convert the following decimal numbers to HEX and Octal numbers $(1 + 1 = 2)$

   (i) 135

   (ii) 78.45

   (c) For the following two questions find the correct choice $(2 \times 1 = 2)$

   (i) Which of the following is an iterative method?

   (1) Gauss Seidel

   (2) Gauss Jordan

   (3) Gauss Elimination

   (4) All of the above

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(ii) Errors may occur in performing numerical computation on the computer due to which of the following reasons?

(1) Operator fatigue

(2) Back substitution

(3) Rounding errors

(4) Any of the above

(d) Approximate the following numbers with 3 significant digit $(4 \times \frac{1}{2} = 2)$

(i) 0.1652

(ii) 15.95

(iii) 0.000454

(iv) 143.6

(e) Write on trade off between speed and accuracy of an iterative solution procedure. (2)

2. (a) Obtain the smallest positive root of $x^3 - 2x - 5 = 0$ correct up to 3 decimal places. Use either bisection method or Regula-Falsi Method. (5)

(b) Find a real root of the equation using Newton Raphson Method $\sin x = 1 - x$ (5)

3. Obtain a complex root of the equation $f(x) = x^2 + 1$ using the Newton Raphson method. Start with the initial approximation $p_0 = (0.20, 0.20)$. (10)

4. Use L-U factorization to obtain the solution of the following system of linear equations. Start with the initial value of $[0\ 0\ 0]^T$. (10)

$x + 3y + z = 10$
$x + 2y + 5z = 12$
$4x + y + 2z = 16$

5. (a) What do you mean by ill-conditioning of a system of linear equations? How can you detect that a system is ill-conditioned? (3)

(b) Solve the following system of equation by Gauss elimination method (7)

$3x - 8y + 3z = 0.1$
$2x - 3y + 4z = 1.4$
$x - y + 2z = 0.3$

6. (a) The population of a town in the decennial census was as given below. Estimate the population in the year 1895. (5)

Year : x	1891	1901	1911	1921	1931
Population y (in thousand)	46	66	81	93	101

(b) Find the missing value in the following table (i) by using difference table and (ii) without using difference table (5)

x	2	4	6	8	10
y	5.6	8.6	13.9	-	35.6

$y = f(x)$ may be assumed to be polynomial of degree 3

7. (a) Obtain an approximate value of π from the formula

$$\frac{\pi}{4} = \int_0^1 \frac{1}{1+x^2} dx$$ using Simpson's 1/3rd rule with nine ordinates (5)

(b) From the following table values of x and y obtain $\frac{dy}{dx}$ at $x = 1.2$ (5)

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.12	3.32	4.06	4.95	6.05	7.38	9.02

8. (a) A reservoir discharging through sluices at a depth of h meter below the water surface has a surface area A for various value of h are given below :

$h(ft)$	10	12	14	16	18
$A(ft^2)$	9.55	10.72	12.09	13.51	15.35

If t denotes the time in minutes the rate of fall of the surface is given by

$$\frac{dh}{dt} = -\frac{48}{A}\sqrt{h}$$

Estimate the time taken for the water level to fall from 18 ft to 10 ft above the sluices. (7)

(b) What are the advantages of numerical differentiation and numerical integration? (3)

9. (a) Find the value of $y(1.2)$, using Euler's method with $h = 0.1$, given that $\frac{dy}{dx} = \frac{2y}{x} + x^2$; $y(1) = 0.5$. (5)

(b) Given $\frac{dy}{dx} - 1 = xy$ and $y(0) = 1$, obtain the Taylor series for $y(x)$ and compute and compute $y(0.1)$ correct to four decimal places. (5)