Total No. of printed pages = 4

19/2nd Sem/PGET 202

2022

NUMERICAL METHODS FOR ENERGY SYSTEM

Full Marks – 100

Time – Three hours

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

Answer any *five* questions.

1. (a) Using Bisection method correct fourth decimal places to find a real root of the following equation $x^3 - x^2 - 1 = 0$. 10

   (b) Using the Regula-Falsi method correct three decimal places to find a real root of the following equation $2x - \log x - 7 = 0$. 6

   (c) To verify the same result, write a C-program. 4

2. (a) Find by a Newton-Raphson method, a root of the equations $3x^3 - 9x^2 + 8 = 0$ correct to the fourth decimal place. 5

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(b) To verify the same result, write a C-Program. 5

(c) Find by a successive approximation method, a root of the following equations correct to three decimal places : $\cos x = 3x - 1$. 3

(d) Apply the Gauss elimination method to solve the equations : 7

$5x + y + z + w = 4$

$x + 7y + z + w = 12$

$x + y + 6z + w = -5$

$x + y + z + 4w = -6$.

3. (a) Using Gauss-Seidel method, solve the following equations : 12

$2x + y + 5z + w = 5$

$x + y - 3z + 4w = -1$

$3x + 6y - 2z + w = 8$

$2x + 2y + 2z - 3w = 2$.

(b) Use the Newton-Raphson method to solve the non-linear simultaneous equations $x = x^2 + y^2$, $y = x^2 - y^2$ correct to two decimal places with starting approximation (0.8, 0.4). 8

4. (a) Given that 7

x :	1.0	1.1	1.2	1.3	1.4	1.5	1.6
Y :	7.989	8.4.3	8.781	9.129	9.451	9.750	10..31

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at

(i) $x = 1.1$ and (ii) $x = 1.6$

(b) Using Bessel's formula, find f(7.5) from the following table : 7

x :	7.47	7.48	7.49	7.50	7.51	7.52	7.53
Y :	0.193	0.195	0.198	0.201	0.2.3	0.206	0.208

(c) Find the maximum and minimum value of y from the following data : 6

x :	– 2	–1	0	1	2	3	4
Y :	2	–0.25	0	–0.25	2	15.75	56

5. (a) Evaluate the integral $\int_0^1 \frac{x^2}{1+x^3} dx$ using Simpson's 1/3 rule. Compare the error with the exact value. 8

(b) Evaluate $\int_0^6 \frac{1}{1+x^2}\,dx$ by using 12

(i) Trapezoidal rule

(ii) Simpson's 3/8 rule

(iii) Weddle's rule

and compare the results with their actual value.

6. (a) Using Picard's process of successive approximations, obtain a solution up to the fifth approximation of the equation $dy/dx = y + x$, such that $y = 1$ when $x = 0$. Check your answer by finding the exact particular solution. 6

(b) Using the Runge-Kutta method of the fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$

with $y(0) = 1$ at $x = 0.2$ and 0.4. 7

(c) Solve by Taylor's series method, the equation $\frac{dy}{dx} = \log(xy)$ for $y(1.1)$ and $y(1.2)$, given $y(1) = 2$. 7