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8539/SCS8A42/
SCS9A41

NOVEMBER 2011

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NUMERICAL METHODS

(For those who joined in July 2008 and 2009)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL the questions.

Choose the correct answer :

1. Which one of the following is called relative error?

(a) $|N - N'|$ (b) $(N - N')$

(c) $\frac{|N - N'|}{|N|}$ (d) $(N - N') \times 100$

2. The order of convergence of Newton-Raphson method is

(a) 1 (b) 2

(c) 3 (d) 4

3. The coefficient matrix A in the system $AX = B$ get transformed in Gauss Jordan method is

(a) Upper triangular matrix

(b) Lower triangular matrix

(c) Diagonal matrix

(d) None

4. The iterative method will converge if in each equation of the system

(a) absolute value of the largest coefficient is greater than or equal to the sum of absolute values of all the remaining coefficient

(b) the diagonal elements $a_{ii} = 0$

(c) absolute value of the largest coefficient is less than the sum of absolute values of all the remaining coefficient

(d) none

5. The process of finding the intermediate values of the function from a set of its values at specific points is known as

(a) interpolation

(b) extrapolation

(c) curve fitting

(d) none

6. Which one of the following interpolation techniques is used if the values of x are not at equal distance?

(a) Newton's forward

(b) Newton's backward

(c) Lagrange's

(d) Bessel's

7. The formula for Trapezoidal rule is

(a) $I = \frac{h}{2}[(y_0 + y_n) + 2(y_1 + y_2 + \ldots + y_{n-1})]$

(b) $I = \frac{h}{3}[y_0 + y_{2n} + 4(y_1 + y_3 + \ldots) + 2(y_2 + y_4 + \ldots)]$

(c) $I = \frac{h}{3}[(y_0 + y_n) + 2(y_1 + y_2 + \ldots + y_{n-1})]$

(d) $I = \frac{h}{2}[(y_0 + y_n) + 2(y_1 + y_3 + y_5 + \ldots.)]$

8. The h in numerical integration formula is defined as

(a) $\frac{b-a}{n}$ (b) $\frac{a-b}{n}$

(c) $\frac{b-a}{h}$ (d) $\frac{b-a}{10}$

9. The formula for Euler's method is

(a) $y(x+h) = hy(x) - f(x,y)$

(b) $y(x+h) = h(y(x)) - f(x,y)$

(c) $y(x+h) = y(x) + hf(x,y)$

(d) $y(x+h) = y(x) - hf(x,y)$

10. Runge-Kutta method gives better approximation for $y(x+h)$ than the Euler's method. What do you say?

(a) True (b) False

(c) Can't say (d) Fixed out

PART B — ($5 \times 7 = 35$ marks)

Answer ALL the questions.

11. (a) Find a root of the equation $x^3 - 3x - 5 = 0$ using regular Falsi method.

Or

(b) Find a root of the equation $\sin x - x + 2 = 0$ using Newton Raphson method.

12. (a) Solve the following system by Gauss elimination method $5x_1 - x_2 = 9$;
$-x_1 + 5x_2 - x_3 = 4$; $-x_2 + 5x_3 = -6$

Or

(b) Solve the following system by Gauss-Jordan method.

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

13. (a) Find the value of y when $x = 40$.

x :	30	35	45	55
y :	148	96	68	34

Or

(b) From the following table given below find y when $x = 0.17$.

x :	0.10	0.15	0.20	0.25	0.30
y :	0.1003	0.1511	0.2027	0.2553	0.3093

14. (a) Find the eigen value of the matrix

$$A = \begin{bmatrix} 3 & 2 & 4 \\ 2 & 0 & 2 \\ 4 & 2 & 3 \end{bmatrix}.$$

Or

(b) Find $\frac{dy}{dx}$ at $x = 1$ for the following data :

x :	0	1	2	3	4	5	6
y :	6.9897	7.4036	7.7815	8.1291	8.4510	8.7506	9.0309

15. (a) Find $y(0.1)$ given that $\frac{dy}{dx} = x - y^2$; $y(0) = 1$ using Taylor series method.

Or

(b) Find $y(0.1)$ and $y(0.2)$ given that $\frac{dy}{dx} + xy^2 = 0$, $y(0) = 2$. Take $h = 0.1$.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Find a root of the equation $x^3 - x - 1 = 0$ using bisection method.

17. Solve the following system by Gauss-Seidel method.

$$50x + 2y - 3z = 196$$
$$3x + 65y + 2z = 81$$
$$-x + y + 33z = 63.$$

18. For the values given below find y when $x = 0.12$.

x :	0.10	0.15	0.20	0.25	0.30
y :	0.1003	0.1511	0.2027	0.2553	0.3093

19. Evalue $\int_0^{\pi} \cos x \, dx$ by dividing the interval into 10 equal parts using Simpson's rule.

20. Find $y(0.2)$ and $y(0.04)$, given that $\frac{dy}{dx} + \frac{1}{10} y^2 = x$, $y(0) = 1$ using Runge-Kutta IV order method.
