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B.E/ B.TECH DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Fourth Semester

MAT108: NUMERICAL METHODS

(Common to AE/AU/CE/EEE/EIE/MCE/ME&TXT)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Another name for Newton-Raphson method is

   a) Method of bisection   b) Falseposition method

   c) Method of tangents   d) Direct method

2. The order of convergence of Regula-Falsi method is

   a) 2   b) 1.618

   c) 1   d) 4

3. To employ Stirling'sformula ,the suitable range of $u = \dfrac{x - x_0}{h}$, is

   a) 2   b) 1

   c) $1 < u < 4$ d) $-\dfrac{1}{4} \le u \le \dfrac{1}{4}$

4. The Newton's divided difference formula is suitable only for the values of x in

   a) equal intervals   b) odd terms

   c) even terms   d) unequal intervals

5. The truncation error in the Trapezoidal rule of integration is

   a) h^2 b) h

   c) h^3 d) four

6. For Newton-Cotes formula , the ordinates should be in :

   a) odd   b) even

   c) equidistant   d) Four

7. The Taylor's series method is
   a) single-step method
   b) exact method
   c) multi-step method
   d) slow method

8. The order of the error in Euler's method is
   a) 4
   b) 3
   c) 1
   d) h^2

9. The number of conditions needed to solve the one dimensional heat flow equation is
   a) 2
   b) 2
   c) 1
   d) 4

10. The number of conditions needed to solve the Laplace equation is
    a) 4
    b) 3
    c) 1
    d) 2

PART B (10 x 2 = 20 Marks)

11. Write the criterion for convergence of Newton–Raphson method.

12. State the condition for the convergence of Gauss-Seidel method.

13. Write the Newton's forward interpolation formula.

14. State the Lagrange's interpolation formula.

15. Write the formula for $\left(\dfrac{dy}{dx}\right)_{x=x_0}$ and $\left(\dfrac{d^2 y}{dx^2}\right)_{x=x_0}$ using Newton's forward interpolation formula.

16. State the Simpson's (3/8) rule.

17. State the Milne's predictor formula.

18. State the order of the error in fourth order Runge-Kutta method.

19. Write the standard five-point formula.

20. State the Bender-Schmidt recurrence relation.

PART C (5 x 14 = 70 Marks)

21. a) (i) Find the positive root of $xe^x=3$ by method of False-position.

    (ii) Using Guass elimination method, solve : 3x+4y+5z=18, 2x-y+8z=13, 5x-2y+7z=20.

(OR)

    b) (i) Using Newton-Raphson Method, find a positive root of $xe^x = \cos x$

    (ii) Using Guass-Seidel method solve : 10x-2y+z=12, x+9y-z= 10, 2x-y+11z=20

22. a) (i) Given :
$$\begin{array}{c|ccccc} x: & 0 & 10 & 20 & 30 & 40 \\ \hline y: & 0 & 0.1736 & 0.3420 & 0.5 & 0.6427 \end{array}$$,Find y(38).

   (ii) Using Lagrange's formula fit the polynomial to the data

   $$\begin{array}{c|cccc} x: & 0 & 1 & 4 & 5 \\ \hline f(x): & 4 & 3 & 24 & 39 \end{array}$$

(OR)

   b) (i) Using Newton's divided difference formula ,find f(2),f(8) & f(15) from :

   $$\begin{array}{c|cccccc} x: & 4 & 5 & 7 & 10 & 11 & 13 \\ \hline f(x): & 48 & 100 & 294 & 900 & 1210 & 2028 \end{array}$$

   (ii) Given :

   $$\begin{array}{c|ccccc} x: & 1 & 1.05 & 1.10 & 1.15 & 2.0 \\ \hline y: & 0.3413 & 0.3531 & 0.3643 & 0.3749 & 0.3849, \end{array}$$ find y(1.02).

23. a) (i) Find the first and second derivative at x=30 from

   $$\begin{array}{c|ccccccc} x: & 30 & 31 & 32 & 33 & 34 & 35 & 36 \\ \hline y: & 85.90 & 86.85 & 87.73 & 88.64 & 89.52 & 90.37 & 91.1 \end{array}$$

   (ii) Using Simpson's (1/3) rule evaluate $\int_{0}^{1} \dfrac{x^2}{1+x^3} dx$

(OR)

   b)
   (i) Using Simpson's (3/8) rule evaluate $\int_{-3}^{3} x^4 dx$

   (ii) Find the first & second derivative at x=1.04 from

   $$\begin{array}{c|ccccc} x: & 0.96 & 0.98 & 1.00 & 1.02 & 1.04 \\ \hline f(x): & 0.7825 & 0.7739 & 0.7651 & 0.7563 & 0.7473 \end{array}$$

24. a) (i) Given $y' = x + y, y(1) = 0$, find $y(1.1), y(1.2)$ by Taylor series method.

   (ii) Given $y' = \dfrac{y^2 - x^2}{y^2 + x^2}, y(0) = 1$, find y at x=0.2 & x=0.4, by fourth order Runge-Kutta method.

(OR)

   b) Given $y' = \dfrac{1}{2}(1 + x^2)y^2$, $y(0) = 1$,find y(0.1) by Taylor's series method,

   y(0.2) by Euler's method, y(0.3) by improved Euler's method and y(0.4) by Milne's method.

25. a)   Solve $\nabla^2 u = -10(x^2 + y^2 + 10)$, over the square mesh with sides x=0,y=0,

x=3,y=3 with u=0 on the boundary with mesh length 1 unit.

(OR)

b)   the Crank-Nicholson method, solve $16u_t = u_{xx}$, $0 < x < 1$, $t > 0$,

u (x,0)= 0, u (0,t) = 0 , u (1,t) = 100 t for one time step.

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