KUMARAGURU
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Register Number:……….……

B.E / B.TECH DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Third Semester

U13MAT301: NUMERICAL METHODS

(Common to AE/AUE/CSE/ECE/EIE /MCE& IT)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The number p is called the order of convergence if

    a) $|e_{i+1}| \le |e_i|^p k$, where e_i is the error in the ith iteration b) $p|e_{i+1}| \le |e_i| k$, where e_i is the error in the ith iteration

    c) $p|e_i| \le |e_{i+1}| k$, where e_i is the error in the ith iteration d) $|e_{i+1}| \ge |e_i|^p k$, where e_i is the error in the ith iteration

2. In Gauss Jordan method the coefficient matrix is transformed into ……………..

3. From the table, the value of $\Delta^5 y_n$ is

X	2	2.5	3	3.5	4
Y	246.2	409.3	537.2	636.3	715.9

    a) 1 b) 2.9

    c) 0 d) 3.0

4. The parabola of the form y $= ax^2 + bx + c$ passing through the points (0, 0), (1, 1) and (2, 20) is ……………..

5. If $f(x) = \dfrac{1}{x}$ then f(a, b) is

    a) $\dfrac{1}{ab}$ b) $-\dfrac{1}{ab}$

    c) $\dfrac{ab}{b-a}$ d) $\dfrac{1}{abcd}$

6. The error in Simpson's 3/8 rule is of the order ……………..

7. The improved Euler's method to find the numerical solution of a first order differential equation is

a) $y_{m+1} = y_m + \dfrac{h}{2}\{f(x_m, y_m) + f[x_{m+1}, y_m + hf(x_m, y_m)]\}$

b) $y_{m+1} = y_m - \dfrac{h}{2}\{f(x_m, y_m) - f[x_{m+1}, y_m + hf(x_m, y_m)]\}$

c) $y_{m+1} = y_m + h\{f(x_m, y_m) + f[x_{m+1}, y_m + hf(x_m, y_m)]\}$

d) $y_{m+1} = y_m - \dfrac{h}{2}\{f(x_m, y_m) + f[x_{m+1}, y_m + hf(x_m, y_m)]\}$

8. The derivatives of higher order are required in the method ……………..

9. For solving numerically the hyperbolic equation $16u_{xx} = u_{tt}$, the starting solution is provided by the boundary condition

   a) $u(0,t) = 0$
   b) $u(l,t) = 0$
   c) $u_t(x,0) = 0$
   d) $u(x,0) = f(x)$

10. The number of conditions required to solve the Laplace equation is ……………..

PART B (10 x 2 = 20 Marks)

(Not more than 40 words)

11. Solve the following equations by Gauss elimination method $3x + 2y = 4$, $2x - 3y = 7$.

12. Find the iterative formula for finding square root of N, where N is a positive real number, by Newton's method.

13. State the principle of least squares.

14. Write Lagrange's inverse interpolation formula.

15. Find $y'(4)$ if

x	1	2	3	4
y	1	2	5	13

16. Evaluate $\displaystyle\int_{\frac{1}{2}}^{1} \frac{1}{x}\,dx$ by Trapezoidal rule, dividing the range into 4 equal parts.

17. By using Euler's method for $y' = -y; y(0) = 1$ find $y(0.1)$.

18. What is predictor – corrector method?

19. Define a difference quotient.

20. Write down the standard five point formula to solve $\nabla^2 u = 0$.

PART C (5 x 14 = 70 Marks)

(Not more than 400 words)

Q.No. 21 is Compulsory

21. (i) Evaluate the pivotal values of the following equation taking h=1 and upto one (7) half of the period of the oscillation $16u_{xx} = u_{tt}$ given

$u(0,t)=u(5,t)=0,\ u(x,0)=x^2(5-x)\ and\ u_t(x,0)=0.$

(ii) Solve $u_{xx}=u_t$, given $u(0,t)=0, u(4,t)=0, u(x,0)=x(4-x)$, assuming (7) $h=k=1$. Find the values of u upto $t=5$ using Bender- Schmidt formula.

22. a) (i) Find a positive real root of $x\log_{10}x-1.2=0$ by false position method correct to (7) 4 decimal places.

(ii) Solve the following system of equations by using Gauss-Seidel method: (7) $8x-3y+2z=20,\ 4x+11y-z=33, 6x+3y+12z=35.$

(OR)

b) (i) Find the real root of the equation $\cos x=3x-1$ correct to 4 decimal places by (7) iteration method.

(ii) Solve the following system of equations by using Gauss elimination method: (7) $10x+y+z=12,\ 2x+10y+z=13,\ x+y+5z=7.$

23. a) (i) Apply the method of least squares to fit a straight line to the following data. (7)

X	71	68	73	69	67	65	66	67
Y	69	72	70	70	68	67	68	64

Also estimate the value of y at x=70

(ii) Using Lagrange's interpolation formula, find the polynomial for the given data: (7)

x: 5 6 9 11

y: 12 13 14 16

and hence find the value of y(10).

(OR)

b) (i) Find f(x) as a polynomial in x from the given data using Newton's divided (7) difference formula and hence find f(8).

x	3	7	9	10
f (x)	168	120	72	63

(ii) From the data given below, find the number of students whose weight is (7) between 60 and 70.

Weight in lbs: 0-40 40-60 60-80 80-100 100-120

No. of students : 250 120 100 70 50

24. a) (i) Find y'(6) and the maximum value of y from the table: (7)

x :	0	2	3	4	7	9
y :	4	26	58	112	466	922

    (ii) A curve passes through the points (1,2), (1.5, 2.4), (2.0, 2.7), (7)
(2.5, 2.8), (3, 3), (3.5, 2.6)and (4.0, 2.1). Obtain the area bounded by the curve, the x –axis , x=1and x=4.

(OR)

b) (i) The table given below reveals the velocity v of a body during the time 't' (5)
specified. Find its acceleration at t= 1.1.

t:	1.0	1.1	1.2	1.3	1.4
v:	43.1	47.7	52.1	56.4	60.8

    (ii) Using trapezoidal rule and Simpson's 1/3 rule evaluate $\int_0^1\int_0^1 \dfrac{1}{1+x+y}\,dx\,dy$ taking (9)

$h = k = 0.25.$

25. a) (i) Using Runge – Kutta method of fourth order, solve $\dfrac{dy}{dx} = \dfrac{y^2 - x^2}{y^2 + x^2}$ given that (10)

$y(0)=1$ at $x=0.2,\ 0.4$

    (ii) Solve $5x\dfrac{dy}{dx} + y^2 - 2=0,\ y(4)=1$ for $y(4.1),\ y(4.2)$ using Improved Euler's (4)
method.

(OR)

b) Given $\dfrac{dy}{dx} = xy + y^2, y(0)=1,\ y(0.1)=1.1169, y(0.2)=1.2773,$ find $y(0.3)$ by
Runge-Kutta method of order four and $y(0.4)$ using Milne's predictor-corrector
method.

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