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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2012

Fifth Semester

MAT108: NUMERICAL METHODS

(Common to ECE/IT)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. In which of the following method, the proper choice of initial value is very important?
   - a) Iteration Method
   - b) Regula falsi method
   - c) Newton –Raphson method
   - d) Elimination Method
2. The condition for the convergence of Newton-Raphson method in solving $f(x)=0$ is
   - a) $|f(x)f''(x)| < |f'(x)|^2$
   - b) $|f(x)f'(x)| < |f''(x)|^2$
   - c) $|f(x)f''(x)| > |f'(x)|^2$
   - d) $|f'(x)f''(x)| < |f(x)|^2$
3. The parabola of the form y = ax^2+bx+c passing through the points (0, 0), (1, 1) and (2, 20)
   - a) $y=8x^2-9x$
   - b) $y=9x-8x^2$
   - c) $y=9x^2-8x$
   - d) $y=8x-9x^2$
4. The n[th] divided differences of a polynomial of the n[th] degree are
   - a) Constant
   - b) Zero
   - c) One
   - d) n
5. The error in the Trapezoidal rule is of order
   - a) h^2
   - b) h
   - c) h^3
   - d) $h/2$
6. In Newton's backward difference formula the second term of the second derivative of y with respect to x is
   - a) $\frac{1}{h^2}(v+1)\nabla^3 y_n$
   - b) $\frac{1}{h}(v+1)\nabla^3 y_n$
   - c) $\frac{1}{h^2}\left(v+\frac{1}{2}\right)\nabla^2 y_n$
   - d) $\frac{1}{h^2}\left(6v+\frac{3}{4}\right)\nabla^3 y_n$
7. Predictor corrector methods are
   - a) single step methods
   - b) multi step methods
   - c) self starting methods
   - d) the methods not possible to get any information about truncation error

8. The derivatives of higher order are required in ___________ method

a) Taylor's b) Euler's

c) Runge – Kutta d) improved Euler's

9. The equation $y\,u_{xx}+u_{yy}=0$ is hyperbolic in the region

a) y > 0 b) y < 0

c) y = 0 d) $y \geq 0$

10. The Bender Schmidt recurrence equation is

a) $u_{i,j+1}=\frac{1}{2}\left[u_{i+1,j}+u_{i-1,j}\right]$ b) $u_{i,j+1}=\frac{1}{2}\left[u_{i+1,j}-u_{i-1,j}\right]$

c) $u_{i,j-1}=\frac{1}{2}\left[u_{i+1,j}+u_{i-1,j}\right]$ d) $u_{i,j-1}=\frac{1}{2}\left[u_{i+1,j}+u_{i-1,j}\right]$

PART B (10 x 2 = 20 Marks)

11. The sum of two numbers is 115 and the difference is -21. Find the two numbers using Gauss Elimination method.

12. Write the sufficient condition for the convergence of Gauss Seidel method.

13. State Newton's backward difference interpolation formula.

14. Form the divided difference table for

X :	4	7	9	12
Y :	-43	83	327	1053

15. Write Stirling's formula to find $\frac{dy}{dx}$ *and* $\frac{d^2y}{dx^2}$.

16. Using Simpson's rule find the value of $\int_0^4 e^x dx$,

given $e^0=1, e^1=2.72, e^2=7.39, e^3=20.09$ *and* $e^4=54.6$.

17. Find the value of k_2 if $y\frac{dy}{dx}=y^2-x$, y(0) = 2 is solved by Range-kutta method, taking h = 0.2.

18. Solve $\frac{dy}{dx}=x+y,\ y(0)=1$ by Euler's method to get the value of y at x = 0.2.

19. What is the step-size of time t if $u_{xx}=u_t$, h = 0.25 is solved by Crank-Nicholson method?

20. Write the difference equation for $u_{xx}+u_{yy}=0$.

PART C (5 x 14 = 70 Marks)

21. a) (i) Find the real root of the equation $x\log_{10} x - 1.2 = 0$ by Regula falsi method. Correct to four decimal places. (7)

(ii) Solve the following system of equations by Gauss-seidel method. (7)

28x + 4y -z = 32,   x + 3y +10z = 24, 2x + 17y + 4z = 35.

(OR)

b) (i) Using Gauss Jordan method find the inverse of $\begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$ (7)

(ii) Find the real root of the equation $x^x = 100$ by Newton–Raphson method. Correct to four decimal places. (7)

22. a) (i) From the following table, estimate the number of students who obtained marks between 40 and 45. (7)

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

(ii) Given the following table, find y(35), by using Stirling's formula (7)

x :	20	30	40	50
y :	512	439	346	243

(OR)

b) (i) Find the equation y = f(x) of least degree passing through the points (-1,-21), (1,15), (2,12), (3,3) and also find y when x = 0. (7)

(ii) Using Lagrange's interpolation formula find the value of y(2) from the following data (7)

x :0	1	3	4	5
y :0	1	81	256	625

23. a) (i) The population of a certain town is given below. Find the rate of growth of the population in 1931 and 1971.. (7)

Year (x) :	1931	1941	1951	1961	1971
Population in thousandsy(x) :	40.62	60.80	79.95	103.56	132.65

(ii) Compute the value of π from the formula $\int_0^1 \frac{dx}{1+x^2} = \frac{\pi}{4}$ using trapezoidal rule with 10 sub-intervals. (7)

(OR)

b) The table below gives the velocity v of a moving particle at time t sec. Find the distance covered by the particle in 12 sec and also the acceleration at t = 2 secs

t	0	2	4	6	8	10	12
v	4	6	16	34	60	94	136

24. a) (i) Use Milne's predictor- corrector formula to find y(0.8), given that $\frac{dy}{dx} = y - x^2$, y(0) = 1, y(0.2) = 1.12186, y(0.4) = 1.4682, y(0.6) = 1.7379. (10)

(ii) Solve $\frac{dy}{dx} = x^2 + y^2$ for x = 1.1 given y(1) = 2 by Taylor's series method. (correct to 4 decimal places). (4)

(OR)

b) Using Range-kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given y(0) = 1 at x =0.1 (0.1) 0.3

25. a) (i) Evaluate the pivotal values of the equation $u_{tt} = 16u_{xx}$ taking $\Delta x = 1$ upto t = 1.25, the boundary conditions are $u(0,t) = u(5,t) = u_t(x,0) = 0\ and\ \ u(x,0) = x^2(5-x)$. (7)

(ii) Solve $\frac{\partial^2 u}{\partial x^2} = 2\frac{\partial u}{\partial t}$ given $u(0,t) = 0,\ u(4,t) = 0,\ u(x,0) = x(4-x),$ taking $\Delta x = 1$ $and\ \Delta t = 1.$ Find the value of u up to t = 5 using Bender – Schmidt's explicit finite difference scheme. (7)

(OR)

b) Solve the elliptic equation $\nabla^2 u = 0$ over the square region of side 4, satisfying the boundary conditions: $u(0,y) = 0$ for $0 \le y \le 4,$ $u(4,y) = 12 + y$ for $0 \le y \le 4,$ $u(x,0) = 3x$ for $0 \le x \le 4,$ & $u(x,4) = x^2$ for $0 \le x \le 4.$ Obtain solution correct to two decimal places. Take h = 1 = k.

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