KATHMANDU UNIVERSITY
End-Semester Examination [C]
January, 2018

Mark Scored:

Level : B.E./B. Sc./ B. Tech.
Year : II

Course : MCSC 202
Semester: II

Exam. Roll. No:

Time: 30 mins.

F.M. : 10

Registration No.:

Date : JAN 16 2018

SECTION "A"

[10Q.×0.5=5 marks]

Fill in the blank space(s) by most appropriate words or symbol(s):

1. Trapezoidal rule is more exact if interval length is taken to be ----------
2. $\Delta - \nabla =$ ----------
3. Missing value of a series can be obtained by using----------technique.
4. Significant digit of the number 50.02030 = ----------
5. Third approximation for differential equation $y' = f(x,y)$ with $y(x_0) = y_0$ by Picard's method of successive approximations is$y^{(3)}$ = ----------
6. Convergence rate not only depend upon method applied but also depends upon ---------- ----------
7. For an equation $x^2 = 0$,root exits at $x = 0$, the bisection method cannot be applied on [a,b] because ----------
8. Matrix$A = [2,3; 4,5]$ has the Euclidean norm $||A||_e$ = ----------
9. Among system of equations solution method,Gauss's Seidel method has convergence rate as twice fast as the----------method.
10. For solving boundary value problem:$y'' + xy' = sinx \; with \; y(1) = 2, y'(3) = 5$, it is changed into system of initial value problem and system is solved by the well known method which we call ----------

SECTION "B"

[10Q.×0.5=5 marks]

Fill in the blank spaces (Question number 11 through 20) by choosing the most appropriate answers from among the given ones. Do not tick the answers.

11. ----------approximates the solution curve by the tangent in each interval.
    (i) Picard's method
    (ii) Euler's method
    (iii) Newton's method
    (iv) RungeKutta method
12. While solving the system of equations, as soon as the new value of the variable is obtained by iteration, it is used immediately to find the value of next variable is called ---------- ----------
    (i) Gauss's Seidel method
    (ii)Gauss's Jacobi method
    (iii)Gauss's elimination method
    (iv)Gauss's Jordan method

13. If the derivative is required at a point to the beginning value in the set of data table, we use---
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(i) Newton's Forward Interpolation formula
(ii) Newton's Backward Interpolation formula
(ii) Newton's difference Forward formula
(iv) Lagrange's Interpolation formula

14. ---------- is not the central interpolation formula
(i) Stirling formula (ii) Bessel's formula
(iii) Everett's formula (iv) Lagrange's formula

15. Given $(x_0, y_0), (x_1, y_1), \ldots, (x_n, y_n)$,best fitting data to $y = f(x)$ by least squares method is meant to minimize ----------
(i) $\sum_{i=1}^{n} | y_i - f(x_i)|$ (ii) $\sum_{i=1}^{n} | y_i - f(x_i)|^2$
(iii) $\sum_{i=1}^{n} [y_i - f(x_i)]^2$ (iv) $\sum_{i=1}^{n} [y_i - f(x_i)]$

16. A polynomial of degree ----------passes though (n+1) data points.
(i) n (ii) n+1 (iii) n-1 (iv) 2n

17. Second approximation of root of equation $xe^x - 1 = 0$ for the initial guesses 0 and 1 is $x_2 =$ ----------

[[0.3678], [0.4678], [0.5786], [0.5033]]

18. Order of convergence of Newton-Raphson method is ----------
(i) 1.618 (ii) 2.617 (iii) 1)iv) 2

19. If h is the step size in Runge-Kutta method of fourth order then this method has the error of order = ----------
(i) $O(h^2)$ (ii) $O(h^3)$ (iii) $O(h^4)$ (iv) $O(h^5)$

20. ----------brackets the roots of an equation
(i) Regula falsi method (ii) Newton Raphson method
(iii) Iteration method (iv) Secant method

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Year : II
Time : 2 hrs. 30 mins.

Course : MCSC 202
Semester: II
F.M. : 50

SECTION "C"
[6Q.×7=42 marks]

1. Define order of convergence of equation. By using Newton-Raphson method, find the positive root of equation $xe^x - \cos\theta = 0$ with $x_0 = 0.5$ correct to two decimal places. [6+1]

2. Derive formula for Simpson's 1/3-rule of numerical integration and use it to evaluate integral $\int_0^1 e^{-x^2} sinx\, dx$ $with\ h = 0.2$ [3+4]

3. Gauss's, Bessel's, Everett's and Stirling formulae are for the central interpolation of set of data. Explain their significance of use and by using Stirling formula find cos(0.17) with the help of the following data: [2+5]

cos (0)	cos (0.05)	cos (0.10)	cos (0.15)	cos (0.20)	cos (0.25)	cos (0.30)
1	0.9988	0.9950	0.9888	0.0.9801	0.9689	0.0.9553

OR

Derive the expression for Newton's forward formula for interpolation and use it to find the $f(0.23)$ from the following table: [3+4]

x	0.20	0.22	0.24	0.26	0.28	0.30
$f(x)$	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

4. Why Runge-Kutta method of fourth order is said to be more superior to other existing methods of solving initial value problem? Solve the following initial value problem for $y(0.2)$ by using Runge-Kutta method of fourth order: [2+5]

$$y' = 1 + \frac{2xy}{1+x^2}\ with\ y(0) = 0\ and\ h = 0.1$$

5. Use Gauss-Seidel method to solve the following system correct to 3 - decimal place [7]

$$10x - 5y - 2z = 3$$
$$4x - 10y + 3z = -3$$
$$x + 6y + 10z = -3$$

With initial guess $(x, y, z) = (0,0,0)$

6. Use numerical differentiation to find the angular velocity of rotating rod in a plane about one of its ends fixed at time t= 0.6 seconds with the help of following table: [7]

Time (t)	0	0.2	0.4	0.6	0.8	1.0
Angle (Θ radians)	0.0	0.15	0.50	1.15	2.0	3.20

SECTION "D"

[4 Q.×2=8 marks]

7. Prove that $\delta^2 E = \Delta^2$

8. If x_i and x_{i+1} are two successive values of x then state Taylor series expansion of the $f(x)$ at $x = x_i$ including the remainder term.

9. Find the constants a *and* b by the method of least squares, such that the curve $y = a + bx$ fits the data:

x: 2	5	10
y: 5	29	139

10. If $y_n(x)$ is the nth degree polynomial approximated actual function $y(x)$ satisfying $(n+1)$ data:(x_i, y_i) , $i = 0,1,\cdots,n$ then state the expression for *error in Newton's forward interpolation*