

KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2018

Marks 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 **DEC 28 2018**

SECTION "A"

[10 Q. × 0.5 = 5 marks]

Fill in the blank space(s) by writing most appropriate word(s) or symbol(s).

1. The relative error of the sum $\sqrt{3} + \sqrt{5} + \sqrt{7}$ to 4 significant digits is _____.
2. Method of least squares consists of minimizing _____.
3. For the vector $\vec{x} = [x_1, x_2, x_3, \dots, x_n]$ the norm $\|x\|_2 =$ _____.
4. The approximate formula for $\left[\frac{dy}{dx}\right]_{x=x_n}$ for a given set of $(n + 1)$ data points $(x_i, y_i), 0 \leq i \leq n$ is _____, where $h = x_1 - x_0 = \dots = x_n - x_{n-1}$.
5. If $u = f(x, y, z, w)$ be a function of four variables then $\Delta u =$ _____.
6. Absolute error in the quotient a/b is given by the formula _____.
7. Let a and b be two initial approximations of $f(x) = 0$ in Bisection method, then $f(a) * f(b)$ _____.
8. Third order central difference formula denoted by $\delta^3 y_{3/2}$ is defined by _____.
9. The normal equations corresponding to fitted curve $y = a + bx$ are _____.
10. If Δ is forward difference operator and h be common difference among $(n + 1)$ data points then $[x_0, x_1, x_2, \dots, x_n] =$ _____, where the symbols have their usual meanings.

SECTION "B"

[10 Q. × 0.5 = 5 marks]

Fill in the blank space(s) by selecting the most appropriate answer from among the given ones. (Do not tick the answer).

11. The first approximate series solution to the initial value problem $\frac{dy}{dx} = x + y, y(0) = 1$, using Picard's method is $y_1 =$ _____.
 $\left[1 + x + \frac{x^2}{2}; \quad 1 + x + x^2; \quad 1 + \frac{x}{2} + \frac{x^2}{4}; \quad 1 + x + \frac{x^2}{2} + \frac{x^3}{6}\right]$

12. For a given initial value problem $\frac{dy}{dx} = -y, y(0) = 1$, the value of $y(0.01)$ with step size $h = 0.01$ using simple Euler's method is _____.
 [0.93; 0.95; 0.97; 0.99]
13. The secant method has order of convergence _____.
 [1.861; 1.816; 1.618; 1.681]
14. Bessel's formula for interpolation gives the most accurate result for _____.
 [$0 \leq p \leq 1/4$; $1/4 \leq p \leq 3/4$; $-1/4 \leq p \leq 1/4$; $-1/4 \leq p \leq 0$]
15. Lagrange interpolation coefficient satisfies the property _____, where symbols have their usual meanings.
 [$l_1(x_1) = 0$; $l_1(x_2) = 1$; $l_2(x_1) = 1$; $l_2(x_2) = 0$]
16. Simpson's 3/8 rule requires the division of the whole range into _____ number of subintervals of width h .
 [multiple of 1; multiple of 2; multiple of 3; multiple of 4]
17. The relative error E_R of the number 8.6 if both of its digits are correct is _____.
 [0.0058; 0.0055; 0.005; 0.05]
18. The relationship between forward operator (Δ) and shift operator (E) is _____.
 [$\Delta = E + 1$; $\Delta = E - 1$; $\Delta = \frac{1}{2}(E^2 + 1)$; $\Delta^2 = \frac{1}{2}(E^2 + 1)$]
19. For a given matrix $A = \begin{pmatrix} 1 & 5 \\ 7 & -3 \end{pmatrix}$, $\|A\|_\infty =$ _____.
 [8; 7; 6; 5]
20. $\int_0^2 y dx =$ _____, if y satisfies the data (0, 0.399), (0.5, 0.352), (1, 0.242), (1.5, 0.129) and (2, 0.054) using trapezoidal rule.
 [0.47475; 0.77445; 0.44775; 0.74745]

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Semester: II
F.M. : 50

SECTION "C"

[6 Q. × 7 = 42 marks]

1. Derive a formula to find an approximate root of an equation $f(x) = 0$ by fixed point iteration method. Use this method to find an approximate root of the equation $x = \frac{1}{3}(2 - e^x + x^2)$ correct to 4 decimal places using initial approximation $x_0 = -2$. Also state its order of convergence. [3+3+1]

2. Derive Newton's divided difference interpolation formula. Ammonia vapor is compressed inside a cylinder by external force acting on the piston. The following data have been experimentally determined during the process. Find the volume of ammonia vapor at pressure 700 kPa. [3+4]

Pressure(kPa)	500	653	802	945	1100	1248	1400
Volume(l)	1.25	1.08	0.96	0.84	0.72	0.60	0.50

3. Derive Simpson's 1/3 formula to compute the value of a definite integral

$I = \int_a^b y(x)dx$. Use Simpson's formula to compute the integral $I = \int_{-1}^1 \frac{\cos x}{\sqrt{1-x^2}} dx$ by taking 10 strips. [3+4]

4. Discuss the Gauss-Seidel method and its convergent criteria for the solution of a linear system. Solve the following system of equations starting with the initial vector (0,0,0): [2+1+4]

$$\begin{aligned}4.63x - 1.21y + 3.22z &= 2.22 \\ -3.07x + 5.48y + 2.11z &= -3.17 \\ 1.26x + 3.11y + 4.57z &= 5.11\end{aligned}$$

OR

Discuss LU factorization method to find the solution of the system of linear equations. Solve the following system using LU-decomposition method: [3+4]

$$\begin{aligned}x + 2y + 3z &= 14 \\ 2x + 20y + 26z &= 120 \\ 3x + 26y + 70z &= 265\end{aligned}$$

5. Use finite difference method with step size $h = 0.25$ to solve the boundary value problem: $y'' - \pi^2 y = -2\pi^2 \sin(\pi x)$, $y(0) = y(1) = 0$. [7]

6. Describe least square curve fitting process of a straight line $y = a + bx$. Find the values of a and b so that $P = ae^{-bh}$ fits the data given in table: [3+4]

h	0	500	1000	1500	2000
P	29.9	29.4	29	28.4	27.7

SECTION "D"

[4 Q. \times 2 = 8 marks]

7. Find $(\Delta u)_{max}$ if $u = 5xy^2/z^3$ at $x = 2.23, y = 0.45$ and $z = 9.72$, where the values of x, y and z are correct to two decimal places.
8. Find dy/dx at $x = 6$ from the following table values:

x	4.5	5.0	5.5	6.0
y	9.69	12.90	16.71	21.18

9. Show that $\mu^2 = \frac{1}{4}(\delta^2 + 4)$, where the symbols have their usual meanings.
10. Using the following table find $f(x)$ as a polynomial in x :

x	-1	0	3
y	3	-6	39