JHARKHAND
Rai University
RANCHI

PRACTICE SET

End Semester Examination, December- 2025

Program: BCA
Subject: Mathematical Foundation for Computer Science
Subject Code: 3CMDC101
Semester: I

Course Outcome:

After the successful completion of the course, the students will be able to:

1. Understand determinants, matrices and their properties.
2. Apply the Fundamental Principle of Counting, Multiplication Principle, Baye's Theorem and Binomial distribution.
3. Describe the concept of vector algebra and its application.
4. Analyze characteristics and properties of two- and three-dimensional geometric Shapes and develop mathematical arguments about geometric relationships

Multiple Choice Question (Section –A)

1**. A matrix having the same number of rows and columns is called: (CO 1) [LOT] Remember**

(a) Rectangular matrix (b) Square matrix (c) Column matrix (d) Diagonal matrix

2. The inverse of a matrix (A) exists only when: (CO 1) [LOT] Understand

(a) $|A| = 0$ (b) A is singular (c) $|A| \neq 0$ (d) A is diagonal

3. The rank of a matrix is equal to: (CO 1) [LOT] Remember

(a) Number of rows (b) Number of columns

(c) Number of non-zero rows in its echelon form (d) Determinant of the matrix

4. The matrix equation (AX = B) has a unique solution only if: (CO 1) [LOT] Remember
(a) |A| = 0 (b) A is singular (c) A is non-singular (d) None of these

5. If A is an (n × n) matrix and (A X = λ X), then λ is called: (CO 1) [LOT] Remember
(A)Determinant (B) Eigenvalue
(C) Scalar multiple (D) Characteristic root

6. The Cayley-Hamilton theorem states that every square matrix satisfies: (CO 1) [LOT] Understand
(A) Its inverse equation (B) Its own characteristic equation
(C) Its eigenvector equation (D) Linear equation

7. If the determinant of a matrix is zero, the matrix is: (CO 1) [LOT] Remember
(A) Non-singular (B) Singular
(C) Diagonal (D) Unit matrix

8. The product of a matrix and its inverse gives: (CO 1) [LOT] Remember
(A) Zero matrix (B) Identity matrix
(C) Singular matrix (D) Null matrix

9. The inverse of a matrix (A) by row operation is found using: (CO 1) [LOT] Remember
(A) Cramer's rule (B) Gauss–Jordan method
(C) Eigenvalue method (D) Determinant method only

10. The Cayley-Hamilton theorem states that every square matrix satisfies: (CO 1) [LOT] Understand
(A) Its inverse equation (B) Its characteristic equation
(C) Its eigenvector equation (D) Linear equation

11. The product of eigen value is equal to : (CO 1) [LOT] Remember
(A) Determinant of matrix (B) Identity matrix
(C) Singular matrix (D) Null matrix

12. Trace of matrix is : (CO 1) [LOT] Remember
(A) Sum of diagonal element (B) Product of diagonal element
(C) only Diagonal element (D) None of these
(CO 1) [LOT] Understand

13. The derivative of a constant is: (CO2) [LOT] Remember
(A) 1 (B) 0
(C) x (D) Undefined

14. The derivative of (x^n) with respect to x is: (CO 2) [LOT] Understand

(A) nx^{n-1} (B) x^{n+1}

(C) nx (D) n/x

15. The derivative of the sum of two functions is: (CO2) [LOT] Remember

(A) Sum of their derivatives (B) Product of their derivatives

(C) Difference of their derivatives (D) Reciprocal of their derivatives

16. If y = u .v , then dy/dx is given by: **(CO2) [LOT] Remember**

(A) (u' v') B) (u' v – u v')

(C) (u' v + u v') (D) (u/v)

17. The derivative of a quotient {u}/{v} is: (CO2) [LOT] Remember

(A) ({u'v' - uv}/{v^2}) (B) ({u'v - uv'}/{v^2})

(C) ({u' - v'}/{v}) (D) (u'v')

18. The Chain Rule is used for finding the derivative of: (CO2) [LOT] Remember

(A) Product of functions (B) Composite function

(C) Quotient of functions (D) Sum of functions

19. Rolle’s Theorem states that if (f(x)) is continuous, differentiable, and (f(a) = f(b)), then: (CO2) [LOT] Remember

(A) f'(x) = 0 for all x (B) There exists

(c) f'(c) = 0 (D) f'(x) is constant

20. **The derivative of x^3 is**: **(CO2) [LOT] Understand**

(A) $3x^2$ (B) x^2 (C) 3x (D) x^3

21. Leibnitz’s Theorem gives the nth derivative of:

(A) (u+v) (B)(u-v)

(C) (u v) (D) ({u}/{v}) (CO2) [LOT] Remember

22. The condition for maximum of a function (f(x)) is:

(A) (f'(x)=0, f''(x)<0) (B) (f'(x =0, f''(x)>0)

(C) (f'(x)>0) (D) (f'(x) <0)

[LOT] (CO2) Remember

23.If f'(x) = 0 for all x , then (f(x)) is:

(A)Constant (B) Linear

(C) Exponential (D) Periodic

(CO2) [LOT] Understand

24. The process of finding the integral of a function is called: (CO2) [LOT] Remember

(A) Differentiation (B) Summation

(C) Integration (D) Substitution

25. The order of the differential equation $d^3y/dx^3 + 5dy/dx=0$ (CO3) [LOT] Understand

(A) 1 (B) 2 (C) 3 (d) 5

26. The degree of the differential equation $(d^2ydx^2)^4 + y=0$ (CO3)[LOT] Understand

(A)1 (B) 2 (C) 4 (D) Not defined

27. The indefinite integral of a function includes: (CO3) [LOT] Understand

(A) A constant of integration (B) A limit

(C) A coefficient (D) An exponent

28. The method of substitution in integration is used when the integrand contains:

(CO3) [LOT] Remember

(A) Product of two functions (B) Function and its derivative

(C) Quotient of two functions (D) Constant terms

29. To integrate rational functions, the standard method used is: (CO3) [LOT] Remember

(A) Substitution (B) Integration by parts

(C) Partial fractions (D) Differentiation

30. The reduction formula is used for: (CO3)[LOT]Understand

(A) Reducing the order of integration (B) Simplifying trigonometric integrals

(C) Eliminating constants (D) Converting improper to proper integrals

31 (Gamma (n+1)) is equal to: (CO3) [LOT]Remember

(A) (n!) B) ((n+1)!)

(C) (n) (D) (1/n)

32. A differential equation is an equation that contains: (CO3)[LOT]Remember

(A) Only constants

(B) Only algebraic expressions

(C) One or more deriv. of a dependent variable w.r.to an inept. Variable

(D) Only variables

33. The order of a differential equation is: (CO3 [LOT]Remember

(A) The highest power of the derivative
(B)The highest derivative present in the equation
(C) The number of variables present
(D) The power of the dependent variable

34. **The degree of a differential equation is: (CO3) [LOT] Remember**
(A) The highest derivative (B) The exponent of the highest derivative,
(C)The number of constants (D) The order of the derivative

35. The integrating factor (I.F.) for the equation ({dy}/{dx} + P(x)y = Q(x)) is: (CO3) [LOT]Remember
(A) (e^{P(x)}) (B) (e^{int P(x)dx})
(C) (e^{\int Q(x)dx}) (D) (\frac{1}{P(x)})

36. A particular integral (P.I.) in a differential equation represents: (CO4)[LOT]Remember
(A) The complementary function (B) The general solution
(C) The particular solution of the non-homogeneous part (D) None

37. A Partial Differential Equation (PDE) contains: (CO4)[LOT]Remember
(A) Only ordinary derivatives
(B) Partial derivatives with respect to two or more independent variables
(C) Algebraic functions only
(D) Constants only

38. **The order of PDE $\partial^3 u/\partial x^3 + \partial u/\partial y=0$ is (CO4)[LOT]Understand**
(A) 1 (B) 2 (C) 3 (D) 4

39. For the ODE $y'+3y=0$, the solution is (CO4)[LOT]Understand
(A) $y=Ce^{x}$ (B) $y=Ce^{-3x}$ (C) $y=3Ce^{x}$ (D) $y=3x+C$

40. The differential equation (y'' - y = 0) has a complementary function: (CO4) [LOT] Remember
(A) $y = A e^{x} + Be^{-x}$ (B) y = A\cos x + B\sin x
(C) $y = A + Bx$ (D) None

Module – I (Section-B)

Marks: 10

1. Solve the following system of equation using matrix method (**CO1) [HOT] Apply**

$5x - 7y + z = 11,\ 6x - 8y - z = 15,\ 3x + 2y - 6z = 7$

2. Find the cofactors of each elements and its determinants **(CO1) [HOT] Evaluate**

where $A = \begin{bmatrix} 3 & 5 & 4 \\ 1 & 2 & -2 \\ 5 & 3 & 1 \end{bmatrix}$

3. Find Eigen value and Eigen vector of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

(CO 1) [HOT] Evaluate

4. Find the value of x, y, and z Using matrix Method of linear equation

$3x + 2y - 2z = 3,\ x + 2y + 3z = 6,\ 2x - y + z = 2$ (**CO 1) [HOT] Apply**

5. Find rank of the matrix $A = \begin{bmatrix} 5 & 9 & 3 \\ -3 & 5 & 6 \\ -1 & -5 & -3 \end{bmatrix}$ From Echelon

(CO 1) [HOT] Apply

Marks: 20

6. (i) If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ Find $A^2 - 4A - 5I$

(ii) If $= \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$, find eigen values of matrix also find eigen value of A-1, and $A^2 - 2A + I$ **(CO1)[HOT] Evaluate**

7. Use Cayley Hamilton theorems obtain the inverse of matrix.

$\begin{bmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{bmatrix}$ Hence using this solve the equation $x + 2y - 2z = 3, x + y + z = -1, x + 3x - z = 2$ **(CO1)[HOT] Apply**

Module – II (Section-B)

Marks: 10

8. $If\ x^3 + y^3 = sin\ (x + y), find\ \frac{dy}{dx}$ (CO2) [HOT] Evaluate

9. Verify Rolle's Theorem for $f(x) = 3x^4 - 4x^2 + 5$ in [-1, 1]. (CO 2) [HOT] Apply

10. Find $\frac{dy}{dx}$ When Sin (xy) = x^2 - y (CO 2) [HOT] Evaluate

11. Find dy/dx if y = $\frac{2x+1}{(3x-1)(x+2)}$ **(**CO 2)[HOT] Evaluate

12. (i) Find $\frac{dy}{dx}$, if Y = $\sqrt{\frac{1-tanx}{1+tanx}}$ w. r. to x **(C**O 2)[HOT] Evaluate

Marks: 20

13. (i) State Rolle's Theorem and verify the given function $f(x) = x^3 - 6x^2 + 11x - 6$ in [1, 3]. (ii) If y = (x2 + 5x -1)log(x3 + 1) + (x+1)/(x+2)(x+3) then find dy/dx.

(CO 2) [HOT] Evaluate

14. (i) State Mean Value theorem and verify the given function f(x) = x(x-1) (x-2). at [a = 0, b= 1/2] (ii) Find the function has Maximum and minimum value y= $x^3 + 6x^2 - 15x + 5$

(CO 2) [HOT] Evaluate

Module – III (Section-B)

Marks: 10

15. Evaluate $(i)\ \int x\ Sinx\ dx$ (ii) $\int (x^4\ + 4x^3 + x^{-2}$ +1/x+ 4) dx

(CO3) [HOT] Apply

16. Evaluate $\int x^2\ Sin2x\ dx$ (CO3) [HOT] Apply

17. Evaluate $\int (3\sin x - 4\ cosx + 5sec^2 x - 2cosec^2 x)\,dx$ (CO3) Remember [LOT]

18. Evaluate $\int \frac{1+sinx}{1-sinx}\ dx$ (CO3) [HOT] Evaluate

19. Solve $\int \frac{1}{1+sinx}$ dx (CO3) [HOT] Evaluate

20. Solve $\int x^2\ logx\ dx$ (CO3) [HOT] Evaluate

Marks 20

21. Evaluate $(i) \int \frac{2}{(1-x)(1+x^2)}\ dx$ (CO3) [HOT] Evaluate

$(ii) Prove\ tht\ \int_0^{\pi/2} \frac{sin^2 x}{(1+sinx.\cos x)} dx = \pi/3\sqrt{3}$

22. Evaluate $(i)\ \int \frac{x-1}{(x-3)(x+2)}\ dx$ (CO3) [HOT] Evaluate

(ii) $\int x^2\ e^{3x}\ dx$

Module – IV (Section-B)

Marks: 10

23. Verify that y = Acosx – Bsinx is a solution of the differential equation $\frac{d^2y}{dx^2} + y = 0$ (CO4) [HOT] Evaluate

24. Solve: (x+1) dx/dy - y = e^x $(x+1)^2$ (CO4) [HOT] Evaluate

25. Form the diff. Equation of the family of curves y = e^x(A Cos x + B Sin x) where A and B are arbitrary const. (CO4)) [HOT] Evaluate

26. Find the general solution of the differential equation log(dy/dx) = ax + by)

(CO4)) [HOT] Evaluate

27. Verify the given differential equation is exact or not

$$(5x^4 + 3y^2x^2 - 2x\,y^3)\ dx + (2\,x^3y\ - 3\,y^2x^2 - 5\,y^4)\ dy = 0$$

(CO4)) [HOT] Apply

28. Solve the Linear differential equation Sec x $\frac{dy}{dx}$ = y + Sin x

(CO4) [LOT] Evaluate

Marks - 20

29. (i) Solve $x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^x$ (CO4) Evaluate [(HOT]

(ii) Solve $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2\,\partial y} + 4\frac{\partial^3 z}{\partial x^3} = e^{x+2y}$

30. (i) Solve y''- $3y'$+2y = e^{3x}+ Sin 2x (CO4) Evaluate [HOT]

(ii) Find the general solution of the differential equation:

$$x\sqrt{1-y^2}dx + y\sqrt{1-x^2}dy = 0$$

****

Summary Sheet

CO Wise

CO	Q. No.	Marks
CO1	1 to 12, 1 to 5, 6 to 7	12, 50, 40 = 102
CO2	13 to 24, 8 to 12, 13 to 14	12, 50, 40=102
CO3	25 to 35, 15 to 20, 21 to 22	11, 60, 40=111
CO4	36 to 40, 23, to 28, 29 to 30	5, 60, 40=105
	Total =	**420**

Unit Wise

Unit	Q. No.	Marks
Unit 1	1 to 12, 1 to 5, 6 to 7	**102**
Unit 2	13 to 24, 8 to 12, 13 to 14	**102**
Unit 3	25 to 35, 15 to 20, 21 to 22	**111**
Unit 4	36 to 40, 23, to 28, 29 to 30	**105**
	Total =	**420**

Blooms Taxonomy Level (BTL) Wise

BTL	Q. No.	Marks
LOT	1 to 12, 13 to 24, 25 to 35, 36 to 40,	40
HOT	1 to 5, 6 to 7, 8 to 12, 13 to 14, 15 to 20, 21 to 22, 23, to 28, 29 to 30	380
	Total =	**420**

Course Outcome:

After the successful completion of the course, the students will be able to:

1. Understand determinants, matrices and their properties.
2. Apply the Fundamental Principle of Counting, Multiplication Principle, Baye's Theorem and Binomial distribution.
3. Describe the concept of vector algebra and its application.
4. Analyze characteristics and properties of two- and three-dimensional geometric Shapes and develop mathematical arguments about geometric relationships

Prepared By: Prof. (Dr.) Manoj Kumar Mandal

<u>Disclaimer</u>: - This is a practice set. The Question in End term examination will differ from this practice set. This practice set is meant for practice only.