

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड.

CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER PATTERN FACULTY OF SCIENCE B.A./B.Sc. (Mathematics)

CURRICULUM

Note:

1. Assessment shall consist of Continuous assessment (CA) and End of Semester Examination (ESE).
2. Weightage: 80% for ESE & 20% for CA.
3. First/Second Semester consists of Two Theory Papers each of 50 marks [40ESE + 10 CA] and One Lab Course 100 marks.
4. Workload includes Unit tests.

B.A./B.Sc. (Mathematics) Semester I and II
Curriculum will be progressively effective from June-2019 Onwards.

Semester	Section and Paper Code	Period per week	Paper No. and Title of the papers	Marks of Semester	Internal C.A.	Total Marks	Credits
I	CCM-1 Section A	4	Paper -I Differential calculus	40	10	50	2
	CCM-1 Section B	4	Paper-II Algebra and Trigonometry	40	10	50	2
II	CCM-2 Section A	4	Paper -III Integral calculus	40	10	50	2
	CCM-2 Section B	4	Paper-IV Geometry	40	10	50	2
Lab Course work (Annual Pattern Practical)	CCMP-1 Based on CCM1 and CCM2	2	Paper-V Practical On MAT-LAB only for B.Sc. Students	80	20	100	4
Total Credit							12

B.A. / B.Sc.F.Y. Semester-I
(CBCS PATTERN)
CCM-1, Section-A
Paper I: Calculus-I (Differential Calculus)

Course Description: This course provides an elementary knowledge of Limit, Continuity, Differentiation, higher order Derivatives, Expansion of functions, Equation of Tangent and Normal, Mean Value Theorem, Partial Differentiation.

Objectives: A primary objective of the course is to learn elementary knowledge of Differential Calculus

Outcomes: After successful completion of the course student will be able to

1. Understanding concept of Limit, Continuity of Single and two variable Functions.
2. Find the Higher order derivatives of Product of Functions
3. Expand functions in terms of infinite series.
4. Find Equation of Tangent, Normal and Length of Tangent, Normal, Sub-tangent, Sub-normal.
5. Understanding of Mean Value Theorem concepts.
6. Understand the concept of Partial differentiation.
7. Use the results to solve problems.
8. Differentiate difference between derivative of single variable and two variables.

Unit-I: Differentiation

Derivability and derivative, derived function, derivability implying continuity, geometrical interpretation of a derivative, derivatives of hyperbolic functions, derivatives of inverse hyperbolic functions, Higher order derivatives, calculation of the n th derivative, determination of n th derivative of rational functions, n th derivatives of the products of the powers of sines and cosines, Leibnitz theorem.

Unit-II: Expansion of functions, Tangents and Normals

Maclaurin's theorem, Taylor's theorem, Equations of the tangent and normal, Angle of intersection of two curves, length of the tangent, normal, sub-tangent, sub-normal, pedal equations.

Unit-III: Mean Value Theorems

Rolle's Theorem, Lagrange's mean value theorem, Meaning of sign of derivative, Graphs of hyperbolic functions, Cauchy's mean value theorem, Generalized mean value theorems (Taylor's theorem, Maclaurin's theorem).

Unit-IV: Partial Differentiations

Introduction, Functions of two variables, Neighborhood of a point (a,b), Limit and Continuity, Partial derivatives, Geometrical Interpretation, Homogeneous functions, Euler's Theorem on homogeneous function and corollary, Theorems on total differentials, Equality of $f_{xy}(a, b)$ and $f_{yx}(a, b)$, Equality of f_{xy} and f_{yx} , Taylors theorem for functions of two variables (Only Statement).

Text Book 1:

Differential Calculus by Shanti Narayan and Dr. P. K. Mittal, S. Chand and Co. Ltd. Revised Edition 2012 (Reprint 2013).

Scope:

Unit I: Chapter 4: 4.1, 4.1.1 to 4.1.5, 4.7, 4.7.1, 4.7.2, Chapter 5: 5.1 to 5.5.

Unit-II: Chapter 6: 6.1, 6.2, Chapter 7: 7.1, 7.2, 7.2.1, 7.2.2, 7.3 to 7.5.

Unit-III: Chapter 8: 8.1 to 8.3, 8.3.1 to 8.3.3, 8.4 to 8.6, 8.6.1.

Unit-IV: Chapter 11: 11.1 to 11.5, 11.6, 11.7, 11.7.1, 11.8, 11.8.1, 11.9, 11.9.1, 11.10, 11.10.1, 11.11, 11.11.1.

REFERENCES :

1. Differential Calculus by Shanti Narayan, S. Chand and Co. Ltd.
2. Text book on Differential Calculus by Gorakh Prasad, Pothishala Private limited Allahabad
3. Calculus , Schaum's outline series by Ayres F.Mc Graw Hill, 1981
4. Differential calculus by Edwards J., Mac Millan and Co. Ltd
5. Introduction to Calculus by Green Span D. , Harper and Row.
6. Lectures on Calculus and Differential Equations by T M Karade and M S Bendre, Sonu Nilu Bandu, Nagpur.
7. Theory and Problems on Advance Calculus by Murray and R.. Spiegel ,Schaum Pub. Co. New York
8. Advanced Calculus by G.P. Shrivastav, Hari Kishan, Nagendra Kumar, Ram Prasad and sons pub.

B.A/B.Sc.F.Y. Semester-I
(CBCS PATTERN)
CCM-1,(Section B)
Paper II: Algebra and Trigonometry

Course Description: This course provides an elementary knowledge of Matrix, Types of Matrices, Adjoint of a Square Matrix, Rank of a Matrix, Linear Equations, Characteristic Roots and Characteristic Vectors, Trigonometry, and Complex Quantities.

Objectives: A primary objective of the course is to learn elementary knowledge of Matrices, Complex Numbers, and Trigonometry.

Outcomes: After successful completion of the course student will be able to

1. Add, Subtract and Multiply two Matrices.
2. Recognize the different types of Matrices.
3. Find the Inverse of invertible Matrices.
4. Determine the Rank of a Matrix.
5. Transform matrix to Row Echelon form
6. Solve the System of Linear Equations.
7. Find the Characteristic Roots and Characteristic Vectors of a Square Matrix.
8. Check that every square matrix satisfies its own Characteristic Polynomial.

Unit-I: Matrices

Matrix, Different Types of Matrices, Equality of Matrices, Addition (Sum) of Two Matrices, Properties of Matrix Addition, Subtraction of Two Matrices, Multiplication of a Matrix by a Scalar, Properties of Multiplication of a Matrix by a Scalar, Multiplication of Two Matrices, Properties of Matrix Multiplication, Positive Integral Powers of a Matrix, Transpose of a Matrix, Conjugate of a Matrix, Transposed Conjugate of a Matrix, Determinant of a Square Matrix, Minor of an Element, Co-factor of an Element, Adjoint of a Square Matrix, Inverse of a Square Matrix, Singular and Non-singular Matrix, Orthogonal Matrices, The Determinant of an Orthogonal Matrix, Unitary Matrix.

Unit-II: Rank of a Matrix

Minor of Order k of a Matrix, Rank of a Matrix, Elementary Row and Column Operations, Elementary Operations, The Inverse of an Elementary Operation, Row and Column Equivalent, Equivalent Matrices, Working Procedure for Finding Rank Using Elementary Operations, Row- Echelon Matrix, Row Rank and Column Rank of a Matrix.

Unit-III: Linear Equations

Linear Equations, Equivalent Systems, System of Homogeneous Equations. Characteristic Roots and Characteristic Vectors : Definitions, To Find Characteristic Vectors, Cayley-Hamilton Theorem (Statement Only)

Unit-IV: Trigonometry

Complex Quantities, DeMoivre's Theorem, Expansions of $\sin n\theta$ and $\cos n\theta$, Expansions of the sine and cosine of an Angle in Series of Ascending Powers of the Angle, Expansions of the sines and cosines of Multiple Angles, and of Powers of sines and cosines, Exponential Series for Complex Quantities, Circular Functions for Complex Angles, Hyperbolic Functions, Inverse Circular Functions, Inverse Hyperbolic Functions.

Text Book 1:

Topics in Algebra by Om P. Chug, Kulbhushan Prakash, A.D.Gupta, Anmol Publications Pvt. Ltd., New Delhi (First Edition 1997)

Scope:

Unit I: Chapter 10: 10.1 to 10.17 (10.13, 10.15, 10.17 Only Statements), 10.20 to 10.22, 10.27 to 10.32, 10.34 to 39 (10.39 Only Statements)

Unit II : Chapter 11 : Art 11.1, 11.2, 11.5 to 11.16.

Unit-III: Chapter-11: 11.32 to 11.39, Chapter 12 : Art 12.1 to 12.3, 12.18 (Only Statement)

Text Book 2: Plane Trigonometry Part II by S.L.Loney, A.I.T.B.S. Publishers and Distributors, Delhi (Reprint 2003)

Unit-IV: Art. 17, 18 19, 21, 22, 27, 32, 33, 42, 43, 44, 45, 46, 47, 56, 57, 58, 59, 60, 61, 62, 63, 67, 68, 69, 71, 73, 74, 76, 77, 79.

REFERENCE BOOKS :

1. A Text Book of Matrices by Shanti Narayan (S.Chand and Company Ltd., New Delhi).
2. Matrices by A.R.Vasishtha Krishna Prakashan Media (P) Ltd., Meerut.
3. First Course in Linear Algebra by P.B.Bhattacharya, S.K.Jain, S.R.Nagpaul (New Age International (P) Limited Publishers).
4. Elementary Topics in Algebra by K. Khurana and S.B. Malik, Vikas Publishing House Pvt. Ltd., New Delhi.
5. Higher Trigonometry by B. C. Das and B. N. Mukherjee, U.N.Dhur and Sons Private Ltd. Kolkata.
6. Arihant Trigonometry by Amit M. Agrawal (Arihant Publication Pvt. Ltd).
7. Lectures on Algebra and Trigonometry by T M Karade and M S Bendre, Sonu Nilu Bandu ,Nagpur.
8. Text Book on Trigonometry by R S Verma and K. S. Shukla, Pothishala Private limited pub.
9. Text Book on Algebra and Theory Of Equations by Chandrika Prasad, Pothishala Private limited pub.

B.Sc.F.Y. Semester-II
(CBCS PATTERN)
CCM-2, Section-A
Paper III: Calculus-II (Integral Calculus)

Course Description: This course provides the methods of finding integration, concept of integral and Its applications to find Area and Volume.

Objectives: The main objective of the course is to study methods of finding Integration of Algebraic Rational Functions, Irrational Algebraic Functions, Transcendental Functions, Study Gamma and Beta Functions, Multiple Integral and Applications of integration to find Area and Volume.

Outcomes: After successful completion of the course student will be able to

1. Apply method of integration to find the integral of function.
2. Solve examples of definite integrals using Properties definite integrals.
3. Find the area and volume of given shape.
4. Understanding concept of Gamma and Beta Functions.
5. Solve problems on Multiple Integrals.

Unit-I: Integration of Algebraic Rational Functions

Methods of Integration, Partial Fractions, Non-repeated linear factors only in the denominator, Linear or quadratic non-repeated linear factor, Integration of $\frac{(Lx+M)}{(Ax^2+2Bx+C)^n}$ where n is a positive integer different from 1, Reduction formula for $\int \frac{1}{(y^2+k^2)^n} dx$, Integration of algebraic rational functions by substitution.

Unit-II: Integration of Irrational Algebraic Functions

Integration of $\frac{1}{\sqrt{(ax^2+bx+c)}}$, Integration of $\sqrt{(ax^2+bx+c)}$, Integration of $(px+q)/\sqrt{(ax^2+bx+c)}$, Integration of $(c_0x^n+c_1x^{n-1}+\dots+c_n)\sqrt{ax^2+bx+c}$, Integration of $1/(Ax+B)\sqrt{(Cx+D)}$, Integration of $1/(ax^2+bx+c)\sqrt{px+q}$, Integration by Rationalisation, Integration of $x^m(a+bx^n)^p$, where m, n and p are not necessarily integers, Reduction formulae for $\int x^m(a+bx^n)^p dx$.

Unit-III: Integration of Transcendental Functions

Reduction formula for $\int \sin^m x dx$ and $\int \cos^n x dx$, where m and n are positive integers, Reduction formula for $\int \sin^m x \cos^n x dx$, Integration of $\sin^m x \cos^n x$, Reduction formula for $\int \tan^n x dx$ and $\int \cot^n x dx$, Reduction formula for $\int \sec^n x dx$ and $\int \operatorname{cosec}^n x dx$, Reduction formula for $\int e^{ax} \sin^m bx dx$ and $\int e^{ax} \cos^n bx dx$, Definite Integrals: Definitions, Properties of Definite Integrals, Definite Integral as the Limit of a Sum.

Unit-IV: Beta, Gamma Functions and Multiple Integrals

Gamma Function, A Fundamental Property of Gamma Function, Product of two Integrals, Value of $\Gamma(\frac{1}{2})$, Beta Function, Relation between beta and gamma function, Integration of $\sin^{2m-1} \theta \cos^{2n-1} \theta$, Double integrals, limit of integration for $\iint f(x, y) dx dy$, Area by

double integration, Volume under a surface, Polar coordinates(Evaluation of double integral statement only), Change from cartesian to Polar Coordinates.

Text Book 1:

Integral Calculus by Shanti Narayan, S.Chand Company Ltd. Edition-1994 (Reprint-1997).

Scope:

Unit I: Chapter 2: 2.1, 2.2, 2.8, Chapter 3: 3.1 to 3.4, 3.4.1, 3.5, 3.5.1, 3.6

Text Book 2:

A textbook of Integral Calculus by U.P. Singh, R.J. Shrivastava and N.H. Siddiqui, Wisdom Press, Edition -2011.

Scope:

Unit-II: Chapter 2: 12.1 to 12.6, 12.9, 12.11, 12.12

Unit-III: Chapter 3: 13.1 to 13.5, 13.11, Chapter 4: 14.1, 14.2, 14.3, 14.4

Unit-IV: Chapter 5: 15.1 to 15.7, Chapter 6: 16.1 to 16.3, 16.5 to 16.8

REFERENCES :

1. Mathematical Analysis by S.C.Malik and Savita Arora (Second revised edition).
2. Integral Calculus by Gorakh Prasad, Pothishala Private Limited, 2, Lajpat Road, Allahabad-211002
3. Integral calculus by Shanti Narayan and P.K.Mittal,S.Chand and Comp.Ltd.
4. Calculus by G.B. Thomas and R.L. Finney, 9th edition, Pearson Education, Delhi, 2005.
5. Calculus by H. Anton, I. Bivens and S. Davis, John Wiley and Sons(Asia) Pvt. Ltd.
6. Calculus A Complete Course by Robert A. Adams, Pearson Addition Wesley, Toronto.

B.Sc.F.Y. Semester-II
(CBCS PATTERN)
CCM-2, Section-B
Paper IV: (Geometry)

Course Description: This course provides an elementary knowledge of Co-ordinates, Transformation of Co-ordinates, Direction Cosines, Plane, Right Line, Sphere, Cones, and Cylinder.

Objectives: A primary objective of the course is to learn elementary knowledge of Three Dimensional Geometry.

Outcomes: After successful completion of the course student will be able to

1. Understanding concepts on Three Dimensional Geometry.
2. Find equations of Right lines, Planes, Spheres, Cones and Cylinders.
3. Find the Direction cosines of any line under the different given conditions.
4. Understand the intersection of any two or three, three dimensional geometrical figures.
5. Transform the equation of a plane to the normal form.
6. Transform equation of line from the unsymmetrical to the symmetrical form.
7. Find the length of perpendicular from a point to a plane.
8. Find the angle of intersection of two spheres.
9. Understanding concepts of plane of contact.

Unit-I: Co-ordinates and Transformation of Co-ordinates

Direction cosines of a line, a useful relation, relation between direction cosines, Projection on a straight line, projection of a point on a line, projection of a segment on another line, projection of a broken line, projection of the join of two lines. Angle between two lines.

Transformation of Co-ordinates: Introduction, change of origin, change of the direction of a axes, relation between direction cosines of three mutual Perpendicular lines.

Unit-II: The Plane

General equation of first degree, converse of the preceding theorem, Transformation to the normal form, direction cosines of the normal to a plane, angle between two planes, determination of plane under given conditions, intercept form of the equation of a plane, plane through three points, system of planes, two sides of a plane, length of perpendicular from a point to a plane, bisectors of angle between two planes.

Unit-III: Right line

Representation of line, equation of line through a given point drawn in a given direction, equation of a line through two points, two forms of the equation of line, Transformation from the unsymmetrical to the symmetrical form, angle between a line and a plane, condition for a line to lie in a plane, coplanar lines, condition for coplanarity of lines, Number of arbitrary constants in the equation of straight line, determination of lines satisfying given conditions, the shortest distance between two lines, length of the perpendicular from a

point to a line.

Unit-IV: Sphere, Cones and Cylinders

Definition, equation of sphere, General equation of a sphere, The sphere through four given points, sphere, plane section of a sphere, intersection of two spheres, sphere with a given diameter, equation of a circle, Power of a point, equation of a tangent plane, plane of contact, the polar plane, pole of plane, some results concerning poles and polars, angle of intersection of two spheres, condition for the orthogonality of two spheres. Cones, cylinders: Definition, equation of a cone with a conic as a guiding curve, The right circular cone, definition, the cylinder, equation of a cylinder, the right circular cylinder, definition.

Text Book 1:

Analytical Solid Geometry, by Shanti Narayan and Dr. P.K. Mittal (S. Chand Publication.) (Reprint 2015).

Scope:

Unit I: Chapter 1: Art. 1.6, to 1.8, 1.9. Chapter 5: Art. 5.1 to 5.2.

Unit-II: Chapter 2: Art. 2.1 to 2.7.

Unit-III: Chapter 3: Art. 3.1 to 3.7.

Unit-IV: Chapter 6: Art. 6.1 to 6.7. Chapter 7: Art. 7.1, 7.1.1, 7.6, 7.6.1, 7.7, 7.7.1, 7.8, 7.8.1.

REFERENCES BOOKS :

1. Analytical Geometry of two and three dimensions, by Quiz Zameeruddin: Narsoba Pub.
2. Text Book on coordinate Geometry, by Gorakh Prasad, H.C. Gupta; Pothishala Pub.
3. Lecturers on Vector Analysis and Geometry, by T.M. Karde and M.S. Bendre.
4. Analytical Geometry of Three dimensions, by N. Saran and R.S. Gupta, Pothishala Pub.
5. A Text Book of Analytical Geometry of Three dimensions, by P. K. Jain and Khalil Ahmad, Wiley Eastern Ltd.
6. Elementary Treatise on Co-ordinate geometry of three Dimensions by R.J.T. Bell, Mac Millan India Ltd.

B.Sc.F.Y. Semester-II
(CBCS PATTERN)
CCMP-1, Based on CCM-1 and 2, Section-A
(Annual pattern)
Paper V: (PRACTICAL PAPER)
(Periods per Batch 2 per week , max . marks 100)

SOFTWARES: MATLAB or Related Freeware.

Note: PRACTICAL PAPER IS ONLY FOR B.Sc. Students.

Course Description: This course provides the Introduction to MATLAB , Interactive computation, Plotting of Graphs using MATLAB Software.

Objectives: The main objective of the course is to study MATLAB software and its application to solve problems in matrices and to plot the graphs of different functions.

Outcomes: After successful completion of the course student will be able to

1. Verify associativity of matrix addition, left distributive law and right distributive law of matrices.
2. Find determinant, eigen values, eigen vectors, inverse, powers and characteristics polynomial of a square matrix.
3. To draw the graph of different functions with the help of MATLAB software and related Freeware.

Section 1: Introduction to MATLAB:

MATLAB Programming language, Built-in Functions, Graphics, computations, External interface and Tool boxes. Basics of MATLAB: MATLAB windows, desktop, command window, workspace, Figure and Editor Windows, Input-output, File types, platform dependence, Printing. Programming in MATLAB: Scripts and 14 functions. Script files, function files: Executing of function, writing good functions, sub functions, compiled functions.

Section 2: Interactive computation :

(MATRICES) Matrices and Vectors, input, indexing, matrix manipulation, creating vectors. Matrix and Array operations, Arithmetic operations, Relational operations, logical operations, Elementary math functions, matrix functions, character string. Command line Functions, Inline functions, Anonymous functions. Built-in functions, finding the determinant of matrix, finding eigen-values and eigenvectors. Saving and loading Data, Importing data files, recording a session. Applications: - Linear Algebra. Solving a linear system, Gaussian elimination, Finding eigenvalues and eigenvectors, matrix factorization, advanced topics.

Section 3: Plotting of Graphs:

Plotting simple Graphs. Graphics: - Plotting of 2D graphs, Using subplot for multiple graphs, 3DPlots (Drawing of different Geometrical objects), saving and Printing.

Reference Book 1:

(for MATLAB Users).

1. Getting Started With MATLAB 7 by Rudra Pratap, Oxford University Press, (Indian Eden)www.oup.com, ISBN-0-19-568001-45.

Scope:

Chapter 1: Art. 1.1,1.6. Chapter 3: Art. 3.1, 3.2, 3.4, 3.5, 3.6, 3.7,

Chapter 4: Art. 4.1, 4.2

Chapter 5: Art. 5.1

Chapter 6: Art 6.1, 6.2, 6.3.

Reference Book 2:

(for Scilab Users).

1. SCILAB: A Practical Introduction to Programming and Problem Solving by Tejas Sheth

NOTE:

1. Section 1 is introductory part, so no question to be set for Examination.
2. Record book must contain 10 practical on section 2 and 10 Practical on section 3.

B.Sc. F.Y. PRACTICAL PAPER
(Annual pattern)
WITH EFFECTIVE FROM June 2019
(LIST OF PRACTICALS)

N.B.: PRACTICAL PAPER IS ONLY FOR B.Sc. STUDENTS.

Any twenty of the following practical problems :

1. To enter the Matrix A and pick-out following entries from it : $A_{11}, A_{21}, A_{22}, A_{23}$.
2. To find the transpose a matrix.
3. For two matrices A and B, to find $A + B$ and $B + A$ and to verify whether the matrix addition is commutative.
4. For a square matrix A to find A^2, A^3, A^4, A^5 .
5. For two matrices A and B, confirmable for multiplication from both sides, to find AB and BA .
6. To verify the associativity of matrix addition.
7. To verify both left distributive law and right distributive law.
8. To find the determinant of a square matrix.
9. To find the inverse of a square matrix
10. To find the rank of the matrices.
11. To solve the system of linear equations whose matrix equation is $Ax = b$ and check the solution.
12. To find the eigen values of a square matrix.
13. To find the eigen vectors of a square matrix.
14. To find the characteristic polynomial of a square matrix.
15. To find the conjugate of a matrix.
16. To plot $f(x) = e^{\frac{-x}{10}} \sin x$ for x between 0 and 20.
17. To plot $r(\theta) = 1 + 2 \sin(2\theta)$ for $0 < \theta < 2\pi$.
18. To plot the contours of $z = \cos x \cos y \exp(\sqrt{x^2 + \frac{y^2}{4}})$ over the default domains.
19. To plot the surface for $z = \frac{-5}{(1+x^2+y^2)}$ over the domain $|x| < 3$ and $|y| < 3$.
20. To plot multiple graphs $y_1 = \sin t, y_2 = t, y_3 = 1 - \frac{t^3}{3!} + \frac{t^5}{5!}$ in same figure window.
21. To plot $x = e^{-t}, y = t, 0 \leq t \leq 2\pi$.
22. To plot $f(t) = t \sin t, 0 \leq t \leq 10\pi$.
23. To plot the surface $z = \frac{xy(x^2-y^2)}{x^2+y^2}, -3 \leq x \leq 3, -3 \leq y \leq 3$ by computing the values of z over 50×50 grid on specified domain.

24. To draw a cylinder with base radius $r = 40$ and top radius $r = 60$.
25. To plot the unit sphere.
26. To draw discrete data plot with stems : $x = t, y = t \sin(t), z = e^{\frac{t}{10}} - 1$ for $0 \leq t \leq 6\pi$.
27. To draw the MATLAB logo $z = \cos x \cos y e^{-\frac{\sqrt{x^2+y^2}}{4}}$ for $|x| \leq 5, |y| \leq 5$.
28. To draw the pie chart for the world population by continents for data.
29. To draw the bar chart for the world population by continents for data.
30. To plot $x = t, y = e^t, 0 \leq t \leq 2\pi$.