SAURASHTRA UNIVERSITY
RAJKOT

MATHEMATICS

Syllabus
B.Sc. Semester-3 & 4

According to Choice Based Credit System
Effective from June – 2020

(Updated on 01-01-2020 and updation implemented from June-2020)
**SAURASHTRA UNIVERSITY RAJKOT.**

New Syllabus of B.Sc. Semester-3
According to Choice Based Credit System
**Linear Algebra & Real Analysis**
*(New Syllabus Effective from June - 2020)*

- **Program:** B.Sc.
- **Semester:** 3
- **Subject:** Mathematics
- **Course code:** 03 (A)-Theory
- **Title of Course:** Linear Algebra & Real Analysis
- **Marks for External Examination:**
  - Total Marks → 70 Marks
- **Segment-wise Distribution of Marks for Internal Examination:**
  - Internal exam. → 10 Marks
  - Assignments → 10 Marks
  - Quiz → 05 Marks
  - Attendance → 05 Marks
  - Total Marks → 30 Marks
- **Credit of the Course:** 6 Credits
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SAURASHTRA UNIVERSITY, RAJKOT
B.Sc. SEMESTER -3 (CBCS)

(New Syllabus Effective from June - 2020)

MATHEMATICS PAPER- 03 (A) Theory
Linear Algebra & Real Analysis

[70 Marks/ 2 1/2 Hours]

Unit 1:  **Vector space, Linear Dependence, Independence of Vectors and Basis of a Vector space:**

- Introduction of Vector space and vectors in , Definition of a Field, Definition of Vector space, Properties of Vector space, Some Standard Vector space, Examples of Vector space, Linear Combination and Span and Subspace, Concept of Linear combination and its examples, Concept of Linear span and its examples, Concept of Subspaces , Sum and Direct sum of subspaces and their examples, Complementary subspace, Disjoint subspace, Quotient space, Theorem related to subspaces and Linear span, Linearly dependence of vectors, Linearly independence of vectors, Theorem and Examples based on this, Geometrical Representation of Linearly Dependence and Independence of vectors, Basis of a vector space, Co-ordinates of vectors respect to basis, Existence theorem for basis, Invariance of the number of the elements of a basis set, Examples and theorem of basis.

Unit 2:  **Basis of a Vector space & Dimension of a Vector space:**

- Basis of a vector space, Co-ordinates of vectors respect to basis, Existence theorem for basis, Invariance of the number of the elements of a basis set, Examples and theorem of basis, Definition of a dimension of Vector space, Existence of Complementary subspace of subspace of finite dimensional vector space, Dimension of sum of subspaces, Example based on dimension, Theorem based on dimension.

UNIT 3:  **Vector Differentiation**

- Vector point functions and Scalar point functions, Vector Differentiation, Laplace operator, Laplace equation, Gradient, Divergence and Curl.

UNIT 4:  **Multiple Integral**

- Double and triple integrals, Application of double and triple integration as area and volume, Change of variable by Jacobian, Change of variables from Cartesian to polar co-ordinates and triple integration in spherical co-ordinates and cylindrical co-ordinates.

UNIT 5:  **Vector Integration & Beta & Gamma Functions**

- Line integral and Green’s theorem & its application to simple problems, Surface integral, Volume Integral, Statement of Divergence theorem(Gauss) & its application to simple problems and Statement of Stoke’s theorem & its application to simple problems. Beta and Gamma functions and relation between them. Value of \( \int_{-\infty}^{\infty} e^{-x^2} \, dx \) as gamma function, Duplication formula. Legendre’s Formula(without proof).

Implemented from June - 2020
Notes:

- There shall be **SIX** periods of 55 minutes per week for Mathematics- **03 (A)-Theory**.
- There shall be one question paper of 70 marks & \( \frac{3}{2} \) hours for Mathematics- **03 (A)-Theory**.

**Format of Question Paper**

- Question Paper will be of **70 Marks** with the following type of **FIVE questions** covering the whole syllabus in equal weightage, **each of 14 marks**.
- There will be one question of 14 marks from each of the 5 units.
- Question 1, 2, 3, 4, and 5 will cover unit 1, 2, 3, 4, and 5 respectively.

<table>
<thead>
<tr>
<th>Question no.</th>
<th>(a) Attempt all FOUR each of ONE 4 Marks</th>
<th>(b) Answer any ONE out of TWO 2 Marks</th>
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<th>(d) Answer any ONE out of TWO 5 Marks</th>
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<td><strong>14 MARKS</strong></td>
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</tbody>
</table>

**TEXT BOOKS:-**

1. An Introduction to Linear Algebra by Krishnamurthy, Mainra and Arora

**REFERENCE BOOKS:-**

2. Differential Calculus by Shanti Narayan, S.Chand & co., New Delhi
3. Differential Calculus by Gorakhprasad, Pothishala Pvt. Ltd., Allahabad
OBJECTIVES
Students will
• acquire knowledge of vector space, basis of vector space, vector differentiation & integration and multiple Integral.
• acquire knowledge of Beta, Gamma function and solve their problems.
• understand concept of terminology of vector space and vector calculus.
• solve problems of Sequences and Infinite Series and Vector Calculus.

COURSE OUTCOMES
Students will be able to-
• recall definitions of vector space, basis of vector space, vector differentiation & integration and multiple integral.
• understand usage of multiple integration.
• prove some results of vector space and vector differentiation and integration.
• remember definitions and theorems of Vector differentiation and integration.
• understand multiple integration.
• find differentiation and integration of vectors.
• solve problems of multiple integration.
• prove results of beta and gamma function.
• solve problems of beta and gamma function.
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Syllabus of B.Sc. Semester-4
According to Choice Based Credit System
Linear Algebra, Real Analysis & Differential Geometry
(New Syllabus Effective from June - 2020)

- Programme: B.Sc.
- Semester: 4
- Subject: Mathematics
- Course code: 04 (A)-Theory
- Title of Course: Linear Algebra, Real Analysis & Differential Geometry

- External Examination: Total Marks → 70 Marks
- Segment-wise Distribution of Marks for Internal Examination:
  - Internal exam. → 10 Marks
  - Assignments → 10 Marks
  - Quiz → 05 Marks
  - Attendance → 05 Marks
  - Total Marks → 30 Marks

- Credit of the Course: 6 Credits
UNIT 1: **Sequences**

Definition of a sequence, Bounded sequences, Convergence of a sequence, Limit point of a sequence, Limits Inferior and Superior, Bolzano-Weierstrass Theorem, Convergent sequences, Cauchy’s sequence, General principle of convergence of sequence, Algebra of sequences, Subsequence, Monotonic sequences, Some important sequences including $\left\{a_n\right\}$, $\left\{a_1 + a_2 + \ldots + a_n \right\}$.

Unit 2: **Infinite Series**

Series of non-negative terms, Geometric series, p-test, Comparison test, Cauchy’s Root test, D’Alembert’s Ratio test, Raabe’s test, Logarithmic Test, Alternating series. (All the tests without proof).

Unit 3: **Linear Transformation**

Concept of Linear Transformation, Zero and Identity Linear Transformation, Properties of Linear Transformation, Example based on Linear Transformation, Range space of Linear Transformation, Nullity and rank of Linear Transformation, Theorem and Example based on Linear Transformation.

Unit 4: **Representation of Transformations by Matrices**

Concept of Linear functional, Dual of a vector space, Adjoint of a Linear Transformation, Eigen value and Eigen vectors of Linear Transformation, Eigen basis and Diagonalization of a Linear Transformation.

Unit 5: **Curvature, Asymptotes and multiple points**

Various formulae for curvature (formulae for Cartesian coordinates, parametric equations and Polar coordinates only), Newton’s method for curvature at origin, Concavity, Convexity and point of inflexion, Asymptotes parallel to co-ordinate axes, oblique type and algebraic methods, Rules for finding asymptotes. Multiple points, Types of double points.
Notes:-

- There shall be SIX periods of 55 minutes per week for Mathematics- 04 (A)-Theory.
- There shall be one question paper of 70 marks & $2\frac{1}{2}$ hours for Mathematics- 04 (A)-Theory

**Format of Question Paper**

- Question Paper will be of 70 Marks with the following type of FIVE questions covering the whole syllabus in equal weightage, each of 14 marks.
- There will be one question of 14 marks from each of the 5 units
- Question 1, 2, 3, 4, and 5 will cover unit 1, 2, 3, 4, and 5 respectively.

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<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td>14 MARKS</td>
</tr>
</tbody>
</table>

**TEXT BOOKS**

2. A course of mathematical Analysis by Shanti Narayan, S.Chand & Co., New Delhi

**REFERENCE BOOKS:-**

1. Shantinarayan, A course of Mathematical Analysis, S. Chand & Sons.
3. Shantinarayan, A course of Mathematical Analysis, S. Chand & Sons.
4. Linear Algebra by J.N. Sharma and A.R. Vasishtha, Krishna Prakashan Mandir, Meerut
6. Linear Algebra by K.Hoffman and R. Kunza
OBJECTIVES

Students will

- acquire knowledge of Linear Algebra, Real Analysis & Differential Geometry.
- solve problems of Linear Algebra, Real Analysis & Differential Geometry.

COURSE OUTCOMES

Students will be able to:

- recall definitions of terminology related to sequence and series.
- understand different tests of convergence and divergence.
- judge which test of convergence is applicable.
- check convergence of series.
- understand concept of linear transformation and representation transformation by matrices.
- understand theorems of linear theorem.
- prove results based on linear transformation.
- recall concept of curvature, asymptotes and multiple points.
- understand formulae for Cartesian coordinates, parametric equations and Polar coordinates.
- find asymptotes and multiple points.
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Syllabus of B.Sc. Semester-3
According to Choice Based Credit System
(New Syllabus Effective from June - 2020)

• Programme: B.Sc.
• Semester: 3
• Subject: Mathematics
• Course code: 03(B) (Practical)
• Title of Course: Numerical Methods
• Total Marks of External Practical Examination: 35 Marks
• Total Marks of Internal Practical Examination: 15 Marks
  Continuous internal assessment of practical work
• Total Marks of Practical Examination:
  External → 35 Marks
  Internal → 15 Marks
  Total → 50 Marks

• Credit of the Course: 3 Credits
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MATHEMATICS PAPER-03(B) (Practical)
Numerical Methods

[50 Marks / 3Hours]

Pr. No. (1) Solution of algebraic and transcendental equation by Graphical method
Pr. No. (2) Solution of algebraic and transcendental equation by Bisection method
Pr. No. (3) Solution of algebraic and transcendental equation by False position method (Regula Falsi Method)
Pr. No. (4) Find all asymptotes for given curve
Pr. No. (5) Solution of algebraic and transcendental equation by Iteration method
Pr. No. (6) Solution of algebraic and transcendental equation by Newton-Raphson’s method
Pr. No. (7) Applications of Newton-Raphson’s method
Pr. No. (8) Transformation of equation
Pr. No. (9) Derivatives of a polynomial by synthetic division method
Pr. No. (10) Horner’s method for solving polynomial equation. Journal and viva

Notes:

- There shall be SIX periods of 1 hour per week per batch of 15 students.
- 10 practical should be done during semester-3.
- At the time of examination candidate must bring his/her own practical journal duly certified and signed by H.O.D.
- There shall be one question paper of 35 Marks and 3 Hours for practical examination
- There shall be 15 marks for Internal Practical Examination (i.e. Continuous internal assessment of performance of each student during the practical work.)

Format of Question Paper for Practical Examination (For paper 03(B) & paper 04(B))

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>Answer any THREE out of FIVE</td>
<td>27 Marks</td>
</tr>
<tr>
<td>Question 2</td>
<td>Journal and Viva:</td>
<td>8 Marks</td>
</tr>
<tr>
<td>Question 3:</td>
<td>Internal Practical Examination</td>
<td>15 Marks</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>50 Marks</td>
</tr>
</tbody>
</table>

Implemented from June - 2020
### OBJECTIVES
Students will
- understand various numerical methods.
- solve problems of numerical methods.

### COURSE OUTCOMES
Students will be able to-
- solve algebraic and transcendental equation by graphical method.
- solve algebraic and transcendental equation by bisection method.
- solve algebraic and transcendental equation by regula falsi method.
- solve algebraic and transcendental equation by iteration method.
- solve algebraic and transcendental equation by Newton Raphson method.
- solve polynomial equations by Horner's method.
- find all asymptotes for given curve
- derive polynomial by synthetic method.
- transform equation.
### Syllabus of B.Sc. Semester-4

According to Choice Based Credit System

*(New Syllabus Effective from June - 2020)*

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme</td>
<td>B.Sc.</td>
</tr>
<tr>
<td>Semester</td>
<td>4</td>
</tr>
<tr>
<td>Subject</td>
<td>Mathematics</td>
</tr>
<tr>
<td>Course code</td>
<td>04(B) (Practical)</td>
</tr>
<tr>
<td>Title of Course</td>
<td>Introduction to SciLab</td>
</tr>
<tr>
<td>Total Marks of External Practical Examination</td>
<td>35 Marks</td>
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<tr>
<td>Total Marks of Internal Practical Examination</td>
<td>15 Marks (Continuous internal assessment of practical work)</td>
</tr>
</tbody>
</table>
| Total Marks of Practical Examination | **External** → 35 Marks  
**Internal** → 15 Marks  
**Total** → 50 Marks |
| Credit Of The Course | 3 Credits |
**MATHEMATICS-PAPER- 04(B) (Practical) [35 Marks / 3Hours]**

**Introduction to SciLab**

<table>
<thead>
<tr>
<th>Practical no.</th>
<th>Objective of Practical</th>
<th>MARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>(1) To input row vectors and column vectors.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) To input square and rectangular matrices.</td>
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<tr>
<td>2.</td>
<td>(1) To obtain addition, subtraction and multiplication of matrix with scalar.</td>
<td>9 Marks</td>
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<tr>
<td></td>
<td>(2) To obtain sub matrices of given matrix and to delete rows and columns.</td>
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<tr>
<td>3.</td>
<td>(1) To find minors, cofactors and adjoint of a matrix.</td>
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<tr>
<td></td>
<td>(2) To find inverse of the matrix using adjoint of a matrix</td>
<td></td>
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<tr>
<td></td>
<td>(3) To learn commands zeros, ones, eye, rand, det(), inv(),</td>
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<tr>
<td>4.</td>
<td>(1) To draw the graph of a circle.</td>
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<tr>
<td></td>
<td>(2) To draw the graph of a parabola</td>
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<tr>
<td>5.</td>
<td>(1) To draw the graph of an ellipse.</td>
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<tr>
<td></td>
<td>(2) To draw the graph of a hyperbola</td>
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<tr>
<td>6.</td>
<td>(1) To draw graph of ( y = \sin(x) )</td>
<td></td>
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<tr>
<td></td>
<td>(2) To draw graph of ( y = \cos(x) ).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) To draw graph of ( y = \sec(x) )</td>
<td></td>
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<tr>
<td>7.</td>
<td>(1) To draw graph of ( y = \cosec(x) ).</td>
<td></td>
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<tr>
<td></td>
<td>(2) To draw graph of ( y = \tan(x) ).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) To draw graph of ( y = \cot(x) ).</td>
<td></td>
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<tr>
<td>8.</td>
<td>(1) To draw graph of ( y = \sin^{-1}(x) )</td>
<td>18 Marks</td>
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<tr>
<td></td>
<td>(2) To draw graph of ( y = \cos^{-1}(x) ).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) To draw graph of ( y = \sec^{-1}(x) )</td>
<td></td>
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<tr>
<td>9.</td>
<td>(1) To draw graph of ( y = \cosec^{-1}(x) ).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) To draw graph of ( y = \tan^{-1}(x) ).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) To draw graph of ( y = \cot^{-1}(x) ).</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>(1) To draw graph of ( y = \exp(x) ).</td>
<td></td>
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<tr>
<td></td>
<td>(2) To draw graph of ( y = \log_e(x) ).</td>
<td></td>
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<td></td>
<td>(3) To draw graph of ( y = \log_{10}(x) ).</td>
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<tr>
<td>11.</td>
<td>(1) To draw graph of ( y = \cosh(x) ).</td>
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<tr>
<td></td>
<td>(2) To draw graph of ( y = \tanh(x) ).</td>
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<tr>
<td>12.</td>
<td>(1) To draw graph of ( y = \sech(x) ).</td>
<td></td>
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<tr>
<td></td>
<td>(2) To draw graph of ( y = \csch(x) ).</td>
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<tr>
<td><strong>Journal and Viva</strong></td>
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<td>8 Marks</td>
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<tr>
<td><strong>Total Marks</strong></td>
<td></td>
<td>35 Marks</td>
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</tbody>
</table>
OBJECTIVES

Students will

- know the mathematical software SCILAB.
- use SCILAB to solve mathematical problems.

COURSE OUTCOMES

Students will be able to:

- input row vectors, column vectors and matrix.
- perform operation of matrices.
- draw graphs of trigonometric functions.
- draw graphs of hyperbolic functions.