

SAURASHTRA UNIVERSITY RAJKOT.

Syllabus of B.Sc. Semester-1 According to Choice Based Credit System Effective from June – 2016

*(Updated on date:- 06-02-2016
and updation implemented from June - 2016)*

- **Program:** B.Sc.
- **Semester:** 1
- **Subject:** Mathematics
- **Paper No:** 01 (A) - Theory
- **Title of the course** Calculus.
- **Marks for External Examination:** (Short Questions) → 20 Marks
(Descriptive type) → 50 Marks

Total Marks → 70 Marks
- **Marks for Internal Examination:** Assignments → 30 Marks
or Test
- **Credit Of The Course** 4 Credits

B.Sc. SEMESTER -1
MATHEMATICS PAPER 01 (A) - Theory
CALCULUS

UNIT 1:

[14 MARKS]

(a) Mean value theorems:

Roll's theorem and problems related to it, Lagrange's mean value theorem and problems related to it, Cauchy's mean value theorem and problems related to it.

(b) Taylor's theorem, expansions and indeterminate forms:

Taylor's theorem (Without proof), Maclaurin's theorem (Without proof), Taylor's and Maclaurin's infinite series expansions, expansions of e^x , $\sin x$, $\cos x$, $(1+x)^n$, $\log(1+x)$ under proper conditions.

Course is roughly covered by the reference book no (1) chapter 6 and chapter no 8 Sections 8.1 to 8.5.

UNIT 2:

[14 MARKS]

(a) Indeterminate Forms:

La' hospital's rules for various indeterminate forms (Without proof). Various indeterminate forms like $\frac{0}{0}$ form, $\frac{\infty}{\infty}$ form, $0 \cdot \infty$ form, $\infty - \infty$ form, 0^0 form, ∞^0 form.

(b) Differential Equations of First Order and First Degree:

Definition and method of solving of Differential Equation of the form Variable separable, Homogeneous Differential Equation and **Linear differential equations** of first order and first degree.

Course is roughly covered by the reference book no (1) chapter 10.

Course is roughly covered by the reference book no (3) chapter 11 section 11.1 to 11.4 and section 11.6 and section 11.7.

UNIT 3:

[14 MARKS]

(a) Differential Equations of First Order and First Degree(continue):

Definition and method of solving of **Bernoulli's** differential equation and Definition and methods of solving of **Exact** differential equation.

Differential equations of first order and higher degree:

(b) Differential equations of first order and first degree solvable for x, solvable for y, solvable for p. Clairaut's form of differential equation and Lagrange's form of differential equations.

Course is roughly covered by the reference book no (3) chapter 11 section 11.5, 11.8 and 11.9 Chapter 12 section 12.1 to 12.5

UNIT 4:**[14 MARKS]****Linear differential equations of higher order**

Linear differential equations of higher order **with constant coefficients**. Operator D, Meaning of auxiliary equation, Roots of auxiliary equation and solution of auxiliary equation $f(D)y = 0$ for real roots and complex roots, Operator $1/D$. Solution of differential equations of the type $f(D)y = X$. Meaning of complimentary function(C.F.) and Particular integral(P.I.). Methods to obtain Particular integral (P.I.) when $X = e^{ax}$, $X = \sin(ax+b)$, $X = \cos(ax+b)$, $X = x^m$, $X = e^{ax} \cdot V$

Course is roughly covered by the reference book no (3) chapter 14 section 14.1 to , 14.91.

UNIT 5:**[14 MARKS]****Linear Differential Equations with Variable Coefficients.**

The homogeneous linear equation First method of solution, Second method of solution, method to find complementary function, method to find the particular integral, The symbolic function $f(\theta)$ and $\frac{1}{f(\theta)}$ Integral corresponding to a term of the form x^α in the second member.

Course is roughly covered by the reference book no (5) chapter 7 section 65 to 69.

Notes:

- There shall be **SIX** periods of 55 minutes per week for Mathematics- **01 (A)-Theory**.
- There shall be one question paper of 70 marks & $2\frac{1}{2}$ hours for Mathematics- **01(A)-Theory**

Format of Question Paper

- There shall be FIVE questions from each unit of 14 marks each.
- Each Question will be of the following form.

Question	(A) Answer any four out of four (Short answer type question)	4 Marks
	(B) Answer any one out of two	2 Marks
	(C) Answer any one out of two	3 Marks
	(D) Answer any one out of two	5 Marks
	TOTAL	14 MARKS

Reference Books :

- (1) Differential Calculus by Shanti Narayan and P K Mittal
- (2) Differential Calculus by Gorakh Prasad
- (3) Integral Calculus by Shanti Narayan
- (4) Integral Calculus by Gorakh Prasad
- (5) Differential Equations by D. A. Murray
- (6) A Text book of Calculus, S. C. Arora and Ramesh Kumar, Pitamber Publishing Company Ltd. Delhi.
- (7) Calculus: Concept and Context, Second edition, By James Stewart Pitamber Publishing Company Ltd. Delhi.
- (8) Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.

SAURASHTRA UNIVERSITY RAJKOT.

Syllabus of B.Sc. Semester-1
According to Choice Based Credit System
Effective from June – 2016

*(Updated on date:- 06-02-2016
and updation implemented from June - 2016)*

- **Programme:** B.Sc.
- **Semester:** 1
- **Subject:** Mathematics
- **Paper No:** 01(B) (Practical)
- **Title of Course:** Mathematics Practical
- **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

SAURASHTRA UNIVERSITY, RAJKOT.

B.Sc. SEMESTER - 1 (CBCS)

MATHEMATICS PAPER- 01(B) (Practical)

Mathematics Practical

[50 Marks / 3Hours]

Practical No . (1) Draw the graph of $y = \sin x$ or $y = \cos x$ or $y = \tan x$.

Practical No . (2) Draw the graph of $y = \sec x$ or $y = \operatorname{cosec} x$ or $y = \cot x$.

Practical No . (3) Draw the graph of $y = \sin^{-1} x$ or $y = \cos^{-1} x$ or $y = \tan^{-1} x$.

Practical No . (4) Draw the graph of $y = \sec^{-1} x$ or $y = \operatorname{cosec}^{-1} x$ or $y = \cot^{-1} x$.

Practical No . (5) Successive differentiation

Find n^{th} derivative of $y = \frac{x}{x^2 + a^2}$ or similar type of example.

Practical No . (6) Show that the n^{th} derivative of $y = \tan^{-1} x$ is

$$y_n = (-1)^{n-1} \cdot (n-1)! [\sin\{n(\frac{\pi}{2} - y)\} \sin^n(\frac{\pi}{2} - y)]$$

or similar type of example.

Practical No . (7) If $y = \sin mx + \cos mx$ then show that $y_n = m^n \sqrt{1 + (-1)^n \sin 2mx}$

or similar type of example.

Practical No. (8) Use reduction formula to evaluate following

$$(1) \int \sin^6 x dx, (2) \int \cos^7 x dx \text{ and } (3) \int \sin^4 x \cos^4 x dx$$

or similar type of example.

Practical No . (9) Use reduction formula to evaluate following

$$(1) \int_0^{2a} x^2 \sqrt{2ax - x^2} dx, (2) \int_0^{\infty} \frac{x^2}{(1+x^2)^{9/2}} dx, (3) \int_0^a x^4 (a^2 - x^2)^{3/2} dx$$

or similar type of example..

Practical No . (10) Use reduction formula to evaluate following

$$(1) \int_0^{\infty} \frac{1}{(1+x^2)^3} dx, (2) \int_0^2 \frac{x^4}{\sqrt{4-x^2}} dx, (3) \int_0^{\infty} \frac{1}{(a^2+x^2)^4} dx$$

or similar type of example.

Notes :

- There shall be **SIX** periods of **1 hour** per week per batch of **15** students.
- **10** practical should be done during semester-1.
- 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

Question 1	Answer any THREE out of FIVE	[9+9+9=	27 Marks
Question 2	Journal and Viva:	[	8 Marks
Question 3:	Internal Practical Examination	[	15 Marks
	TOTAL	[	50 Marks

SAURASHTRA UNIVERSITY RAJKOT.

Syllabus of B.Sc. Semester-2
According to Choice Based Credit System
Effective from June – 2016

*(Updated on date:- 06-02-2016
and updation implemented from June - 2016)*

- **Program:** B.Sc.
- **Semester:** 2
- **Subject:** Mathematics
- **Paper No:** 02 (A) - Theory
- **Title of Course:** Geometry, Calculus and Matrix Algebra.

- **Marks for External Examination:** (Short Questions) → 20 Marks
(Descriptive type) → 50 Marks

Total Marks → 70 Marks

- **Marks for Internal Examination:** Assignments → 30 Marks
or Test
- **Credit Of The Course** 4 Credits

B.Sc. SEMESTER -2
MATHEMATICS PAPER BSMT – 02 (A) Theory
GEOMETRY, CALCULUS AND MATRIX ALGEBRA

UNIT 1:

[14 MARKS]

[a] Sphere:

Equation of a sphere in different forms:

Standard form, Central form, Vector form,

General equation of sphere with center (α, β, γ) and radius a. Plane section of a sphere, intersection of two spheres, Sphere with a given diameter, Sphere through a given circle, Intersection of a sphere and a line, Power of a point, Equation of a tangent plane, Equation of normal to the sphere, Condition for the plane $lx + my + nz = p$ touches the sphere $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$.

[b] Cylinder:

Definition of a cylinder, equation of a cylinder with given

Generating parallel to the line $\frac{x}{l} = \frac{y}{m} = \frac{z}{n}$ and guiding curve $ax^2 + 2hxy + by^2 + 2gx + 2fy$

$+ c = 0, z = 0$. The equation of right circular cylinder with axis $\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$ and radius r.

Course is roughly covered by the reference book no (12) chapter 6 section 6.1 to 6.6 And chapter 7 section 7.7 and 7.7.1 and 7.8.

UNIT 2:

[14 MARKS]

Partial Differentiation: -

Limit and continuity of function of several variables.

Partial derivatives, Partial derivatives of higher order, Partial differentiation of composite function, Homogeneous function, Euler's theorem on homogeneous function of two and three variables, Total differential and chain rule, Change of variables, Partial differentiation of implicit function, Young's and Schwartz's theorem (without proof).

Course is roughly covered by the reference book no (1) chapter 11.

UNIT 3:

[14 MARKS]

Applications of Partial Derivatives:

Errors and approximate values, Jacobians, Taylor's theorem of function of two variables, Maxima, Minima, Saddle points of function of several variables, Lagrange's method of undetermined multipliers.

Course is roughly covered by the reference book no (1) chapter 9.

UNIT 4:

[14 MARKS]

[a] Concept of a matrix:

Some special matrices, adjoint of a matrix, Non-singular and singular matrices, inverse of a matrix, Symmetric and skew symmetric matrices, Hermitian and skew Hermitian matrices.

[b] Rank of a matrix:

Elementary row and column operations on a matrix, row and column vectors, linear independence of row and column matrices, rank of a matrix, row and column rank of a matrix, equivalence of row and column ranks.

Course is roughly covered by the reference book no (10) chapter 1 section 1.4 to , 1.9, Chapter 4 section 4.1 to 4.3.1.

UNIT 5:

[14 MARKS]

Eigen values of a matrix:

Characteristic equation of a matrix, eigen values and eigen vectors of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix. Application of a matrices to solve a system of linear (homogeneous and non-homogeneous both) equations. Theorems on consistency of a system of linear equations.

Course is roughly covered by the reference book no (10) chapter 11 section 11.1 to 11.1.2, Chapter 2 section 2.19.

Notes:

- There shall be **SIX** periods of 55 minutes per week for Mathematics- **01 (A)-Theory**.
- There shall be one question paper of 70 marks & $2\frac{1}{2}$ hours for Mathematics- **01(A)-Theory**

Format of Question Paper

- There shall be FIVE questions from each unit of 14 marks each.
- Each Question will be of the following form.

Question.	(A) Answer any four out of four (Short answer type question)	4 Marks
	(B) Answer any one out of two	2 Marks
	(C) Answer any one out of two	3 Marks
	(D) Answer any one out of two	5 Marks
	TOTAL	14 MARKS

Reference Books:

- 1) Differential Calculus by Shanti Narayan. 15th Edition (2004)
- 2) Differential Calculus by Gorakh Prasad
- 3) Integral Calculus by Shanti Narayan
- 4) Differential Equations by D. A. Murray
 - a. A Text book of Calculus, S. C. Arora and Ramesh Kumar, Pitamber Publishing
 - b. Company Ltd. Delhi.
- 5) Calculus: Concept and Context, Second edition, By James Stewart
 - a. Pitamber Publishing Company Ltd. Delhi.
- 6) Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.
- 7) The Elements of Co-ordinate Geometry by S.L. Loney Mac Millan & Co.
- 8) Elementary Treatise on Co-ordinate geometry of three dimensions by R.J.T. Bell Mac Millan & Co.
- 9) A Text book of Analytical Geometry of three dimensions by P.K. Jain & Khalid Ahmad
- 10) A textbook of matrices by Shanti Narayan.
- 11) A Course of Mathematical Analysis by Shanti Narayan
- 12) Analytical Solid Geometry by Shanti Narayan and P.K.Mittal, S.Chand & Co.

SAURASHTRA UNIVERSITY RAJKOT.

Syllabus of B.Sc. Semester-2
According to Choice Based Credit System
Effective from June - 2016

*(Updated on date:- 06-02-2016
and updation implemented from June - 2016)*

- **Programme:** B.Sc.
 - **Semester:** 2
 - **Subject:** Mathematics
 - **Paper No:** 02 (B) (Practical)
 - **Title of Course:** Mathematics Practical.
 - **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
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- Total → 50 Marks**
- **Credit Of The Course** 3 Credits

SAURASHTRA UNIVERSITY, RAJKOT.

B.Sc. SEMESTER -2 (CBCS)

MATHEMATICS PAPER- 02 (B) (Practical)

Mathematics Practical

[50 Marks / 3Hours]

Practical No. (1) Draw the graph of $y = e^x$ or $y = 2^x$ or $y = 3^x$.

Practical No. (2) Draw the graph of $y = \log_e x$ or $y = \log_{10} x$.

Practical No. (3) Draw the graph of $y = \sinh x$ or $y = \cosh x$.

Practical No. (4) Draw the graph of $y = \operatorname{sech} x$ or $y = \operatorname{cosech} x$

Practical No. (5) Draw the graph of $y = \tanh x$ or $y = \coth x$.

Practical No. (6) Draw the graph of cycloid.

Practical No. (7) To find inverse of a matrix using Cayley- Hamilton theorem.

(At least four examples to be written in journal)

Practical No. (8) To find inverse of a matrix using Gauss-Elimination Method.

(At least four examples to be written in journal)

Practical No. (9) To solve the system of simultaneous linear algebraic equations using Gauss Elimination Method. (At least four examples to be written in journal)

Practical No. (10) To solve the given system of simultaneous linear algebraic equations using Gauss-Jordan Method. (At least four examples to be written in journal)

Notes :

- There shall be **SIX** periods of **1 hour** per week per batch of **15** students.
- **10** practical should be done during semester-2.
- 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

Question 1	Answer any THREE out of FIVE	[9+9+9=	27 Marks
Question 2	Journal and Viva:	[	8 Marks
Question 3:	Internal Practical Examination	[	15 Marks
	TOTAL	[	50 Marks

SAURASHTRA UNIVERSITY RAJKOT.

New Syllabus of B.Sc. Semester-3 According to Choice Based Credit System from June - 2011

(New Syllabus Effective from June - 2017)

- **Program:** B.Sc.
- **Semester:** 3
- **Subject:** Mathematics
- **Course code:** 03 (A)-Theory
- **Title of Course:** Real Analysis
- **Section-wise Distribution of Marks for External Examination:**

Total Marks	→70 Marks
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- **Segment-wise Distribution of Marks for Internal Examination:**

Assignments	→ 10 Marks
QUIZ test	→10 Marks
Internal exam.	→ 10
Marks	
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Total Marks	→30 Marks
- **Credit Of The Course** 4 Credits

SAURASHTRA UNIVERSITY, RAJKOT

B.Sc. SEMESTER -3 (CBCS)

MATHEMATICS PAPER- 03 (A) Theory

Real Analysis

[70 Marks/ $2\frac{1}{2}$ Hours]

UNIT 1: Sequences [14 MARKS]

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

$$\left\{ \sqrt[n]{n} \right\}; \left\{ \frac{a_1 + a_2 + \dots + a_n}{n} \right\}$$

Unit 2: Infinite Series [14 MARKS]

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: Vector Differentiation [14 MARKS]

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

UNIT 4: Multiple Integral [14 MARKS]

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 [14 MARKS]

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).

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 & $2\frac{1}{2}$ 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 weight-age, **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.

Question no.	(a)	Attempt all FOUR each of ONE mark	4 Marks
	(b)	Answer any ONE out of TWO	2 Marks
	(c)	Answer any ONE out of TWO	3 Marks
	(d)	Answer any ONE out of TWO	5 Marks
TOTAL			<hr style="width: 10%; margin: 0 auto;"/> 14 MARKS

TEXT BOOKS:-

1. S. C. Malik and Savita Arora, Mathematical Analysis, New Age International(P) Ltd, Publishers, 2nd Edition.
2. Narayan Shanti and Mittal P.K., Integral Calculus, S. Chand & Sons.

REFERENCE BOOKS:-

2. Shantinarayan, A course of Mathematical Analysis, S. Chand & Sons.
3. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
4. Walter Rudin, Principle of Mathematical Analysis, MC Graw-Hill Book & Company, 2nd Edition.
5. Differential Calculus by Shanti Narayan, S.Chand & co., New Delhi
6. Differential Calculus by Gorakhprasad, Pothishala Pvt. Ltd., Allahabad
7. Real Analysis by R.R. Goldberg, Oxford and I.B.H. Publishing Co. Pvt. Ltd.
8. S. C. Malik, Principles of Real Analysis, New Age International (P) Ltd, Publishers, 2nd Edition.

SAURASHTRA UNIVERSITY

RAJKOT

Syllabus of B.Sc. Semester-4
According to Choice Based Credit System
from June - 2011

(New Syllabus Effective from June - 2017)

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

- **Section-wise Distribution of Marks for External Examination:**

Total Marks	→70
Marks	

- **Segment-wise Distribution of Marks for Internal Examination:**

Assignments	→ 10 Marks
QUIZ test	→10 Marks
Internal exam.	→ 10 Marks
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Total Marks	→30
Marks	

- **Credit Of The Course** 4 Credits

SAURASHTRA UNIVERSITY, RAJKOT

B.Sc. SEMESTER - 4 (CBCS) MATHEMATICS PAPER- 04 (A)

Linear Algebra & Differential Geometry Theory

[70 Marks / $2\frac{1}{2}$ Hours]

- Unit 1:** **Vector space, Linear Dependence, Independence of Vectors and Basis of a Vector space:-** **[14 MARKS]**
Introduction of Vector space and vectors in \mathbb{R}^n , 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:-** **[14 MARKS]**
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:** **Linear Transformation:-** **[14 MARKS]**
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:-** **[_____ 14**
MARKS]
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:-** **[14 MARKS]**
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 weight-age, **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.

Question no.	(a)	Attempt all FOUR each of ONE mark	4 Marks
	(b)	Answer any ONE out of TWO	2 Marks
	(c)	Answer any ONE out of TWO	3 Marks
	(d)	Answer any ONE out of TWO	5 Marks
		TOTAL	14 MARKS

TEXT BOOKS

1. An Introduction to Linear Algebra by Krishnamurthy, Mainra and Arora
2. Differential Calculus by Shanti Narayan, S.Chand & co., New Delhi
3. A course of mathematical Analysis by Shanti Narayan , S.Chand & Co., New Delhi

REFERENCE BOOKS:-

1. Shantinayakan, A course of Mathematical Analysis, S. Chand & Sons.
2. Linear Algebra by J.N. Sharma and A.R. Vasishtha, Krishna Prakashan Mandir, Meerut
3. Matrix and Linear Algebra by K.B. Datta, Prentice Hall of India Pvt. Ltd. New Delhi
4. Linear Algebra by K.Hoffman and R. Kunza
5. A text book of Modern Abstract Algebra by Shanti Narayan, S.Chand & Co., New Delhi
6. Basic Linear Algebra with Matlab by S. K. Jain, A. Gunawardena & P.B. Bhattacharya.

SAURASHTRA UNIVERSITY RAJKOT.

Syllabus of B.Sc. Semester-3
According to Choice Based Credit System
Effective from June – 2011
(New Syllabus Effective from June - 2017)

- **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

SAURASHTRA UNIVERSITY, RAJKOT

B.Sc. SEMESTER -3 (CBCS) 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))

Question 1	Answer any THREE out of FIVE	[9+9+9=	27 Marks
Question 2	Journal and Viva:	[	8 Marks
Question 3:	Internal Practical Examination	[	15 Marks
	TOTAL	[	50 Marks

SAURASHTRA UNIVERSITY RAJKOT

Syllabus of B.Sc. Semester-4
According to Choice Based Credit System
Effective from June – 2011
(New Syllabus Effective from June - 2017)

- **Programme:** B.Sc.
- **Semester:** 4
- **Subject:** Mathematics
- **Course code:** 04(B) (Practical)
- **Title of Course:** Introduction to SciLab
- **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

B. Sc. SEMESTER -4 (CBCS)
MATHEMATICS-PAPER- 04(B) (Practical) [35 Marks / 3Hours]
Introduction to SciLab

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

**SAURASHTRA UNIVERSITY
RAJKOT**

MATHEMATICS

Syllabus of B.Sc. Semester-5 & 6

According to Choice Based Credit System

Effective from June – 2018

*(Updated on date:- 26-07-2017
and updation implemented from June - 2018)*

Syllabus of B.Sc. Semester-5
According to Choice Based Credit System
Effective from June – 2018

*(Updated on date:- 26-07-2017
and updation implemented from June - 2018)*

- **Program:** **B.Sc.**
- **Semester:** **5**
- **Subject:** **Mathematics**
- **Course codes:** **05 (A) -Theory**
06 (A) -Theory
07 (A) -Theory
05 (B) - Practical
06 (B) - Practical
07 (B) - Practical
1 Project
- **Total Credit Of The Semester 5:** **24 Credit**

B. Sc. MATHEMATICS SEMESTER: V

- The Course Design of B. Sc. Sem.- V (Mathematics) according to choice based credit system (CBCS) comprising of Paper Number, Paper Name, No. of theory lectures per week, No. of practical lectures per week, total marks of the each paper are as follows :

SR.NO	SUBJECT	NO. OF THEORY LECTURE PER WEEK	NO. OF PRACTICAL LECTURE PER WEEK	TOTAL MARKS	Credit Of Each Paper.
1	PAPER 05 (A) (Theory) Mathematical Analysis-1 & Abstract Algebra - I	6	-	70(External)+ 30 (Internal) = 100 Marks	4
2	PAPER 06 (A) (Theory) Programming in C & Numerical Analysis-1	6	-	70(External)+ 30 (Internal) = 100 Marks	4
3	PAPER 07 (A) (Theory) Boolean Algebra & Complex Analysis-1	6	-	70(External)+ 30 (Internal) = 100 Marks	4
4	PAPER 05 (B) (Practical) Programming with SCILAB	-	6	35(External)+ 15(Internal) = 50 Marks	3
5	PAPER 06 (B) (Practical) Programming in C language	-	6	35(External)+ 15(Internal) = 50 Marks	3
6	PAPER 07 (B) (Practical) Numerical Analysis – I		6	35(External)+ 15(Internal) = 50 Marks	3
7	Project Work & Viva	<ul style="list-style-type: none"> 1 Guidance Lecture. for a group of 3 to 5 students / week. Evaluation of project will be in SIXTH semester 		The title of the project work to be decided and data will be collected in this semester	3
<u>Total credit of the semester V</u>					24

**Marks Distribution of Each Paper
for
Theory and Practical (for SEMESTER-V)**

- **Total Marks of Each Theory Paper [External Examination]** **70 Marks**
- **Total Marks of Each Theory Paper [Internal Examination]** **10 Marks Assignments +
10 Marks QUIZ / test +
10 Marks Internal exam. =
30 Total Marks**
- **Total Marks of Each Practical Paper [External Examination]** **35 Marks**
- **Total Marks of Each Practical Paper [Internal Examination]** **15 Marks
[Continuous internal assessment of
practical work]**

Format of Question Paper

- There shall be one question paper of **70 marks & $2\frac{1}{2}$ hours** for each Mathematics Theory Paper.
- There shall be **FIVE** questions from each unit of 14 marks each.
- Each Question will be of the following form.

Question	(A) Answer any four out of four (Short answer type question)	4 Marks
	(B) Answer any one out of two	2 Marks
	(C) Answer any one out of two	3 Marks
	(D) Answer any one out of two	5 Marks

TOTAL **14 MARKS**

-: Project Work:-

- There will be a project on any topic in Mathematics preferably not covered in the syllabus.
- The project will be assigned in the teams (groups) of at least one and at most five students.
- There will be one lecture per week to guide and motivate for each group of students.
- Topic of the project may be selected based on the following
 1. Demand of mathematics required to cater the need of industries and the society as a whole.
 2. New topic not taught up to final semester.
 3. The topic may be an extension of topic covered in any of the topics/subject taught up to sixth semester.
 4. Innovative teaching methodology of Mathematics may also be selected as a topic of the project work.
 5. Students may also construct innovative models based on mathematical concepts even those taught at secondary or higher secondary level.
 6. Every project or even model must be submitted with proper documentation about the concept and the model.

- **During the fifth semester students will be**
 1. Introduced and assigned title of the project,
 2. Teams will be formed for the same.
 3. Each group will study, search reference, collect data and work-out details for their topic of project-work.

- **During the sixth semester**
 1. Students will finalize, document, submit and get the project work certified in their names.
 2. The project work must be submitted by the student in the fourteenth week of the sixth semester.
 3. Only on the submission of project dissertation the student will be issued hall ticket for the end semester theory and practical examination.
 4. The dissertation may be typed or hand-written and be limited to 40 to 70 pages of A4 size.
 5. Project work shall be evaluated by an external and one internal examiner which will be followed by presentation of the work and viva-voce.
 6. Students will be required to undergo verification, evaluation and viva of the project-work they have done.
 7. Certified documentation of the project-work done by each group is mandatory. The certified documentation should be produced while appearing for viva and evaluation of project during final examination of sixth semester.
- The project work will be evaluated for 100 marks of which **60% marks** will be allotted for the **dissertation** and **40% for the presentation** and **viva-voce**
- **The Evaluation of the project work will be done at the end of the sixth semester. For the Evaluation of the project work there shall be three hours duration at the end of the sixth semester. There shall be batch of 15 students for project and viva.**

B.Sc. Mathematics
SEMESTER - 5
Mathematics PAPER 05 (A) (Theory)
Mathematical Analysis -I and Abstract Algebra - I

UNIT 1: Metric Spaces: [14 Marks]
Definition and examples of metric space, neighborhood, limit points, interior points, Open and closed sets, Closure, derived set and interior, boundary points. Dense sets, Cantor sets [**include Cantor set is closed**] but [**OMIT: - cantor set is compact and complete.**]

UNIT 2: Riemann Integral: [14 Marks]
Partitions and Riemann sums, Upper and lower R-integrals, R-integrability, The integral as limit, Some classes of integrable functions, Properties of integrable function, Properties of R-integrable function., Statement of **Darboux's theorem** (without proof)

UNIT 3: [14 Marks]
[a] Riemann Integral
Continuity, Derivability of the integral functions, Fundamental theorem of integral calculus, Mean value theorem of integral calculus.
[b] Abstract Algebra
Definition of Binary Operation, Properties of B.O. & Examples, Group & its Properties, Examples of Group.

UNIT 4: Subgroups and Symmetric Group [14 Marks]
Subgroup & Its Properties, Cosets & Its Properties, Lagrange's theorem. Permutation, Transposition, Even & Odd Permutation, Symmetric Group, Inverse of Permutation, Alternative Group & Its Universal Property.

UNIT 5: Isomorphism and other properties [14 Marks]
Cyclic Group & Cyclic Subgroup & Its Properties, Deduction Of Lagrange's Theorem. Definition of Isomorphism, Equivalence Relation. Cayley Theorem, Automorphism, Properties of isomorphism, Normal subgroup and quotient group.

Text Book for MATHEMATICS PAPER 05 (A) (Theory) Unit – 3[b], 4 and 5 Group Theory

Abstract Algebra

By : Dr. I. H. Sheth,

Prentice Hall Of India,

New Delhi.

Course of Mathematics PAPER – 05 Abstract Algebra - I

is covered by following Chapters/ Sections of the above mentioned book namely Abstract Algebra

Chapter 4: § 4.1, § 4.2, § 4.3, § 4.4, §4.5 [OMIT: Example 4.1.11]

Chapter 6: § 6.1, § 6.2[OMIT: Example 6.2.7], § 6.3,

- [**Omit**:- § 6.4], § 6.5

[**Omit**:- Generalized associative law, Theorem: 6.5.2, Theorem: 6.5.3]

§ 6.6, § 6.7

Chapter 7: § 7.1, § 7.2, § 7.3

Chapter 8: § 8.1, § 8.2, § 8.3 [**Omit**:- Theorem: 8.2.2]

Chapter 9: § 9.1, § 9.2, § 9.3

Chapter 10: § 10.1, § 10.2

Chapter 11

- **Omit :-** Chapter 11 Cyclic Groups
- [The whole chapter is to be omitted]

Chapter 12:

- § 12.3, § 12.4 [**Omit**:- § 12.5]

[Remaining sections of this chapter will be covered in 6th semester]

References

- (1) Topics in Algebra, 1. N. Herstein, Willey Eastern Ltd. New Delhi
- (2) A text Book of Modern Abstract Algebra, by Shantinarayan, S. Chand & Co., New Delhi.
- (3) Fundamentals of Abstract Algebra, D. S. Malik, J. N. Mordoson and M. K. Sen, McGraw Hill International Edition - 1997
- (4) University Algebra, M. S. Gopalakrishna, Wiley Eastern Ltd.
- (5) Abstract Algebra, By Bhattacharya, Yallo Publications.
- (6) Modern Algebra, By Kazi zamiudia & Sursit, Vikas Publication. Delhi.
- (7) Text Book: Abstract Algebra, Dr. 1. H. Sheth, Nirav Prakashan, Ahmedabad.
- (8) Mathematical Analysis (2nd edition) by S. C. Malik & Arora, New Age Inter. Pvt.'
- (9) Mathematical Analysis, by T. M. Apostol
- (10) Real Analysis, by R. R. Goldberg (Chapel' 4,5,6, 7,9 & 10.1)
- (11) A course of Mathematical Analysis, by Shantinarayan, S. Chand & Sons.
- (12) Metric space, by E. T. Capson
- (13) Metric space, P. K. Jain & Ahmad, Narora Publishing House
- (14) Real Analysis by Sharma and Vasishtha Krishna Prakashan, Meerut-2.
- (15) Mathematical Analysis, by Dr. Goyal and Gupta, Krishna Prakashan, Meerut-2.

B.Sc. Mathematics
SEMESTER -5
MATHEMATICS PAPER 06 (A) (Theory)
Programming in C and Numerical Analysis - I

UNIT 1: [14 Marks]
History of C, C character set, Constants, Variables, Keywords, Type Declaration, Type Conversion, Hierarchy of operators, printf & scanf functions, if statement, if-else statements, Nested if-else, Logical operators, Conditional operators, including simple programs relevant to this unit.

UNIT 2: [14 Marks]
While loop, for loop, do while loop, break statement, Continue statement goto statement, Introduction to User Defined Functions. [Omit:- switch case statement, Pointers and Recursion] Data types in C Integers: long and short types, signed and unsigned characters, Signed and unsigned float and doubles, including simple programs relevant to this unit.

UNIT 3: [14 Marks]
C processors, meaning, Only Macro Expansion, Macros with Arguments, [OMIT:- File inclusion and various directives Conditional Compilation #if and #elif Directives Miscellaneous Directives #undef Directive #pragma Directive] Arrays, meaning: one dimensional and two dimensional, only initialization and use in simple programs [OMIT:- no pointers and no three dimensional array, Arrays and functions.], including simple programs relevant to this unit.

UNIT 4: [14 Marks]
Simultaneous linear algebraic equation:
Direct methods: Gauss elimination method, Gauss Jordan method, Method of factorization (L.U. Decomposition), Crout's method. Iterative methods: Jacobi's method, Gauss Seidal's method.
Empirical laws and curve fitting.
The linear law, Laws reducible to linear laws, Principle of least square, Fitting a straight line, a parabola and exponential curve and the curve $y = ax^b$

UNIT 5: [14 Marks]
Finite differences:
Finite differences(forward, backward and central), Differences of polynomials, Factorial polynomial, Reciprocal Factorial polynomial, Polynomial factorial notation, Error propagation in difference table, Other difference operators(Shift, averaging, differential and unit) and relation between them.
Interpolation with equal intervals:
Gregory- Newton forward interpolation formula, Gregory- Newton backward interpolation formula, Equidistance terms with one or more missing values.

Text Book for MATHEMATICS PAPER 06 (A) (Theory)
PROGRAMMING IN C is as follows:
'LET US C' By : Yashvant Kanetker 5th Edition,
BPB Publications, New Delhi.

Course of PROGRAMMING IN C (THEORY)

i.e. UNIT 1,2 and 3 is covered by following Sections / Chapters of the book “LET US C”

- **Chapter 1**
Getting Started
[Omit:- the section of Associativity of Operator]
- **Chapter 2**
The decision control Structure [Whole chapter]
- **Chapter 3**
The loop control Structure [Whole chapter]
For the topic of “User Defined Functions” refer to
any other standard book
- **Chapter 4**
The case control Structure
[Omit: - Switch –Case Statement and related sections]
Only The goto keyword and its usage.
- **Chapter 5 :-**
[Omit:- The whole Chapter 5 – namely “Functions and Pointers” of the book “LET US C”]
- **Chapter 6:-**
Data Types Revisited
[Omit:- Storage Classes like Automatic Storage Class Register Storage Class, Static Storage Class ,
External Storage Class, Which to Use When...etc.]
- **Chapter 7:-**
The C Preprocessor
Features of C Preprocessor, Macro Expansion, Macros with Arguments, Macros versus Functions
[OMIT:- File Inclusion Conditional Compilation, #if and #elif Directives, Miscellaneous Directives, #undef Directive, #pragma Directive]
- **CHAPTER 8:-**
Arrays. What are Arrays, A Simple Program Using Array, More on Arrays, Array Initialization, Bounds Checking, Passing Array Elements to a Function, Two Dimensional Arrays, Initializing a 2-Dimensional Array
[OMIT:-Pointers and Arrays, Passing an Entire Array to a Function, The Real Thing, Memory Map of a 2-Dimensional Array, Pointers and 2-Dimensional Arrays, Pointer to an Array, Passing 2-D array to a Function, array of pointers, three dimensional array, summary.]

The scope of the syllabus of UNIT 4 & 5 is roughly indicated as under:

"Numerical methods" by Dr. V. N. Vedamurthy & Dr. N. Ch. S. N. Iyengar, Vikas Publishing house.

Chap. 1. (Except 1.4,1.5,1.11,1.12), Chap. 4 (Except 4.4,4.7), Chap. 5. (Except 5.12), Chap. 6

Reference Books: (for Unit 4 & 5)

(1) Introduction to Numerical Analysis (2nd Edition) by C.E.Froberg Addison Wasley, 1979

(2) Numerical Mathematical Analysis, by J. B.Scarforough, Oxford & IBH Publi.Co. Pvt. Ltd., 1966

(3) Numerical method, Problems & Solutions, by M. K. Jain, S. R. K.Iyengar, R. K. Jain, New Age International Pvt. Ltd., 1996.

B.Sc. Mathematics
SEMESTER -5
MATHEMATICS PAPER 07 (A)- (Theory)
Boolean Algebra & Complex Analysis - I

UNIT 1: [14 Marks]

Relations:

Relations and different types of relations. Binary relations, Equivalence relations and partitions, partial order relations, Posets, Hasse diagram, Lattices as posets, Properties of lattices, Lattices as algebraic systems, Sub lattices, Direct product of two lattices, Homomorphism, order isomorphism of two posets, Isomorphic lattices, Complete lattices, Distributive lattices, Complemented lattices.

UNIT 2: [14 Marks]

Boolean algebra:

Definition, Examples BA, Direct product of two BA, homomorphism, Atoms of BA, Anti atoms, Stone's representation theorem, The set $A(x)$ of all atoms of BA and its properties. Isomorphism of a finite of finite BA and $(P(A), \subseteq)$, Boolean functions / expressions, Minterms, Maxterms, Representation of a B. expression as a sum of product Canonical form. Karnaugh map. Minimization of a B. expression by cube array representation and by Karnaugh map.

UNIT 3: [14 Marks]

Analytic functions:

Functions of complex variables, limits, Theorems on limits, Continuity and differentiability, of complex functions, harmonic functions, Entire functions and analytic functions.

UNIT 4: [14 Marks]

Cauchy's integral formula:

Cauchy Riemann conditions in Cartesian and polar form. Definite integral contours, line integrals Cauchy-Goursat theorem(**without proof**), Cauchy's integral formula.

UNIT 5: [14 Marks]

Fundamental theorem of algebra:

Higher order derivative of analytic function, Morera's theorem, Cauchy's inequality and Liouville's theorem, Fundamental theorem of algebra, Maximum modulus theorem.

Text Book of Mathematics PAPER 07 (A) for the UNITS 3, 4 & 5
COMPLEX ANALYSIS-1

“Complex Variables and Applications”
Fifth Edition,
Rul V. Churchill and James Ward Brown.
Mc Graw Hill Publishing Company.

Chapter 2

- Sections 9 to 21.

Chapter 4

- Sections 30 to 35.

- Sections 36 to 37.
[Lemma and Cauchy-Goursat theorem (in sections) 36 **without proof**],
- Sections 39 to 43.

References

- (1) Complex variables and applications, by R. V. Churchill and J. \ Brown
- (2) Theory of functions of a Complex variables, by Shantinakaran, Chand & Co.
- (3) Complex variables, Introduction and applications, by Mark Ablowitz and A. S. Fokas, Cambridge University Press.
- (4) (4) Graph theory with application to engineering and computer science. by Narsingh Deo. 1993,Prentice Hall of India Pvt. Ltd.
- (5) Foundation of Discrete Mathematics, K. D. Joshi, New Age International Ltd. Publishers.
- (6) A first look at Graph theory, by Clark.
- (7) Discrete Mathematical Structures with applications to computer science,
- (8) by Trembley I.P. and Manohar R.
- (9) Elements of Discrete Mathematics (2nd edition) by L. Liu, Me.
- (10) GrawHill, International edition, Computer Science series, 1986.
- (11) Discrete Mathematics, By Vatsa, Vikas Publications.
- (12) Introduction Graph Theory, By R. J. Willsons
- (13) Discrete Mathematics Structure, By. Dugragi, Narora Pub.

B.Sc. Mathematics
SEMESTER - 5
Mathematics PAPER – 05 (B) (Practical)
Programming with SCILAB

- **Total Marks:- 35 Marks (External)+ 15 Marks (Internal)= 50 Marks / 3 hours**

- 1) To find the inverse of a matrix using **GAUSS-ELIMINATION** method..
- 2) To find inverse of given matrix using **GAUSS-JORDAN** method
- 3) To find **Eigen values** and **Eigen vectors** of given matrix
- 4) To find inverse of given matrix using **CAYLEY-HAMILTON** theorem
- 5) To solve given system of simultaneous linear algebraic equations using **GAUSS-JORDAN** method.
- 6) To solve given system of simultaneous linear algebraic equations using **GAUSS-JACOBI** method.
- 7) To solve given system of simultaneous linear algebraic equations using **GAUSS-SEIDAL'S** method.
- 8) To draw graphs of **Cycloid**
- 9) To draw graphs of **Catenaries**
- 10) To draw graphs of **spiral $r = \exp(-\theta/10)$** .

Notes :

- There shall be **SIX** periods of **1 hour** per week per batch of **15** students.
- **10** practical should be done during semester-5.
- 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

Question 1	Answer any THREE out of FIVE	[9+9+9=	27 Marks
Question 2	Journal and Viva:	[	8 Marks
Question 3:	Internal Practical Examination	[	15 Marks
	TOTAL	[	50 Marks

B.Sc. Mathematics
SEMESTER - 5
Mathematics PAPER – 06 (B) (Practical)
Programming in C language

- **Total Marks:- 35 Marks (External)+ 15 Marks (Internal) = 50 Marks / 3 hours**

- (1) To write a program to find net salary of the employee.
- (2) To write a program to solve the quadratic equation,
- (3) To write a program to reverse a number,
- (4) To write a program to verify a number whether it is palindrome or not.
- (5) To write a program to find sum of the digits,
- (6) To write a program to print Armstrong numbers,
- (7) To write a program to find compound interest for given years,
- (8) To write a program to find nPr and nCr.
- (9) To write a program to find number of odd number and even numbers.
- (10) To write a program to generate arithmetic and geometric progressions.
- (11) To write a program to find prime number between two numbers,
- (12) To write a program to solve the equation by Bisection method or
- (13) To write a program to solve the equation by N-R method.
- (14) To write a program to add and multiply two matrices.

Notes :

- There shall be **SIX** periods of **1 hour** per week per batch of **15** students.
- **10** practical should be done during semester-5.
- 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

Question 1	Answer any THREE out of FIVE	[9+9+9=	27 Marks
Question 2	Journal and Viva:	[	8 Marks
Question 3:	Internal Practical Examination	[	15 Marks
	TOTAL	[	50 Marks

B.Sc. Mathematics
SEMESTER - 5
Mathematics PAPER – 07 (B) (Practical)
Numerical Analysis – I

- **Total Marks:- 35 Marks (External) + 15 Marks (Internal) = 50 Marks / 3 hours**

- 1) Fitting (1) a straight line and (2) $y = e^{ax}$
- 2) Fitting (1) a parabola and (2) $y = ax^b$
- 3) Gauss elimination
- 4) Gauss Jordan method
- 5) Jacobi's method
- 6) Gauss Seidel's method
- 7) Finite differences.
- 8) Gregory-Newton's forward interpolation formula.
- 9) Gregory-Newton's backward interpolation formula.
- 10) Equidistance terms with one or more missing values

Notes :

- There shall be **SIX** periods of **1 hour** per week per batch of **15** students.
- **10** practical should be done during semester-5.
- 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

Question 1	Answer any THREE out of FIVE	[9+9+9=	27 Marks
Question 2	Journal and Viva:	[	8 Marks
Question 3:	Internal Practical Examination	[	15 Marks
	TOTAL	[	50 Marks

Syllabus of B.Sc. Semester-6
According to Choice Based Credit System
Effective from June – 2018

*(Updated on date:- 26-07-2017
and updation implemented from June - 2018)*

- **Program:** **B.Sc.**
- **Semester:** **6**
- **Subject:** **Mathematics**
- **Course codes:** **08 (A) -Theory**
09 (A) -Theory
10 (A) -Theory
08 (B) - Practical
09 (B) - Practical
10 (B) - Practical
1 Project
- **Total Credit Of The Semester** **24 Credit**

B. Sc. MATHEMATICS SEMESTER : VI

- The Course Design of B. Sc. Sem.- VI (Mathematics) according to choice based credit system (CBCS) comprising of Paper Number, Name, No. of theory lectures per week, No. of practical lectures per week , total marks of the course are as follows :

SR.NO	SUBJECT	NO. OF THEORY LECTURE PER WEEK	NO. OF PRACTICAL LECTURE PER WEEK	TOTAL MARKS	Credit Of Each Paper.
1	PAPER 08 (A) (Theory) Graph Theory & Complex Analysis-II	6	-	70(External)+ 30 (Internal) = 100 Marks	4
2	PAPER 09 (A) (Theory) Mathematical Analysis-II & Abstract Algebra-II	6	-	70(External)+ 30 (Internal) = 100 Marks	4
3	PAPER 10 (A) (Theory) Optimization & Numerical Analysis-II	6	-	70(External)+ 30 (Internal) = 100 Marks	4
4	PAPER 08 (B) (Practical) Introduction to GeoGebra	-	6	35(External)+ 15(Internal) = 50 Marks	3
5	PAPER 09 (B) (Practical) Numerical Analysis-II	-	6	35(External)+ 15(Internal) = 50 Marks	3
6	PAPER 10 (B) (Practical) Optimization	-	6	35(External)+ 15(Internal) = 50 Marks	3
7	Project Work & Viva	1 Guidance Lect. For a group of 2 to 5 students / week	Project work to be finalized and certified and evaluated.	60Marks (Dissertation) + 40 Marks (Viva) = 100 Marks	3
Total credit of the semester five					24

**Marks Distribution of Each Paper
for
Theory and Practical (for SEMESTER-VI)**

- **Total Marks of Each Theory Paper [External Examination]** **70 Marks**
- **Total Marks of Each Theory Paper [Internal Examination]** **10 Marks Assignments +
10 Marks QUIZ / test +
10 Marks Internal exam. =
30 Total Marks**
- **Total Marks of Each Practical Paper [External Examination]** **35 Marks**
- **Total Marks of Each Practical Paper [Internal Examination]** **15 Marks
[Continuous internal assessment of
practical work]**

Format of Question Paper

- There shall be one question paper of **70 marks & $2\frac{1}{2}$ hours** for each Mathematics Theory Paper.
- There shall be **FIVE** questions from each unit of **14 marks** each.
- Each Question will be of the following form.

Question	(A) Answer any four out of four (Short answer type question)	4 Marks
	(B) Answer any one out of two	2 Marks
	(C) Answer any one out of two	3 Marks
	(D) Answer any one out of two	5 Marks
	TOTAL	14 MARKS

B.Sc. Mathematics

SEMESTER - 6

MATHEMATICS PAPER – 08 (A) (Theory)

GRAPH THEORY and COMPLEX ANALYSIS - II

-

UNIT 1: [14 Marks]

Graph theory:

Basic definitions and simple examples, Directed, Undirected, multi-graph, mixed graph. Incidence relation and degree of the graph. Empty, complete, regular graphs. Sub graph, connected and disconnected graphs.

Walk and unilateral components, Euler graphs, Unicursal graph, Operation of graph circuit & tree. Hamiltonian path and cycles, tree, Binary and Spanning trees.

UNIT 2: [14 Marks]

Cut-set, connectivity and separability

[OMIT:-1-isomorphism, 2-isomorphism]

planar graphs and their different representation, Dual of a planar graph, Euler's formula, Kuratowski's first and second non-planar graph, vector space associated with a graph, Circuit subspace and cut sets subspace, Orthogonal space.

Vertex coloring, Chromatic number, Index number and partition, Cyclic graph and demyelization of cyclic graphs, Matrix representation of a graph, Adjacency matrix, Incidence matrix, Path matrix,

[OMIT :- Circuit matrix, Fundamental circuit matrix and cut set matrix, Relation ship of these matrices]

Rank of the adjacency matrix.

UNIT 3: [14 Marks]

Mapping and Conformal mapping:

Elementary functions, mapping by elementary functions, Mobius mapping, linear function, Bilinear mapping $w=(az+b)/(cz+d)$, $w = z^2$, $w = 1/z$, $w = \exp(z)$,

[OMIT: $w = \sin z$, $w = \cos z$, $w = \cosh z$, $w = \sinh z$]

Transformations, Conformal mappings and their examples.

UNIT 4: [14 Marks]

Power series:

Definition of complex sequence, Complex series and power series Expansion of a complex function in Taylor's series and Laurent's series.

UNIT 5: [14 Marks]

Residues and poles:

Definition of a singular point, Isolated singular points, Zeros of complex functions, Poles and residues of complex function, Cauchy's residue's theorem, Evaluation of improper real integrals by residue theorem and evolution of definite integral of trigonometric functions by residue theorem.

Text book for Mathematics PAPER – 08 (Unit 1 & 2)

Graph theory

Graph theory with application to engineering and computer science

By: - Narsingh Deo,

Prentice Hall of India Private Limited, New Delhi.

Chapter: 1

- § 1.1, § 1.3, § 1.4, § 1.5
- [OMIT : - § 1.2 and § 1.6]

Chapter: 2

- § 2.1, § 2.2, § 2.3, § 2.4, § 2.5, § 2.6, § 2.7, § 2.8, § 2.9
- [OMIT: - § 2.10]

Chapter: 3

- § 3.1, § 3.2, § 3.3, § 3.5, § 3.6, § 3.7, § 3.8
- [OMIT: - § 3.4, § 3.9, § 3.10]

Chapter: 4

- § 4.1, § 4.2, § 4.3, § 4.4, § 4.5,
- [OMIT: - § 4.6, § 4.7, § 4.8]

Chapter: 5

- § 5.2, § 5.3, § 5.4, § 5.5, § 5.6
- [OMIT: - § 5.1, § 5.7, § 5.8, § 5.9]

Chapter: 6

- § 6.1, § 6.5, § 6.7, § 6.9
- [OMIT: - § 6.2, § 6.3, § 6.4, § 6.8]

Chapter: 7

- § 7.1, § 7.8, § 7.9
- [OMIT: - § 7.2, § 7.3, § 7.4, § 7.5, § 7.6, § 7.7]

Chapter: 8

- § 8.1, § 8.2, § 8.5
- [OMIT: - § 8.3, § 8.4, § 8.6]

Chapter: 9

- § 9.1, § 9.11
- [OMIT: - § 9.2 to § 9.10]

Text Book of Mathematics Paper 08 Unit 3, 4 & 5 is as follows

“Complex Variables and Applications”

Fifth Edition,

Ruel V. Churchill and James Ward Brown.

Mc Graw – Hill Publishing Company

Chapter 5

- Sections 44, 45, 46, 47, 48 [Omit Sections: -49, 50, 51],

Chapter 6

- Sections 53 to 58, 60 [OMIT:- Sections 59]

Chapter 7

- Sections 64, 65, 66, 67, 68, 70
[OMIT Sections: - 63, 71, 72]
[OMIT: - Chapter 8]

References

- (1) Complex variables and applications, by R. V. Churchill and J. \ Brown
- (2) Theory of functions of a Complex variables, by Shantinakaran, Chand & Co.
- (3) Complex variables, Introduction and applications, by Mark Ablowitz and A. S. Fokas,

Cambridge University Press.

(4) Graph theory with application to engineering and computer science.by Narsingh Deo. 1993,Prentice Hall of India Pvt. Ltd.

(5) Foundation of Discrete Mathematics, K. D. Joshi, New Age International Ltd. Publishers.

(6) A first look at Graph theory, by Clark.

(7) Discrete Mathematical Structures with applications to computer science, by Trembley I.P. and Manohar R.

(8) Elements of Discrete Mathematics (2nd edition) by L. Liu, Me. GrawHill, International edition, Computer Science series, 1986.

(9) Discrete Mathematics, By Vatsa, Vikas Publications.

(10) Introduction Graph Theory, By R. J. Willsons

(11) Discrete Mathematics Structure, By. Dugragi, N

B.Sc. Mathematics

SEMESTER - 6

MATHEMATICS PAPER – 09 (A) (Theory)

MATHEMATICAL ANALYSIS - II and ABSTRACT ALGEBRA - II

UNIT 1: [14 Marks]

Compactness in Metric Spaces

Cover, Open cover, Finite sub cover, Compact set, Properties of compact sets
Connected sets, Separated sets, Bolzano-Weirstrass theorem, Countable set.
Homeomorphism of two metrics, Sequential compactness, totally bounded space.

UNIT 2: [14 Marks]

Laplace Transforms

Definition of Laplace Transforms, Laplace Transforms of elementary Function
Inverse Laplace Transforms, Laplace Transforms of Derivative

UNIT 3: [14 Marks]

Application of Laplace Transforms to Differential Equations.

Laplace Transforms of Integrals, Laplace Transforms Differentiation and
integration of Laplace Transforms, Convolution theorem, Application to
Differential Equations.

UNIT 4: [14 Marks]

First fundamental theorem of homomorphism of groups and Rings

Homomorphism of groups, Kernel of homomorphism, First fundamental theorem
of homomorphism of groups. Ring and its properties, Subring, [OMIT:- **Boolean
ring, Euclidean ring**]

Field, Zero divisor, Integral domain, Characteristics of ring, Cancellation law,
Ideals, Principal ideal, Polynomial ring, [OMIT:- **Quotient ring. Maximal
ideal**] Polynomial, Degree of polynomial, Factor and remainder theorem of
polynomial, Product, sum and division of polynomials.

UNIT 5: [14 Marks]

Polynomial Rings

Reducible and irreducible polynomials, Factorization of polynomials(unique
Factorization theorem (**without proof**), [OMIT:- **Eisenstein's criterion**]

Division algorithm theorem of polynomial

G.C.D. of polynomials, Quaternion [OMIT:- **Ring homomorphism, Euler and
Fermat's theorem**]

Text book for Mathematics PAPER – 09 (A)

MATHEMATICAL ANALYSIS - II (Unit 2 and 3)

For Laplace Transforms

'Advanced Mathematics for Pharmacy'

By: - Dr. M. M. Patel, Atul Prakashan, Ahmedabad

Chapter: - 17 Laplace Transforms

§ 16.1 to 16.9 , § 16.11, § 16.12 [OMIT :- § 16.10]

Text Book for MATHEMATICS PAPER 09 (A)

"Abstract Algebra" By: Dr. I. H. Sheth, Prentice Hall Of India, New Delhi.

Course of Mathematics PAPER – 09 (A) (Unit 4 & 5) are covered by following Chapters/
Sections of the above mentioned book Abstract Algebra

- Chapter 12:** § 12.1, § 12.2, § 12.6
Chapter 13: § 13.1, § 13.2, § 13.3, § 13.4
Chapter 14: § 14.1, § 14.2, § 14.3, § 14.4
Chapter 15: § 15.1, § 15.2, § 15.4 [OMIT:- § 15.3]
Chapter 18: § 18.1, § 18.2, § 18.3,
§ 18.4 [Omit: Theorem: 18.4.8
i. e. unique Factorization theorem (without proof)],
§ 18.5[OMIT: - § 18.6 - Eisenstein's criterion]
§ 18.7.

References :

- (1) Topics in Algebra, I. N. Herstein, Willey Eastern Ltd. New Delhi
- (2) A text Book of Modern Abstract Algebra, by Shantinakaran, S. Chand & Co., New Delhi.
- (3) Fundamentals of Abstract Algebra, D. S. Malik, J. N. Mordoson
and M. K. Sen, McGraw Hill International Edition - 1997
- (4) University Algebra, M. S. Gopalakrishna, Wiley Eastern Ltd.
- (5) Abstract Algebra, By Bhattacharya, Yallo Publications.
- (6) Modern Algera, By Kazi zamiudia & Sursit, Vikas Publication. Delhi.
- (7) Text Book: Abstract Algebra, Dr. I. H. Sheth, Nirav Prakashan, Ahmedabad.
- (8) Mathematical Analysis (2nd edition) by S. C. Malik & Arora, New Age Inter. Pvt.'
- (9) Mathematical Analysis, by T. M. Apostol
- (10) Real Analysis, by R. R. Goldberg (Chapel' 4,5,6, 7,9 & 10.1)
- (11) A course of Mathematical Analysis, by Shantinakaran, S. Chand & Sons.
- (12) Metric space, by E. T. Capson
- (13) Metric space, P. K. Jain & Ahmad, Narora Publishing House
- (14) Real Analysis by Sharma and Vasishtha Krishna Prakashan, Meerut-2.
- (15) Mathematical Analysis, by Dr. Goyal and Gupta, Krishna Prakashan, Meerut-2.

B.Sc. Mathematics
SEMESTER - 6
MATHEMATICS PAPER – 10 (A) (Theory)
OPTIMIZATION and NUMERICAL ANALYSIS - II

UNIT 1: [14 Marks]

Linear Programming Problems

The linear programming problems, Formulation of LPP, Matrix form of the LPP, general form, Canonical form, Standard form of the LPP, Graphical method to solve LPP, Some definitions and basic properties of convex sets convex functions and concave function. Basic definitions to use Simplex method, Simplex method, Big-M method (Penalty method), Two phase method to solve LPP(without alternative solution and unbounded solution)

UNIT 2: [14 Marks]

Transportation and Assignment Problems

Principle of duality in LPP, Primal LPP and method to find its dual LPP (Simple problems of above articles). The transportation problems: Mathematical and matrix form of TP. Initial solution of TP by NWCM, LCM and VAM, Optimum solution of TP by Modi method (u-v method) (except degenerate solution), Balanced and unbalanced TP(Simple problem), Assignment problem: Mathematical and matrix form of AP, Hungarian method to solve method(simple method).

UNIT 3: [14 Marks]

Central difference interpolation & interpolation with unequal intervals:

Gauss's forward, Gauss's backward, Sterling's, Bessel's and Laplace- Everett's interpolation formulae.

Divided differences, Properties of divided difference, Relation between divided differences and forward difference, Newton's divided difference formula, Lagrange's interpolation formula, Inverse interpolation, Lagrange's inverse interpolation formula,

UNIT 4: [14 Marks]

Numerical Differentiation & Integration::

Numerical Differentiation, Derivatives using Gregory-Newton's forward difference formula, Derivatives using Gregory-Newton's backward difference formula, Derivative using Sterling's formula. Numerical Integration, General quadrature formula, Trapezoidal rule, Simpson 's 1/3 rule, Simpson's 3/8 rule.

UNIT 5: [14 Marks]

Numerical solution of ordinary differential equations

Solution by Taylor's series method, Taylor's series method for simultaneous first order differential equations, Picard's method, Picard's method for simultaneous first order differential equations, Euler's method, Improved Euler's method, Modified Euler's method.

Runge's method, Runge-Kutta methods, Higher order Runge-Kutta methods, Runge-Kutta methods for simultaneous first order differential equations, R-K methods for simultaneous first order differential equations, Predictor-Connector methods, Milne's method.

Text Book for Mathematics PAPER – 10 (A) (Theory) OPTIMIZATION (Unit - 1 & 2)

**Operation Research Theory and Applications’,
J. K. Sharma, Second Edition,
MACMILLAN INDIA LTD**

Course of Mathematics PAPER – 10 (A) OPTIMIZATION
is covered by following Chapters/ Sections of the above mentioned book

Chapter 2:-

- § 2.6 [Only]

Chapter 3:-

- § 3.1, § 3.2, § 3.3 [Omit:- § 3.4]

Chapter 4

- § 4.1, § 4.2, § 4.3, § 4.4 [Omit:- § 4.5 and § 4.6]

Chapter 5

- § 5.1, § 5.2, § 5.3 [Omit:- § 5.4, § 5.5]

Chapter 9

- § 9.1 to § 9.5 § 9.6
- [Only § 9.6.1 Unbalanced Supply and Demand]
- [Omit: - § 9.6.2, § 9.6.3, § 9.6.4... etc in § 9.6]
- [Omit: - § 9.7, § 9.8]

Chapter 10 § 10.1 to § 10.3

- Appendix A A.10 and A.12
- [Omit: - § 10.4 to § 10.6]
- [Omit: - the rest]

The scope of the syllabus of **UNIT – 3, 4 & 5** is roughly indicated as under:

"Numerical methods" by Dr. V. . Vedamurthy & Dr. N. Ch. S. N. Iyengar, Vikas Publishing house.

Chap.7 (Except 7.7,7.8), Chap. 8. (Except 8.8), Chap. 9. (Except 9.5, 9.13), Chap. 11. (Except 11.1, 11.2,11.3, 11.6, 11.9, 11.17, 11.20)

Reference Books:

- (1) Introduction to Numerical Analysis (2nd Edition) by C.E.Froberg Addison Wasley, 1979
- (2) Numerical Mathematical Analysis, by J. B.Scarforough, Oxford & IBH Publi.Co. Pvt. Ltd., 1966
- (3) Numerical method, Problems & Solutions, by M. K. Jain, S. R. K.Iyengar, R. K. Jain, New Age International Pvt. Ltd., 1996.

B.Sc. Mathematics
SEMESTER -6
MATHEMATICS PAPER – 08 (B) (PRACTICAL)

Introduction to GeoGebra

- 1) Introduction to the interface of GeoGebra.
- 2) Use of tool bars to draw various Geometric Shapes including lines, line segments, triangles, polygons, circles and conics.
- 3) Drawing of graphs of any function of one variable for Cartesian equation using menu bar and to analyze the function using function inspector tool from tool menu and find its properties like maximum and minimum values .
- 4) Drawing of graph of curves using menu bar, when equation of the curves are given.
- 5) Drawing of various types of triangles including equilateral triangles, isosceles triangles, right angle triangles, acute triangle, obtuse triangle, and finding its various important centers including centroid, in-center, circum -- enter and ortho-center.
- 6) Introduction of various circle and compass tools and practice of drawing construction of various geometric shapes including triangles, polygons, squares, rectangle ..etc.
- 7) Verification of important theorems of geometry, algebra and calculus using GeoGebra.
- 8) Drawing and measuring various geometric shape using angle, distance, area and slop tools from tool bar.
- 9) Introduction and usage of reflect, rotate and translate by a vector tools.
- 10) Introduction to the usage of slider and basic animation.

Notes :

- There shall be **SIX** periods of **1 hour** per week per batch of **15** students.
- **10** practical should be done during semester-6.
- 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

Question 1	Answer any THREE out of FIVE	[9+9+9=	27 Marks
Question 2	Journal and Viva:	[	8 Marks
Question 3:	Internal Practical Examination	[	15 Marks
	TOTAL	[	50 Marks

B.Sc. Mathematics
SEMESTER -6
MATHEMATICS PAPER – 09 (B) (PRACTICAL)
NUMERICAL ANALYSIS – II

- 1) Gauss forward interpolation formula.
- 2) Gauss backward interpolation formula.
- 3) Sterling's or Bessel's formula
- 4) Laplace-Everett's formula
- 5) Interpolation with unequal intervals.
- 6) Numerical differentiation.
- 7) Numerical integration.
- 8) Taylor's or Picard's
- 9) Euler's method.
- 10) Runge's method
- 11) Runge-Kutta's method
- 12) Milne's method

Journal and viva.

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(i.e. Continuous internal assessment of performance of each student during the practical work.)

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	TOTAL	[50 Marks

B.Sc. Mathematics
SEMESTER -6
MATHEMATICS PAPER – 10 (B) (PRACTICAL)
OPTIMIZATION

- 1) Solve the given LPP using Graphical method.
- 2) Solve the given LPP using Simplex method.
- 3) Solve the given LPP using BIG -M method.
- 4) Solve the given LPP using TWO-PHASE method.
- 5) Obtain DUAL of the given Primal LPP;
- 6) Find the initial solution of given transportation problem using NWCM method.
- 7) Find the optimum solution of given transportation problem using LCM method.
- 8) Find the optimum solution of given transportation problem using VAM method.
- 9) Find the optimum solution of given transportation problem using MODI method.
- 10) Find the optimum solution of given assignment problem.

Journal and viva.

Notes :

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- **10** practical should be done during semester-6.
- At the time of examination candidate must bring his/her own practical journal duly certified and signed by **H.O.D.**
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