

**BHAKT KAVI NARSINH MEHTA
UNIVERSITY, JUNAGADH**

MATHEMATICS

Syllabus of B.Sc. Semester-5 & 6

According to Choice Based Credit System

Effective from June – 2018

*(Updated on FEBRUARY 1,2018
and updation implemented from June - 2018)*

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

*(Updated on FEBRUARY 1,2018
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 (Might be cancelled and English might be introduced from the Ac. Year 2018-19)	<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 FIVE questions from all five units one each of 14 marks.
- Each question will be of the following form

Question no.	(A)	Answer any four out of four (short answer type questions)	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**

Format of Question Paper
(Effective from Academic Year 2018-19 onwards)

- There shall be FIVE questions from all five units one each of 14 marks.
- Each question will be of the following form

Question no.	(A)	Answer any one out of two (Theory Question)	07 Marks
	(B)	Answer any one out of two (Applications/Examples/Problems/Theory)	04 Marks
	(C)	Answer any one out of two (Short Answer/One word/One line/True or False/Fill up blanks)	03 Marks

TOTAL **14 MARKS**

-: Project Work:-

(Might be cancelled and English might be introduced from the Ac. Year 2018-19)

- 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 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 Algebra, 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 (Chapters: 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 Vasishta 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) Theory of functions of Complex variables, by Shantinakaran, Chand & Co.
- (2) Complex variables, Introduction and applications, by Mark Ablowitz and A. S. Fokas, Cambridge University Press.
- (3) Graph theory with application to engineering and computer science. by Narsingh Deo. 1993, Prentice Hall of India Pvt. Ltd.
- (4) Foundation of Discrete Mathematics, K. D. Joshi, New Age International Ltd. Publishers.
- (5) A first look at Graph theory, by Clark.
- (6) Discrete Mathematical Structures with applications to computer science, by Trembley I.P. and Manohar R.
- (7) Elements of Discrete Mathematics (2nd edition) by L. Liu, Me. Tata GrawHill, International edition, Computer Science series, 1986.
- (8) Discrete Mathematics, By Vatsa, Vikas Publications.
- (9) Introduction Graph Theory, By R. J. Willsons
- (10) Discrete Mathematics Structure, By. Dugragi, Narosa 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 FEBRUARY 1,2018
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 (Might be cancelled and English might be introduced from the Ac. Year 2018-19)	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 FIVE questions from all five units one each of 14 marks.
- Each question will be of the following form

Question no.	(A)	Answer any four out of four (short answer type questions)	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**

Format of Question Paper
(Effective from Academic Year 2018-19 onwards)

- There shall be FIVE questions from all five units one each of 14 marks.
- Each question will be of the following form

Question no.	(A)	Answer any one out of two (Theory Question)	07 Marks
	(B)	Answer any one out of two (Applications/Examples/Problems/Theory)	04 Marks
	(C)	Answer any one out of two (Short Answer/One word/One line/True or False/Fill up blanks)	03 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 decyclization of cyclic graphs, Matrix representation of a graph, Adjacency matrix, Incidence matrix, Path matrix, Rank of the adjacency matrix.

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

UNIT 3: [14 Marks]

Mapping and Conformal mapping:

Elementary functions, mapping by elementary functions, Mobious 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 evaluation 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) Theory of functions of a Complex variables, by Shantinarayan, Chand & Co.
- (2) Complex variables, Introduction and applications, by Mark Ablowitz and A. S. Fokas, Cambridge University Press.
- (3) Graph theory with application to engineering and computer science. by Narsingh Deo. 1993, Prentice Hall of India Pvt. Ltd.

- (4) Foundation of Discrete Mathematics, K. D. Joshi, New Age International Ltd. Publishers.
- (5) A first look at Graph theory, by Clark.
- (6) Discrete Mathematical Structures with applications to computer science, by Trembley I.P. and Manohar R.
- (7) Elements of Discrete Mathematics (2nd edition) by L. Liu, Me. GrawHill, International edition, Computer Science series, 1986.
- (8) Discrete Mathematics, By Vatsa, Vikas Publications.
- (9) Introduction Graph Theory, By R. J. Willsons
- (10) 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: - Mahajan Publishing House, Ahmedabad

Chapter: - 17 Laplace Transforms

§ 17.1, § 17.2, § 17.3, § 17.4, § 17.5, § 17.6

[OMIT :- **Application to Differential Equations**]

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, Narosa 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)

**Operations 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.

Notes :

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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 :

- 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.**
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	TOTAL	[50 Marks

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