

**Parvatibai Chowgule College of Arts & Science  
(Autonomous)  
Margao – Goa**

**MINUTES OF MEETING OF THE BOARD OF STUDIES IN MATHEMATICS**

**HELD ON 21<sup>st</sup> JUNE 2021**

A meeting of this BOS was convened on 21<sup>st</sup> June 2021 via online mode through Google Meet. Since the number of members present represented the Quorum, the BOS began its proceedings.

Minutes are presented in the format.

Members present:

1. Anand Masur
2. Danielle Monteiro
3. RovánVaz
4. Sunil Harmalkar
5. Cera Fernandes
6. MeetalRaikar
7. Dr. Milind Kulkarni
8. Dr. Stefan Dais Barreto
9. Dr. Rajeev Sapre

Members Absent with Intimation

1. Dinkar Sathe

Proceedings

The Chairperson welcomed the members of the Board of Studies. The Chairperson introduced and explained the agenda for the meeting and Board transacted the following business:

Agenda Items:

1. To restructure the courses.
2. Pass syllabi of three new courses.
3. Any other matter with permission of the chair.

PART A:

The following resolutions were passed by the members of the BOS:

1. Course restructure was approved.
2. Two new elective courses Logic and Boolean Algebra and Operations Research II was added in sem IV and sem V respectively.
3. The syllabus of Logic and Boolean Algebra, Abstract Algebra I, Abstract Algebra II was approved.
4. The Programme outcomes and course outcomes was approved.

The syllabus and course structure are attached

### Course Structure for Mathematics Major

	Core	Core	Elective-I	Elective-II	Elective-III	Elective-IV	Elective V
<b>Sem-I</b>	Basic Algebra	Basic Real Analysis	-----	-----	-----	-----	
<b>Sem-II</b>	Coordinate Geometry	Mathematical Analysis-I	-----	-----	-----	-----	
<b>Sem-III</b>		Mathematical Analysis-II	Abstract Algebra-I	Number Theory-I	Combinatorics	Numerical Methods	
<b>Sem-IV</b>		Linear Algebra	Advanced Analysis	Number Theory-II	Cryptography	Probability Theory	Logic and Boolean Algebra
<b>Sem-V</b>		Functions of Several Variables	Metric Spaces	Differential Equations-II	Graph Theory	Pedagogy of Mathematics	Operations Research II
<b>Sem-VI</b>		Vector Analysis	Complex Analysis	Abstract Algebra-II	Computational Linear Algebra	Computers for Mathematics	

Semester	Skill Enhancement Course
Sem III	Differential Equations- I
Sem IV	Operations Research-I

### Course Structure for Mathematics Minor

Semester	Core (Minor)
I	Basic Algebra
II	Coordinate Geometry
III	Basic Real Analysis
IV	Mathematical Analysis I/ Linear Algebra
V	Graph Theory / Numerical Methods
VI	Probability Theory/ Vector Calculus

**Course Title:** Logic and Boolean algebra.

**Course Code:** MAT- (Sem IV )

**Marks:** 100

**Credits:** 4

**Course objective:** To formalize logic and set theory and introduce students to Boolean algebra.

**Course outcome:** At the completion of the course students will be able to

1. Use symbolic logic and illustrate it.
2. Appreciate set theoretical relations and examples.
3. Apply Boolean algebra in some real-life situations.

**Prerequisites:** Basic Algebra

## **Content**

### **Unit 1: Logic – 15 lectures**

- 1.1 Revision: Statements in logic, symbolic representation, connectives, truth-tables.
- 1.2 The logic of compound statements: Logical form and logical equivalence, conditional statements, duality law, normal forms, rules of inference, valid and invalid arguments.
- 1.3 Quantified statements: Predicates and quantified statements, universal quantifiers, existential quantifiers, statements with multiple quantifiers, arguments with quantified statements.
- 1.4 Study of logic gates: AND, OR, NOT, XOR, XNOR, NAND and NOR gates.

### **Unit 2: Sets – 15 lectures**

- 2.1 Revision: Basic concepts of set theory, finite and infinite sets, set operations, laws of set theory.
- 2.2 Binary relations, types of relations, equivalence relations, Partial ordering relations, posets, Hasse diagrams, upper bound, lower bound, lub, glb.

### **Unit 3: Lattices & Boolean algebra – 30 lectures**

- 3.1 Lattice as a poset, duality principle for lattices, properties of lattice.
- 3.2 Sub-lattice, complemented lattice, distributive lattice,
- 3.3 Lattice homomorphisms & isomorphisms, order preserving homomorphisms.
- 3.4 Boolean algebra, its properties, sub-algebra, direct products, homomorphisms, joint-irreducible elements.
- 3.5 Boolean expressions, equivalent boolean expressions, minterm, maxterm, values of boolean expressions, Stone's representation theorem for finite boolean algebra,
- 3.6 Canonical forms: sum-of-products, product-of-sums canonical forms.
- 3.7 Boolean functions and their representations- cube notation, Karnaugh maps, applications.

#### **References:**

1. Discrete mathematical structures with applications to computer science  
- by J.P. Tremblay, R. Manohar (Principle text)
2. Elements of Discrete mathematics – by C. Liu
3. Discrete mathematics – (Schaum's outlines) by Seymour Lipschutz, Marc Laras Lipson & Varsha H. Patil.

**Course Title:** Algebra I

**Course Code:** MAT-III.E-1 (Sem 3)

**Marks:** 100

**Credits:** 4

**Course Objectives:** To introduce basic algebraic structures (Groups Rings and fields).

**Learning Out comes:** the students will have an understanding of group, ring and field structure.

**Prerequisites:** Basic Algebra

### **Content**

1) **Groups:** (20 Hours)

Definition and Examples of Groups, Elementary Properties of Groups, finite-infinite groups, Subgroups, definition and examples, Subgroup Tests, Cyclic Groups, Cosets, Properties of Cosets, Lagrange's Theorem and consequences.

2) **Group Homomorphisms:** (20 Hours)

Permutation Groups, Isomorphisms definition and examples, Properties of Isomorphism., Cayley's Theorem, Automorphisms, Homomorphisms, Properties of Homomorphisms, Normal Subgroups, Factor Groups, The Isomorphism theorems.

3) **Rings:** (20 Hours)

Rings Definition and examples, Properties of Rings, Subrings, Integral Domains, Fields, Characteristic of a Ring, Ideals and Factor Rings, Prime Ideals and Maximal Ideals, Ring Homomorphisms, properties and examples, The Field of quotients.

### **References:**

1) Gallian J, Contemporary Abstract Algebra, Cengage Learning

2) Fraleigh J.B., A First Course in Abstract Algebra, Pearson

3) Herstein I.N., Topics In Algebra, Wiley

**Course Title:** Algebra II

**Course Code:** MAT- (Sem 5)

**Marks:** 100

**Credits:** 4

**Course Objectives:** - To further the knowledge of algebraic structures.

**Learning Out comes:** the students will be able to understand important results and their application of algebraic structures.

**Prerequisites:** Basic Algebra, Algebra I

### **Content**

1) **Sylow Theorems** (25 Hours)

Orbit- Stabiliser theorem, Conjugacy classes, The Class equations, The Sylow Theorems and their Applications

3) **Polynomial Rings:** (25 Hours)

Definition, The Division Algorithm and its consequences, factorisation of Polynomials, reducibility and irreducibility tests, Eisenstein criteria, Unique factorization in  $\mathbb{Z}[x]$ , Irreducible element, Prime element, UFD, PID, ED.

4) **Finite Fields** (10 Hours)

Definition, examples, Classification of finite Fields,  $\mathbb{Z}_p, \mathbb{Z}_{p^n}$ , Special case study when  $p=2$ .

### **References:**

- 1) Gallian J, Contemporary Abstract Algebra, Cengage Learning
- 2) Fraleigh J.B., A First Course in Abstract Algebra, Pearson
- 3) Herstein I.N., Topics In Algebra, Wiley

The foregoing minutes of the meeting were read out by the Chairman at the meeting itself and they were unanimously approved by all themembers present

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Ms. Danielle Monteiro  
Member Secretary, BOS

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Mr. Anand Masur  
Chairman, BOS

Date:

PART C: The remarks of the Dean of the Faculty:-

- a. The minutes are in order
- b. The minutes may be placed before the Academic Council with remark, if any.
- c. Important points of the minutes which need clear policy decision of the Academic council to be recorded.

Date:

Signature of the Dean: \_\_\_\_\_  
(Faculty of Sciences)