

**Parvatibai Chowgule College of Arts and Science
(Autonomous)
Margao-Goa**

**MINUTES OF MEETING OF THE BOARD OF STUDIES IN MATHEMATICS
HELD ON 29th OCTOBER 2022**

Vide Chowgule College notice (F.133(C)/1156 dated 18/10/2022) a meeting of this BOS was convened on 29th October 2022 at Parvatibai Chowgule College of Arts and Science (Autonomous), Margao-Goa. Since the number of members present represented the Quorum, the BOS began its proceedings.

Members present:

1. Anand Masur
2. Danielle Monteiro
3. Chitra Mekoth
4. Rovavaz
5. Dr. Stefan Dais Barreto
6. Dr. Rajeev Sapre

Members Absent with Intimation

1. Dr. Milind Kulkarni
2. Meetal Raikar

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. Approve Course outcomes.
2. Any other matter with permission of the chair.

PART A: Important Points/ recommendations of BOS that require consideration/ approval of BOS:

1. The Course objectives of all the courses were approved as per annexure I.
2. A course on Finite Mathematics was suggested as a possible course for students of other fields as regards to NEP 2020.

PART B: Important Points/ recommendations of BOS that require consideration/ approval of Academic Council:

1. The Course objectives of all the courses were approved as per annexure I.
2. A course on Finite Mathematics was suggested as a possible course for students of other fields as regards to NEP 2020.

The foregoing minutes of the meeting were read out by the Chairperson at the meeting itself and they were unanimously approved by all the members present.

The following members of the BOS in Mathematics were present for the meeting:

1. Anand Masur
2. Danielle Monteiro
3. Chitra Mekoth
4. Rovin Vaz
5. Dr. Stefan Dais Barreto
6. Dr. Rajeev Sapre



Ms. Danielle Monteiro
Chairman, BOS



Ms Chitra Mekoth
(Member Secretary)

Date: 29/10/2022

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: 17/11/2022

Signature of the Dean:
(Faculty of Sciences)



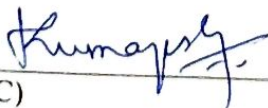
(Dr. Meghana Devli)

PART D: The remarks of the Member Secretary of Academic Council:-

- 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: 18/11/2022

Signature of the Member Secretary:
(Academic Council)



(Mr. Kumaresh V.C)

ANNEXURE I

Course Code	Course Title	Course Outcomes
MAT-I-C-1	Basic Algebra	<p>C01. Apply various concepts of logic to produce clear and valid arguments</p> <p>C02. Define and interpret the various concepts of sets relations and functions</p> <p>C03. Compute and use determinants and matrices</p> <p>C04. Recognize consistent and inconsistent systems of linear equations by reducing to the row echelon form of the augmented matrix, using rank</p> <p>C05. Understand the importance of roots of real polynomials and learn various methods of obtaining roots.</p>
MAT-I-C-2	Basic Real Analysis	<p>C01. Construct real numbers</p> <p>C02. Use properties of real numbers in analysis</p> <p>C03. Draw and recognize graphs of some important functions</p> <p>C04. Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and calculate the limit superior, limit inferior, and the limit of a bounded sequence.</p> <p>C05. Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.</p>
MAT-II-C-3	Coordinate Geometry	<p>C01. Understand the properties of Central conics.</p> <p>C02. Explain the properties of three dimensional shapes.</p> <p>C03. Use the general equation of second degree to classify and sketch conic sections.</p> <p>C04. Sketch curves in Cartesian and polar coordinate systems.</p>
MAT-II-C-4	Mathematical Analysis I	<p>C01. Reproduce properties of continuous functions.</p> <p>C02. Illustrate the various properties of differentiable functions</p> <p>C03. Use the properties of continuous and differential functions in other fields</p>
MAT-III-C-5	Mathematical Analysis II	<p>C01. Study the properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.</p> <p>C02. Determine various applications of the fundamental theorem of integral calculus.</p> <p>C03. Classify and evaluate improper integrals.</p> <p>C04. Integrate numerically using various methods.</p>

MAT-III-E-1	Algebra I	<p>C01. Understand the definition and properties of groups.</p> <p>C02. Learn about structure preserving maps between groups and their consequences.</p> <p>C03. Understand the fundamental concepts in ring theory such as ideals, quotient rings, integral domains, and fields.</p>
MAT-III-E-2	Number Theory I	<p>C01. Understand divisibility, congruence and their properties.</p> <p>C02. Apply various results of number theory to problems.</p> <p>C03. Learn about number theoretic functions and their applications.</p> <p>C04. Understand the working of certain Diophantine equations</p>
MAT-III-E-3	Combinatorics	<p>C01. Understand basic techniques and schemes to solve different combinatorial problems</p> <p>C02. Analyse a given combinatorial problem and solve it by applying one of the standard techniques learnt.</p>
MAT-III-E-4	Numerical Methods	<p>C01. Obtain numerical solutions of algebraic and transcendental equations.</p> <p>C02. Learn about various interpolating and extrapolating methods.</p> <p>C03. Solve differentiation and integration problems numerically</p> <p>C04. Write python programs for some numerical methods.</p>
MAT-III-SEC-1	Differential Equations I	<p>C01. Understand the genesis of ordinary differential equations.</p> <p>C02. Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.</p> <p>C03. Grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.</p> <p>C04. Formulate mathematical models in the form of ordinary differential equations to obtain possible solutions of the day-to-day problems arising in different disciplines.</p>
MAT-IV-C-6	Linear Algebra	<p>C01. Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.</p> <p>C02. Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations, diagonalization.</p>

		C03. Understand inner product spaces and the process of orthogonalization.
MAT-IV-E-5	Advanced Analysis	<p>C01. Analyse sequence and series of functions.</p> <p>C02. Learn convergence of some special functions like exponential, logarithmic, trigonometric etc.</p> <p>C03. Represent continuous functions as polynomials</p>
MAT-IV-E-6	Number Theory II	<p>C01. Familiarise with modular arithmetic and find primitive roots of prime and composite numbers.</p> <p>C02. Understand quadratic congruences.</p> <p>C03. Express integers as sum of squares.</p> <p>C04. Use concepts of finite and infinite continued fractions.</p>
MAT-IV-E-7	Operations Research I	<p>C01. Analyse and solve linear programming models of real-life situations.</p> <p>C02. Provide graphical solutions of linear programming problems with two variables, and illustrate the concept of convex set and extreme points.</p> <p>C03. Understand the theory of the simplex method.</p> <p>C04. Know about the relationships between the primal and dual problems</p> <p>C05. Learn about the transportation, assignment problems.</p>
MAT-IV-E-8	Theory of Probability	<p>C01. Solve the problems related to discrete and continuous probability distribution</p> <p>C02. Identify the different sampling distributions</p> <p>C03. Learn about the various distribution functions like binomial, Poisson, normal etc..</p>
MAT-IV-SEC-2	Differential Equations II	<p>C01. Find power series solutions of differential equations</p> <p>C02. Solve ordinary differential equations using Laplace transforms.</p> <p>C03. Solve systems of first order differential equation</p> <p>C04. Understand Boundary value problems, Sturm-Liouville Theorems, linear differential equation of higher order</p>
MAT-V-C-7	Functions of Several Variables	<p>C01. Progress from single variable functions to several variable functions.</p> <p>C02. Learn about partial derivatives and its applications.</p> <p>C03. Understand the concept of differentiability for several variables</p> <p>C04. Solve problems using line, double integrals.</p>
MAT-V-E-9	Metric Spaces	<p>C01. Understand several standard concepts of metric spaces</p> <p>C02. Explain properties of metric spaces like openness, closedness, completeness, Bolzano-Weierstrass property.</p>

		compactness, and connectedness. C03. Learn about functions defined on metric spaces
MAT-V-E-10	Graph Theory	C01. Appreciate the definition and basics of graphs along with types and their examples. C02. Understand the definition of a tree and use various algorithms to find the shortest path C03. Know the applications of graph theory to network flows. C04. Understand the notion of planarity and colouring of a graph.
MAT-V-E-11	Cryptography	C01. Understand the difference between classical and modern cryptography. C02. Learn the fundamentals of cryptography, including Data and Advanced Encryption Standards and RSA. C03. Encrypt and decrypt messages using block ciphers C04. Know about the aspects of number theory which are relevant to cryptography.
MAT-V-E-12	Logic and Boolean Algebra	C01. Use symbolic logic and illustrate it. C02. Learn about partially ordered sets, lattices and their types. C03. Understand Boolean algebra and Boolean functions, logic gates, switching circuits and their applications
MAT-V-E-13	Operations Research II	C01. Solve game theory using different methods C02. Evaluate EOQ in different inventory models. C03. Evaluate various measures of performance in queueing models C04. Find better approximations of results using simulations
MAT-VI-C-8	Vector Analysis	C01. Define Vector valued functions and various concepts like gradient, divergence and curl of these functions C02. Analyse vector functions to find limits, derivatives, tangent lines, integrals, arc length, curvature, torsion C03. Evaluate line integrals, surface area, surface integrals and volume integrals C04. Apply Green, Gauss and Stokes' theorems to solve problems
MAT-VI-E-14	Complex Analysis	C01. Understand complex numbers and their representations C02. Understand the significance of differentiability and analyticity of complex functions C03. Evaluate contour integrals. C04. Compute Taylor and Laurent series expansions of analytic functions,

		C05. Classify the nature of singularity, poles and residues and application of Cauchy Residue theorem.
MAT-VI-E-15	Algebra II	C01. Recognize and use the Sylow theorems to characterize certain finite groups. C02. Learn in detail about polynomial rings. C03. Understand fundamental properties of finite field extensions, and classification of finite fields.
MAT-VI-E-16	Computational Linear Algebra	C01. Use Gaussian Elimination to understand the system of linear equations C02. Understand the orthogonal vectors C03. Test a matrix for positive definiteness C04. Find the singular value decomposition of the matrix C05. Understand matrix norm and condition number
MAT-VI-E-17	Computers for Mathematics	C01. Type mathematics using Latex C02. Understand basic aspects of programming. C03. Use programming languages to solve mathematical problems C04. Perform basic data analysis using R
MAT-VI-E-18	Pedagogy of Mathematics	C01. Understand the nature and value of mathematics C02. Learn different methods and techniques of teaching mathematics C03. Find the appropriate method to teach various topics of school mathematics