<p style="text-align: center">MINUTES OF THE BOS (Board of Studies) MEETING</p>

<p style="text-align: center">Mathematics</p>

Board Of Studies Meeting in Mathematics was held on 21st February 2020.

Following members were present.

1] Anand Masur

2] Rovan Vaz

3] Sunil Harmalkar

4] Cera Fernandes

5] Ankita Desai

6] Meetal Raikar

7] Dr. Milind Kulkarni

8] Dr. Stefan Dais Barrato

9] Dr. Rajeev Sapre

10] Devayani Nitturkar

Following had informed about their absence.

1] Danielle Montero

2] Dinkar Sathe

The meeting commenced with Anand Masur, the Chairman of BOS welcoming all the attendees.

 The Agenda was

A] To discuss and approve new course structure

B] To discuss and approve new syllabi of Analysis

C] To discuss and approve two SEC

D] To discuss and approve list of Minor courses.

E] To discuss and approve restructured Statistics courses.

Following resolutions were passed

A) Two Skill enhancement courses were approved.

1. Differential Equations (For even sem.)
2. Operations Research (For odd sem.)

B) Analysis Syllabi in four parts was approved.

   C) Rearrangement of courses across the semester was approved.

   D) List of Minor courses was approved.

Approved Syllabus and rearranged course structure.

Basic Real Analysis

Aim:- To introduce number system with its geometrical properties and axioms of real numbers.

Course outcome:- After completion of this course students will be able to

> 1] relate geometry with real number system.
>
> 2] use axioms of real numbers in analysis.
>
> 3] draw and recognize graphs of some elementary but important functions.
>
> 4] use technical terminology and some basic tools in analysis.

1] Numbers :- Simple Algebraic development from Natural numbers to Real numbers.   (5)

2] Geometry of Real numbers :- Representation of real numbers on a line, Tricotomy Law, Order on R, Archimedes property, Hausdorff property, distance concept: absolute value (all inequalities ex. Triangle inequality). Subsets of R : bounded-unbounded sets, bounded sets, lub. glb. Completeness axiom, intervals, open-closed intervals, open/closed nbd. of a point, limit points, dense set (Q and Q' only), concept of infinity,   (15)

 3] Functions :- Examples with graphs (log , a^x, x^n, trigonometric functions, step function, absolute value function, polynomial / rational functions, signum function.) Inverse function:- How /why to restrict domain/ co-domain (range), graphs of inverses of above functions, Compositions, addition, product of functions.   (7)

4] Sequences:- definition , examples, convergence/ divergence of sequence, types of sequences, Cauchy sequences, Sub sequences, absolute convergence, all theorems, Bolzano Weierstrass theorem.   (17)

5] Series :- Definition, Examples, alternate series, Convergence, Cauchy criteria, absolute convergence, rearrangement of series, All theorems for testing the convergence (absolute and non absolute),   (17)

Mathematical Analysis- I

Aim:- To introduce two important families of functions (continuous and differentiable)

Course Outcome:- After completion of this course students will be able to

1] use the properties of continuous (differentiable) function to solve problem in real life

   situation.

2] illustrate and reproduce all theorems and properties continuous (differentiable) functions.

1] Continuous functions:- Limit of a function (Limit at ∞ and lim ---› ∞) , Algebra of limits, continuous functions($\varepsilon-\delta$ definition), types of discontinuity, sequential continuity, continuous functions on closed and bounded intervals , their properties, All results of continuous function, IVT and bisection method to find root of a continuous functions, uniform continuity,   (25)

2] Differentiable functions :- Definition, properties, theorems, increasing/decreasing functions, Taylor's theorem, Newton's Method, L'Hospital's rules, maxima-minima, MVTs. , convex / concave functions, singular points.   (25)

3] Use of differentiation in Physics, Economics and other subjects.   (10)

Mathematical Analysis- II

Aim:- To introduce one more family of functions, Integrable functions.

Course outcome:- After completion of this course students will be able to

1] Identify Integrable functions.

2] Classify and evaluate improper integrals.

3] Integrate functions numerically.

1] Riemann integrals:- Tagged partition, Riemann sum, Riemann integrable functions, some simple results on integrable functions using Riemann sum.   (10)

2] Darboux integrals:- Upper/lower sum, integrable function, Riemann criteria of integrable function, classes of integrable functions,   (15)

3] Fundamental theorems of integration and their applications (chain rule, substitution and product rule theorems)   (12)

4] Improper integration (type I, type II and type III), α and β functions.   (8)

5] Numerical integration – Quadrature Rules, Trapezoidal, Mid-point, Simpson's and Weddle's rules of integration.   (15)

Advance Analysis

Aim:- To introduce some approximations of continuous/differentiable functions.

Course outcome :- After completion of this course students will be able to

1] Analyze sequence and series of functions.

2] Use some basic techniques to represent continuous functions as polynomials.

1] Sequence of functions:- convergence, uniform convergence, interchange theorems.   (15)

2] Series of functions:- Convergence, uniform convergence, interchange theorems. Power series and their radius of convergence, Cauchy-Hadamard theorem, Differentiation and uniqueness theore. (15)

3] Some special functions.(exponential, logarithmic and trigonometric) (12)

4] Continuity and Gauges, δ-fine partition, step function, inverse function theorem, Weierstrass approximation theorem (using Bernstein polynomials), Dini's theorem. (18)

New Course Structure is as follows

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

Apart from this Two Skill Enhancement Courses

1] Differential Equation-I   in ODD SEMESTER

2] Operations Research   in EVEN SEMESTER

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

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Rearranged and enhanced Statistics courses was approved.

Course Structure for Statistics

	Core	**Core**				
SEM - I	Basic Analysis	Combinatorics - I				
SEM – II	Mathematical Analysis	Probability theory				
			Elective-I	**Elective-II**	**Elective-III**	**Elective -IV**
SEM – III		Testing of hypothesis	Applications of Probability Distributions	Statistical Estimation.	Numerical Methods	
SEM – IV		Linear Algebra	Design of	Decision theory	Operations Research	

			experiments and sampling	and anova		
SEM – V		Graph Theory	Stochastic Process	Applied GIS	Python	
SEM - VI		Statistical Graph Theory	Practical -I	Practical-II	Matematical Finance (On Line.)	

SUGGETIONS GIVEN BY THE MEMBERS.

Two more courses were suggested as SEC

    [1]Courses in Applied Statistics (introduce Computer Components)

    [2]Single variable Calculus

➤ Courses Suggested by the Experts nominated by the academic council
1. Industrial mathematics (calculus, programming, data base management, application of mathematics)
2. Financial Mathematics
3. Bio-mathematics
4. Foundation of mathematics (history of mathematics)
5. Boolean Algebra with logic (include predicate calculus, proportionality Calculus & applications)
6. Fourier Courses

➤ Suggestions by the Experts nominated by the academic council
1. Giving importance to Application of Mathematics.
2. Teach Discrete Mathematics as a full course.
3. Introduction of Operation Research-II Course in Semester VI.
4. Inclusion of path connectedness In Metric Space Course.
5. To get visiting faculty in specialized courses.

Vote of thanks was given by Professor Anand P. Masur.

(prepared by Cera Fernandes)