Minutes of the meeting of Board of Studies in Mathematics held on 14th June 2022 via Google Meet

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

1. The syllabus for Differential Equations I was approved.
2. The syllabus for Numerical Methods with Python was approved.
3. The syllabus for Computers for Mathematics was approved.

PARVATIBAI CHOWGULE COLLEGE OF ARTS AND SCIENCE
(AUTONOMOUS)
DEPARTMENT OF MATHEMATICS
COURSE STRUCTURE
THREE YEARS B.A./B.Sc. DEGREE COURSE IN MATHMATICS

SEMESTER	**CORE COMPULSORY**		**CORE ELECTIVE**					**SKILL ENHANCEMENT COURSES**
I	Basic Algebra	Basic Real Analysis						
II	Coordinate Geometry	Mathematical Analysis I						
III	Mathematical Analysis II		Abstract Algebra I	Number Theory I	Combinatorics	Numerical Methods		Differential Equations I
IV	Linear Algebra		Advanced Analysis	Number Theory II	Operations Research I	Probability Theory		Differential Equations II
V	Functions of Several Variables		Metric Spaces	Graph Theory	Cryptography	Logic and Boolean Algebra	Operations Research II	
VI	Vector Analysis		Complex Analysis	Abstract Algebra II	Computational Linear Algebra	Computers for Mathematics	Pedagogy of Mathematics	

PARVATIBAI CHOWGULE COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS), MARGAO - GOA

SYLLABUS FOR PROGRAMME BACHELOR OF ARTS/SCIENCE IN MATHEMATICS

S.Y.B.A./S.Y.B.Sc. (SEMESTER-III)

1. Course Title : Differential Equations I

2. Course Code :MAT-III.SEC-I

3. Marks : 100

4. Credits : 4

5. Duration : 60 hours

6. Prerequisite Courses : Mathematical Analysis

7. Course Objectives :To introduce some methods of solving ODE of first and higher order, Applications of the same in different fields.

8. Course Outcomes :Students can solve ODE with constant coefficients, given a simple situation can make an ODE.

Syllabus :

Unit 1:- (15 lectures)

Introduction. Some simple situations where we come across ODE, Geometrical Meaning of ODE, Solutions of an ODE. Picard's Existence and Uniqueness theorem.

First order ODE. Variable separable, Homogeneous, Non- Homogeneous, Exact differential equations, integrating factor, linear differential equations, Bernoulli equations.

Unit 2:- (15 lectures)

Second order differential equations, Homogeneous and non-homogeneous differential equations, complementary function, particular integral, Wronskian, Solution space, General solution, complex solutions. Some methods of solving second order differential equations (undetermined coefficients, variation of parameters, using one solution to find other).

Unit 3:- (15 lectures)

Linear differential equations of higher order, simple examples of non-homogenous differential equations.Some application of differential equations, LR / LCR circuits, SHM (simple-damped- forced), Equation of Catenaries, Planetary Motions – Kepler's Laws.

Unit 4:- (15 lectures)

Some numerical methods : Euler method, modified Euler method, Runge- Kutta methods (order two and order four). Picard's method of successive approximation.

References :

Textbook: - Simmons G.F., Differential Equations with historical Notes, Tata McGraw Hill

1. Boyce W.E. & DiPrima R.C., Elementary Differential Equations and Boundary Valued Problems, John Wiley Pvt Ltd.
2. Braun C, Differential Equations and Their Applications: An Introduction to Applied Mathematics (Texts in Applied Mathematics), springer.
3. Coddington E., Theory of Ordinary Differential Equations, Tata McGraw Hill
4. Rainville E.D., Elementary Differential Equations, Pearson

1. Course Title : Numerical Methods with Python

2. Course Code : MAT-III.E-4

3. Marks : 100

4. Credits : 4

5. Duration : 60 hours

6. Prerequisite Courses : Mathematical Analysis

7. Course Objectives :This course covers the basic methods for finding the finite difference, solution of simultaneous equations and the techniques of Numerical Differentiation and Numerical Integration. It also deals with solution of Algebraic and Transcendental equations.

8. Course Outcomes :The student will be able to solve numerically various equations. Also write python programs for some numerical methods.

Syllabus :

Module I: Error Analysis (15 Lectures)

Approximate numbers, significant figures, rounding off numbers, Error- Absolute, relative and percentage

Introduction to Python

Installation, Basics of programming, If, elif, for and while loop, simple programs involving these loops, Lists, list comprehension.

Finite Differences

Operators- Δ, and E (Definitions and some relations among them), finite difference tables, fundamental theorem on differences of a polynomial and examples.

Module II: Interpolation and Extrapolation (15 lectures)

Newton Gregory Forward and backward interpolation formulae (with deduction of formulae) and examples (for equal intervals)

For unequal intervals- Lagrange's Formula and Newton's divided difference formula (No proof) and examples
Python program for Newton Gregory Forward and Backward interpolation formula, Lagrange interpolation formula, Newton's Divided difference formula.

Module III: Numerical Integration and differentiation (15 lectures)
Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules (with proof) and problems. Weddle's rule (no proof, only problems)
Numerical differentiation and examples
Python program for Trapezoidal rule, Simpson's $1/3^{rd}$ rule, $3/8^{th}$ rule, Weddle's rule and numerical differentiation formula (derivative at the initial point only).

Module IV: Numerical Solutions of Equations (15 Lectures)
To find a real root of an algebraic or transcendental equation using Bisection method, regular falsi method, Newton Raphson method with geometrical significance and problems and method of iteration. Gauss- Seidel method to solve simultaneous equations.
Python program for Bisection method, Regula falsi method, Newton Raphson method Gauss- Seidel method.
Curve fitting : Method of least squares- fitting a line, second degree polynomial, exponential curve and examples. Python programs for fitting a line, second degree polynomial, exponential curve.

References :

1. Atkinson K., An Introduction to Numerical Analysis, John Wiley & Sons
2. Chatterji P.N, Numerical Analysis
3. Comte S.D and Carl de Boor, Elementary Numerical analysis - An Algorithmic approach, McGraw Hill
4. Hildebrand F.B, Introduction to Numerical Analysis, McGraw Hill
5. Sastry S.S, Introductory Methods of Numerical Analysis, Prentice Hall India
6. Scarborough J.B, Numerical Mathematical Analysis, Oxford and IBH Publishing Company, New Delhi.

SYLLABUS FOR PROGRAMME BACHELOR OF ARTS/SCIENCE IN MATHEMATICS
T.Y.B.A./T.Y.B.Sc. (SEMESTER-VI)

1. Course Title : Computers for Mathematics
2. Course Code : MAT-III.E-16
3. Marks : 100
4. Credits : 4
5. Duration : 60 hours

6. Prerequisite Courses :Basic knowledge of computers, a basic course in ODE, Numerical analysis. Familiarity with computer programming will be helpful but not compulsory.

7. Course Objectives :To train students to use computers for mathematical typing, computing and plotting. Helping them understand theory using computational methods

8. Course Outcomes :Students will be able to use these free packages for writing and drawing mathematical papers. Also can understand some basic aspects of programming and perform basic data analysis in R.

Syllabus :

Unit 1.Introduction to LaTeX (15 Lectures)

Mathematical typing in MS Word 07/13
Short comings of Word, need of some other package of writing.
Document Editing using LaTeX: - Text formatting, Paragraph formatting
Fonts and colours, special char acters, Tables, Page layout, importing graphics, footnotes, referencing, Beamer Presentations

Unit 2.Mathematical typesetting in LaTeX (10 Lectures)

Mathematical environments and packages Symbols, Greek letters and operators, Powers and indices, fractions, Roots, Sums,
integrals and derivatives, Brackets, Matrices

Unit 3. Introduction R Programming. (12 Lectures)

Fundamentals of R programming:-Introduction to interface (R studio), evolution, features, All Data types in R, Variable (assignment, its data type), All operators in R, Loops and R functions (user defined and built in functions), Entering data from keyboard, Importing data from various data Sources.

Unit 4. R Statistics , data visualization and management (12 Lectures)

R charts and graphs, Data frame, Data reshaping, Mean, Median , Mode.

Unit 5. Scilab/ Matlab/ Geogebra (11 Lectures)

Introduction to Scilab, familiarizing with the Scilab, Scilab syntax, Variables, functions, Loops, plotting graphs.

References :

1. M.Alley, the Craft of Scientific Presentations, Springer (2003).
2. W.C. Booth, G.G. Colomb, and J.M. Williams, The Craft of Research (Chicago Guides to Writing, Editing, and Publishing) Univ. of Chicago Press, 2008.
3. George Graetzer, Math into LaTex, An introduction to LaTex and AMS-LaTex, Birkhauser, 1996.
4. Donald E. Knuth; Tracy E Larrabee, Paul M. Roberts: Mathematical writing, Mathematical Association of America, 1989.
5. S. Krantz: A Primer of Mathematical Writing: Being a Disquisition on Having Your Ideas Recorded, Typeset, Published, Read & Appreciated, American Mathematical Society, 1996.
6. S. Krantz: How to Teach Mathematics, American Mathematical Society, 1999.
7. Leslie Lamport: LaTex, a document preparing system, Addison-Wesley, 1994.

8. Jr. Strunk, William; E. B. White, The Elements of Style, Fourth Edition, Longman; 4th edition (1999).
9. Robert I. Kabacoff(2011): R in Action – Data Analysis and graphics in R, Manning.
10. Hadley Wickham(2009):ggplot: Elegant graphics for Data Analysis, Springer.

ANNEXURE A

(Summary of changes incorporated in the syllabus)

Semester	Course Title	Existing (Indicate only the unit where the change is proposed)	Changes Proposed	Specify the reason for the change
III	Differential Equations I	Unit 4	The Numerical methods to solve differential equations were added to the course	Numerical Method course was becoming heavy with the introduction of Python so some part of it was shifted here.
III	Numerical Methods with Python	All units	Python programming is added to the	Python programming was shifted from computers for mathematics
VI	Computers for Mathematics	Unit 3, 4	R programming added to the syllabus and python programming removed.	R program was found to be useful for students so it needed to be added.