



# **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(DEEMED TO BE UNIVERSITY)**

**Accredited A++ Grade by NAAC | 12B Status by UGC | Approved by AICTE**

**[www.sathyabama.ac.in](http://www.sathyabama.ac.in)**

**SCHOOL OF SCIENCE AND HUMANITIES**

**DEPARTMENT OF MATHEMATICS**

**MINUTES OF BOARD OF STUDIES MEETING**

**DATE: 23/01/2023**

**TIME: 10 a.m. – 1 p.m.**

**Venue: Department of Mathematics**

**Board of Studies meeting was held on 23/01/ 2023 at 10. a.m.**

- **Dr. M. Nirmala, Head of the Department greeted the external members**

**Dr. V. Kumaran, Professor,  
Department of Mathematics,  
NIT, Trichy.**

**Dr. Krishnamoorthy Somanchi  
Professor and Head,  
Department of Applied Mathematics,  
Defence Institute of Advanced Technology,  
Giri Nagar, Pune**

**and the internal staff members of Board of Studies.**

- **During the meeting the syllabus revision for UG courses and M.Sc. Mathematics were discussed.**

- A copy of syllabus is framed by internal BOS members was sent in advance to the external members for their perusal. Their comments were already received and noted down by the internal BOS members.
- The Suggestions from the external board members were put forth in the meeting for further discussions.
- As per the suggestions of external board members the titles of the courses have been revised.
- Some of the topics in the courses of B.E./B.Tech./B.Sc./ M.Sc. programmes were included in relevance with present day needs such as ability enhancement course, value added course, multi disciplinary course and skill development course.
- External members appreciated the outcomes of the courses.
- External members gave valuable suggestion on list of reference books.
- External members suggested including elective courses in M.Sc., Mathematics.
- B.Sc. Mathematics syllabus has been incorporated according to new education policy
- In B.Sc. Mathematics, external board members advised to include the below mentioned courses
  - ❖ Sequence and Series
  - ❖ Financial Mathematics
- In M.Sc. Mathematics, external board members advised to include the below mentioned courses
  - ❖ Fuzzy sets, Logic Theory and Applications
  - ❖ Mathematical Computation with Python
  - ❖ Mathematical Computation with Python-Lab
  - ❖ Matlab for Advanced Numerical Methods
  - ❖ Mathematical Modeling
  - ❖ Statistical Inference and Stochastic Process
  - ❖ Self-Pased Learning History of mathematics
- All the suggestions in the meeting were noted down
- The meeting ended with vote of thanks by Dr. M. Nirmala.

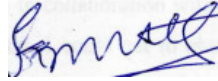
#### **SIGNATURE OF THE MEMBERS**

1. Dr. V. KUMARAN



Department of Mathematics,  
NIT, Trichy

2. Dr. KRISHNAMURTHY SOMANCHI



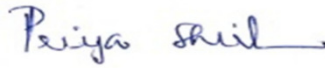
Professor and Head,  
Department of Applied Mathematics,  
Defence Institute of Advanced Technology,  
Giri Nagar, Pune

3. Dr. M. NIRMALA



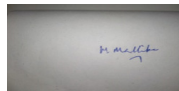
Professor & Head  
Department of Mathematics,  
Sathyabama Institute of Science and Technology  
Chennai

4. Dr. PRIYA SHIRLEY MULLER



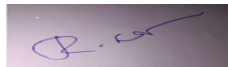
Associate Professor  
Department of Mathematics,  
Sathyabama Institute of Science and Technology  
Chennai

5. Dr. M. MALLIKA



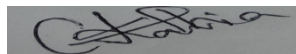
Associate Professor  
Department of Mathematics,  
Sathyabama Institute of Science and Technology  
Chennai

6. Dr. R. PARAMESWARI



Assistant Professor  
Department of Mathematics,  
Sathyabama Institute of Science and Technology  
Chennai

7. Dr. C. KAVITHA



Assistant Professor  
Department of Mathematics,  
Sathyabama Institute of Science and Technology  
Chennai.

|          |                                |   |   |   |    |   |
|----------|--------------------------------|---|---|---|----|---|
| SMTB5111 | MEASURE THEORY AND INTEGRATION | L | T | P | EL | C |
|          |                                | 3 | 1 | 0 | 0  | 4 |

### COURSE OBJECTIVES:

- To Introduce the measure on a real line
- To develop the Lebesgue Measure and Borel Measure
- To gain understanding the abstract measure theory and main properties of integral

### UNIT- I RIEMANN INTEGRATION

12 Hrs

Definition and existence of the integral, properties of the integral, integration and differentiation, Rectifiable Curves.

### UNIT-I MEASURE ON A REAL LINE

12Hrs

Measure on a real line –Lebesgue Outer measure – Measurable sets – Regularity – Measurable functions

### UNIT-II LEBESGUE MEASURE

12 Hrs

Measure on a real line – Lebesgue Outer measure – Measurable sets – Regularity – measurable functions.

### UNIT-II BOREL SET

12Hrs

Borel Set –Borel and Lebesgue measurability– Integration of functions of a real variable–Integration of non-negative functions – General Integral

### UNIT-III BOREL MEASURE

12 Hrs

Borel & Lebesgue measurability– Integration of Functions of a real variable – integration of non-negative functions –The General Integral

### UNIT-III ABSTRACT MEASURE SPACE

12Hrs

Measure and Outer measure –Completion of a measure – Measure spaces – $L^p$ -Spaces– Completeness of  $L^p(\mu)$

### UNIT-IV ABSTRACT MEASURE SPACE

12 Hrs

Abstract Measure Space – Measure and Outer measure – Uniqueness of the extension – Completion of a measure –Measure space – Integration with respect to measure

### UNIT-IV SIGNED MEASURE AND THEIR DERIVATIVES

12Hrs

Signed Measures –Hahn Decomposition – Jordan Decomposition–RadonNikodym theorem– Some Applications of the RadonNikodym theorem

### UNIT-V THE HAHN JORDAN DECOMPOSITION

12 Hrs

Signed measure and their derivatives – The Hahn Decomposition – The Jordan Decomposition – The Radon

**Nikodym theorem – some applications of the The Radon Nikodym theorem – Measure and Integration in a Product space – Measurability in a Product Space – The Product Measure and Fubini's theorem.**

## **UNIT-V PRODUCT SPACE**

**12Hrs**

**Product Space –Measure and Integration in a Product space – Measurability in a Product Space – Product Measure and Fubini's theorem**

### **Textbooks**

1. G. De Barra, Measure Theory and Integration, New Age International (P) Limited, Publishers, New Delhi Fourth Reprint, (1997).

UNIT I Sections 2.1 – 2.4

UNIT II Sections 2.5, 3.1 – 3.2

UNIT III Sections 5.1, 5.4 – 5.5, 6.1, 6.5

UNIT IV Sections 8.1 – 8.4

UNIT V Sections 10.1–10.2

### **Books for Reference**

1. M. C. Munroe, Measure and Integration, Addison, Wesley Publishing Company, Second Edition (1971).
2. H.L. Roydon and P.M. Fitzpatrick, Real Analysis, Prentice Hall of India, Learning Pvt. Ltd., New Delhi, Four Edition (2011).

| <b>SMTB5110</b> | <b>MATHEMATICAL COMPUTATION WITH PYTHON</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>EL</b> | <b>C</b> |  |
|-----------------|---------------------------------------------|----------|----------|----------|-----------|----------|--|
|                 |                                             | <b>3</b> | <b>0</b> | <b>0</b> | <b>0</b>  | <b>3</b> |  |

### **COURSE OBJECTIVES:**

- The course is designed to introduce the fundamental ideas of the mathematical computation Python
- To develop a clear understanding of the concepts of Python.
- To acquire skills to solve various mathematical models
- To prepare the data for effective visualization

## **UNIT I PYTHON BASICS**

**9Hrs**

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

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Added Content

**UNIT II BEGINNING PYTHON PROGRAMMING****9Hrs**

Creating Python Programs :Input and Output Statements, Control statements(Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.), Defining Functions, default arguments, Errors and Exceptions

**UNIT III SYMBOLIC MATHEMATICS****9 Hrs**

Introduction to the SymPy library for symbolic mathematics-Symbolic variables and expressions - Simplification, expansion, and substitution of expressions-Solving equations and systems of equations symbolically

**UNIT III PYTHON DATA STRUCTURES****9 Hrs**

Dictionary, List, Tuples, Sets, Dataframe, Series, Handling CSV and spreadsheets

**UNIT IV NUMERICAL COMPUTATION****9 Hrs**

Introduction to the NumPy- library for numerical computations- Working with arrays and matrices- Mathematical operations with NumPy arrays- Numerical differentiation and integration using SciPy- Solving Differential Equations- root finding.

**UNIT IV NUMERICAL COMPUTATION (using Numpy and Pandas)****9 Hrs**

Working with arrays (sort, filter, shuffle, slice) – Matrices – Polynomials – Linear Algebra – Inverse Matrix – System of Equations

**UNIT V DATA VISUALIZATION WITH PYTHON****9 Hrs**

Basic Plotting – Polynomial Fitting using matplotlib- Plotting trigonometric plotting using Matplotlib.

**UNIT V DATA VISUALIZATION WITH PYTHON (using plotly, seaborn, matplotlib, ggplot2)****9 Hrs**

Visualization Techniques for Spatial Data, Geospatial Data, Time-Oriented Data, Bivariate Data, Trees, Graphs, and Networks

**Max Hrs: 45 Hrs**

**COURSE OUTCOME:** At the end of the course, the student will be able to

- CO1 To provide Basic knowledge of Python
- CO2 To learn how to design and program Python applications
- CO3 Develop proficiency in data structures using Python
- CO4 To learn Numerical computations with python
- CO5 Understand different customization options available in Matplotlib to enhance the appearance and readability of the visualizations.
- CO6 Explore different styles and themes available in plotly and ggplot2 for creating visually appealing plots

**TEXT/REFERENCE BOOKS:**

1. Allen Downey, Jeffrey Elkner, Chris Meyers.How to think like a computer scientist learning with Python / 1st Edition,2012
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705.

3. Fuhrer, Claus, Jan Erik Solem, and Olivier Verdier. *Scientific Computing with Python 3*. Packt Publishing Ltd, 2016.
4. Johansson, Robert. *Numerical Python: A Practical Techniques Approach for Industry*. Apress, 2015.
5. Millman, K. Jarrod, and Michael Aivazis. "Python for scientists and engineers." *Computing in science & engineering* 13.2 (2011): 9-12.



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Added Content

|          |                     |   |   |   |    |   |
|----------|---------------------|---|---|---|----|---|
| SMTB1204 | SEQUENCE AND SERIES | L | T | P | EL | C |
|          |                     | 3 | 1 | 0 | 0  | 4 |

### COURSE OBJECTIVES:

- To understand the basic definitions of limits and convergence in the context of sequences and series of real numbers.
- To provide the limits of sequences involving elementary functions by applying Cauchy's test D Alembert's test Raabe's test

### UNIT I SEQUENCES

12 Hrs

Sequence-Limit, Convergence of a sequence- Cauchy's general principle of convergence Cauchy's first theorem on Limits-Bounded sequences – Divergent and Oscillating Sequence.

### UNIT II LIMIT OF THE SEQUENCE

12 Hrs

Behavior of monotonic sequence – finite or infinite Sequence- Limit superior and Limit inferior -Some theorems on limits and Problems.

### UNIT III INFINITE SERIES

12 Hrs

Infinite series - Definition of Convergence, Divergence & Oscillation Series – Necessary condition for convergence –Convergence of Geometric series-Exponential & Logarithmic series –Summation of Series & Approximations using these theorems.

### UNIT IV TESTING OF SERIES-I

12 Hrs

Testing the convergence and divergence of series using Comparison test -D,Alembert's ratio test- Raabe's test and Leibnitz's Test with simple problems.

### UNIT V TESTING OF SERIES-II

12Hrs

Testing of series to obtain the convergence and divergence using Cauchy's condensation Test- Cauchy's root test and their simple problems- Alternative series with simple problems



Added Content

**Course Outcomes: At the end of the course, the student will be able to:**

- CO1 Discuss the convergence of sequence
- CO2 Evaluate the limits of finite and infinite sequence
- CO3 Compute the convergence and summation of infinite series
- CO4 Test the convergence of series using comparison, D'Alembert's ratio test, Raabe's Test and Leibnitz's test
- CO5 Investigate the convergence of series using Cauchy's Condensation Test and Cauchy's root test
- CO6 Explore convergence and divergence of Alternating series

**TEXT / REFERENCESBOOK**

1. T.K. Manicavachagam Pillai, T. Natarajan, K.S. Ganapathy, , Vol. I, S. Viswanathan Pvt. Limited, Chennai, 2004.
2. M.K.Singal &Asha Rani Singal, A first course in Real Analysis, R. Chand & Co. 1999.
3. Dr.S.Arumugam, Sequences & Series, New Gamma Publishers, 1999.

|          |                       |   |   |   |    |   |
|----------|-----------------------|---|---|---|----|---|
| SMTB3009 | FINANCIAL MATHEMATICS | L | T | P | EL | C |
|          |                       | 3 | 1 | 0 | 0  | 4 |

- **COURSE OBJECTIVES:**
- The objective of this course is to develop understanding on the concepts associated with financial mathematics
- To comprehend practical applications of interest rate in real life situation

**UNIT I PROBABILITY**

**12 Hrs**

Probability – Probabilities and Events – Conditional probability – Random Variables and Expected Values – Convergence and correlation – Continuous Random variables –Normal Random Variables – Properties of Normal Random Variables – The central limit Theorem – Simple Problems.

**UNIT II GEOMETRIC BROWNIAN MOTION**

**12Hrs**

Geometric Brownian Motion – G.B.M. as a limit of simple models – Brownian Motion – Simple problems - Interest rates – Present value analysis – Rate of return – Continuation of varying interest rates – An example of option pricing – other examples of pricing via arbitrage.

**UNIT III THE ARBITRAGE THEOREM AND BLACK SCHOLES FORMULA**

**12 Hrs**

The Arbitrage theorem – The multi period Binomial model – proof of the Arbitrage theorem - Black Scholes formula – properties of the Black Scholes option cost – Derivation of Black Scholes formula – simple problems.

**UNIT IV ADDITIONAL RESULTS ON OPTIONS****12 Hrs**

Additional results on options – Call options on Dividend paying Securities – Pricing American put options – Adding Jumps to Geometric Brownian Motion – Estimating the Volatility Parameter – Simple problems.

**UNIT V VALUING BY EXPECTED UTILITY****12 Hrs**

Valuing by Expected Utility – Limitation of Arbitrage pricing – valuing Investments by Expected utility – The portfolio selection problem – Value at risk and conditional value at risk The capital assets pricing model – Mean variance analysis of risk – Neutral priced Call options – Rates of return – Single period and Geometric Brownian Motion – simple problems.

**Course Outcomes: At the end of the course, the student will be able to:**

- CO1 Identify and approximate probability distribution for a given discrete or continuous random variable and use its properties to calculate probabilities.
- CO2 Relate the continuous time stochastic process using geometric Brownian motion.
- CO3 Apply black schools formula in financial market, which contains derivative investment instruments. Construct Arbitrage theorem to help the investors and financial analyst in price securities
- CO4 Analyze the stock prices, prices of other assets caused by unpredictable events using jumps to geometric Brownian motion.
- CO5 Evaluate the expected utility by taking the weighted average of all possible outcomes under certain circumstances.
- CO6 Compose the invariance principle that a decision maker should not be affected by the way alternates are presented.

**TEXT / REFERENCE BOOKS**

1. Sheldon .M.Ross, An Elementary Introduction to Mathematical Finance, 2nd Edition, Cambridge University press, 2005.
2. S.M.Ross, A first course in probability, Englewood cliffs Prentice Hall-NJ, 2002.
3. J.Cox and M.Rubinstein, Options Market, Englewood cliffs Prentice Hall-NJ, 2012.
4. J.E.Ingersill, Theory of financial decision making, Lanjarn, MD Rowerman of Little fields, 1987.

| SMTB7004 | FUZZY SETS , LOGIC THEORY AND APPLICATION | L | T | P | EL | C |
|----------|-------------------------------------------|---|---|---|----|---|
|          |                                           | 3 | 1 | 0 | 0  | 4 |

**COURSE OBJECTIVES:**

- To introduce the theory of fuzzy sets.
- To discuss theoretical differences between fuzzy sets and classical sets.
- To discuss fuzzy logic inference

     Added Content

**UNIT I FUZZY SET****12 Hrs**

Classical sets: Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets.

**UNITII FUNDAMENTALS OF FUZZY LOGIC****12 Hrs**

Classical and Fuzzy relations: Cartesian product, crisp relations-cardinality, operations and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other format of the composition operation.

**UNITIII FUZZIFICATION AND DEFUZZIFICATION****12 Hrs**

Features of the membership functions, various forms, Fuzzification, Defuzzification to crisp sets, - cuts for fuzzy relations, Defuzzification to scalars. Fuzzy logic and approximate reasoning, Other forms of the implication operation..

**UNITIV FUZZY SYSTEMS****12 Hrs**

Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of fuzzy rules, Graphical techniques of inference, Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories

**UNIT V FUZZY CLASSIFICATION****12 Hrs**

Classification by equivalence relations-crisp relations, Fuzzy relations, Cluster analysis, Cluster validity, C-Means clustering, Hard C-Means clustering, Fuzzy C-Means algorithm, Classification metric, Hardening the Fuzzy C-Partition

**Course Outcomes: At the end of the course, the student will be able to:**

- CO1 Interpret Fuzzy Set Theory And Uncertainty Concepts
- CO2 Identify The Similarities And Differences Between Probability Theory
- CO3 Fuzzy Set Theory And their Application Conditions
- CO4 Apply Fuzzy Set Theory In Modeling And Analyzing Uncertainty In A Decision Problem
- CO5 Apply Fuzzy Control By Examining Simple Control Problem Examples
- CO6 Evaluate The Fuzzy Classification Problems With Examples

## TEXT / REFERENCE BOOKS

1. Timothy J.Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2010.
2. George J.KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi, 2009.
3. S. Rajasekaran, G.A.Vijayalakshmi - Neural Networks and Fuzzy logic and Genetic Algorithms, Synthesis and Applications, PHI, New Delhi,2003.
4. Michal Baczynski and BalasubramaniamJayaram, Fuzzy Implications, Springer Verlag, Heidelberg, 2008

|          |                                             |   |   |   |    |   |
|----------|---------------------------------------------|---|---|---|----|---|
| SMTB6101 | MATHEMATICAL COMPUTATION WITH PYTHON<br>LAB | L | T | P | EL | C |
|          |                                             | 0 | 0 | 4 | 0  | 2 |

## COURSE OBJECTIVES:

- To acquire basic knowledge ofPython Programming .
- To educate the students about basics of data acquisition.
- To investigateBasic mathematical operations

## List of Experiments:

1. Introduction to Python Programming
2. Simple Python programs in Matrices
  - Addition, Subtraction
  - Matrix multiplication and inverse of a matrix
  - Determinant of a matrix
  - Eigen values and Eigen vectors
3. Basic mathematical operations
  - Sum of natural numbers
  - Finding factorial of a number
  - 
  - Finding square root and exponential of a given number
4. Program with relational conditional and logical Operators
  - LCM and DCD of numbers
  - Finding max and min of given numbers
5. Symbolic computations
  - Program to check the consistency of given system of equations
  - Program to solve the system of equations
  - Program to find the root of the polynomial equation
6. Numerical Computation using NumPy and Scipy
7. Differentiation and Integration
  - Program to find the derivatives of the given function
  - Partial derivative of a given function
  - Find the limit of a function
8. Plotting using matplotlib
  - Plotting standard curves
  - Line plot
  - Bar plot

- Histogram

#### 9. Statistics

- Mean
- Median
- Mode

#### 10. Solution of ordinary differential Equation

|                 |                                              |          |          |          |          |          |
|-----------------|----------------------------------------------|----------|----------|----------|----------|----------|
| <b>SMTB6201</b> | <b>MATLAB FOR ADVANCED NUMERICAL METHODS</b> | <b>0</b> | <b>0</b> | <b>4</b> | <b>0</b> | <b>2</b> |
|-----------------|----------------------------------------------|----------|----------|----------|----------|----------|

#### **COURSE OBJECTIVES:**

- It is designed to give students a basic understanding of MATLAB
- To process experimental data and to make plots to visualize experiments and extract conclusion

#### **LIST OF EXPERIMENTS**

1. Introduction to MATLAB
2. Study of Vector and Matrix Operations
3. Determination of roots of a polynomial
4. Solution of Linear equations for Underdetermined and Overdetermined cases.
5. Determination of Eigen values and Eigen vectors of a Square matrix.
6. Determination of polynomial using method of Least Square Curve Fitting.
7. Numerical Differentiation and Partial Differentiation
8. Numerical Integration and Double integration.
9. Solution of differential equation using 4th order Runge- Kutta method.
10. Solution of differential equation using Taylor's series method.
11. Solution of implicit Rungekutta method

**COURSE OUTCOME:** At the end of the course, the student will be able to

- CO1 Recall the basic terms and commands in MATLAB
- CO2 Summarize the vector and matrix operations in MATLAB
- CO3 Apply MATLAB to find roots of a polynomial
- CO4 Compare the MATLAB programming for finding numerical differentiation an partial differentiation
- CO5 Evalute solution of a differential equation by fourth order RK method
- CO6 Produce the polynomial using MATLAB by least square curve fitting

#### **REFERENCES:**

1. Fausett L.V., Applied Numerical Analysis using MATLAB, 2<sup>nd</sup> Edition, Pearson Education. 2007.
2. Chapra S.C. and CanaleR.P,Numerical Methods for Engineers, 5<sup>th</sup> Edition, McGraw Hill, 2006

## END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam

|     |                                                                           |          |
|-----|---------------------------------------------------------------------------|----------|
| CAE | Evaluation of Regular Lab class 25 Marks<br>Model practical exam 25 Marks | 50 Marks |
| ESE | University Practical exam                                                 | 50 Marks |

Duration: 3 Hrs

|          |                       |   |   |   |    |   |
|----------|-----------------------|---|---|---|----|---|
| SMTB7005 | MATHEMATICAL MODELING | L | T | P | EL | C |
|          |                       | 3 | 1 | 0 | 0  | 4 |

- COURSE OBJECTIVES:**

- To identify the significance of Mathematical Modeling and the various types of Mathematical models applied in different fields.
- To apply the models in various real life applications.

### Unit-I INTRODUCTION

12 Hrs

Basic Steps of Mathematical Modeling, its needs, types of models, limitations, Elementary ideas of dynamical systems, Equilibrium point, node, saddle point, focus, centre and limit-cycle idea with simple illustrations and figures

### Unit-II POPULATION MODELS

12 Hrs

Basic concepts, Exponential growth model, formulation, solution, interpretation and limitations.  
Compensation and depensation, Logistic growth model, formulation, solution, interpretation and limitations.

### Unit-III EPIDEMIC MODELS

12 Hrs

Basic concepts, SI model, SIS model with constant coefficient, SIS model with coefficient as a function of time  $t$ , SIS model with constant number of carriers, SIS model when the carriers is a function of time  $t$ , SIR model, Epidemics with vaccination.

### Unit-IV ECONOMIC MODELS

12 Hrs

Production and supply functions, price-elasticity, utility of consumption and consumer surplus, theory of production, production function.

### Unit-V BIOLOGICAL MODELS

12 Hrs

Blood flow and oxygen transfer Modeling blood flow, viscosity, Poiseuille law, mathematical formulation of the problem, solution and interpretation.

**Course Outcomes: At the end of the course, the student will be able to:**

- CO1 List the origin of Mathematical Modeling, needs and limitations
- CO2 Discuss the components and facts of various Population models.
- CO3 Sketch the models used to explore the epidemics
- CO4 Analyze the nature of the Economic models
- CO5 Summarize the science of blood flow and oxygen transfer
- CO6 Organize how the Poiseuille law is applied for modeling biological flows

**TEXT / REFERENCE BOOKS**

1. Mark M. Meerschaert, Mathematical Modeling, Academic Press, New Work, 1993
2. W. Meyer , Concepts of Mathematical Modeling, McGraw Hill, New York, 1994
3. Beltrami , Mathematics for Dynamic Modeling, Academic Press, Orlando, Florida, 1987
4. N. Bailey, The Mathematical Theory of Infectious Diseases, Haftier press, New York, 1975

|          |                                                 |   |   |   |    |   |
|----------|-------------------------------------------------|---|---|---|----|---|
| SMTB5106 | STATISTICAL INFERENCE AND STOCHASTIC<br>PROCESS | L | T | P | EL | C |
|          |                                                 | 3 | 0 | 0 | 0  | 3 |

**COURSE OBJECTIVES:**

- To Understand the probability, parametric, Non parametric test and basic of stochastic processes
- To study the real life experiments using ANOVA (design of experiment), Markov chain, Poisson process and its variations.
- To determine the higher order transition probabilities.

**UNIT I THEORY OF ESTIMATION**

9Hrs

Properties of estimates - asymptotically most efficient estimates - Likelihood function - Cramer-Rao inequality - Rao-Black-Well's theorem - Properties of Maximum likelihood estimates - Problems related to Maximum likelihood estimates.

**UNIT II THEORY OF HYPOTHESIS**

9Hrs

Power function and OC function –Errors - Most Powerful test- Uniformly Most Powerful test - Unbiased test - Neyman-Pearson fundamental Lemma - Problem.

**UNIT III NON-PARAMETRIC TEST**

9Hrs

Introduction - Kolomogorov Smirnov test for two samples - sign test - Wald Wolfowiz Run test - Median test for two samples and Mann-Whitney U-test.

**UNIT IV DESIGN OF EXPERIMENTS**

9Hrs

Analysis of variance - One-way classification - Two way classification - Principles of Experimental design - CRD, RBD and LSD and simple problems.

**UNIT V STOCHASTIC PROCESSES****9Hrs**

Specification of SP - Markov chain; transition probabilities - Determination of higher order transition probabilities - Chapman-Kolmogorov equation - Poisson processes(introduction only).

**Course Outcome: At the end of the course, the student will be able to**

|     |                                                                                                        |
|-----|--------------------------------------------------------------------------------------------------------|
| CO1 | Identify the properties of estimates and Maximum likelihood estimates and recall Cramer-Rao inequality |
| CO2 | Describe parametric tests for testing of hypothesis                                                    |
| CO3 | Illustrate various non-parametric tests for testing of hypothesis.                                     |
| CO4 | Analyze the variance using one-way and two-way ANOVA and distinguish between CRD, RBD and LSD.         |
| CO5 | Determine the higher order transition probabilities in a Markov chain.                                 |
| CO6 | Design a Markov model with transition probabilities using Chapman Kolmogorov equation.                 |

**TEXT/REFERENCE BOOKS:**

1. MarekFisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, 1976
2. H.C.Saxena&P.V.Surendran, Statistical Inference, S.Chand. 1994
3. S.C.Gupta&V.K.Kapoor, Fundamentals of Applied Statistics ,S.Chand. 2014
4. J.Medhi, Stochastic Processes, New Age International Publishers. 1994
5. W.Feller, An Introduction to Probability Theory and its Applications ,Revised Volume I, Third Edition, Wiley,2008
6. J.L.Doob, Stochastic Processes, Wiley Inter Science,1991.

| S63BSEM | SELF -PACED LEARNING:<br>HISTORY OF MATHEMATICS | L | T | P | EL | C |
|---------|-------------------------------------------------|---|---|---|----|---|
|         |                                                 | 0 | 0 | 0 | 6  | 2 |

**COURSE OBJECTIVES:**

- To understand the origin of mathematics
- To understand the evolution of Algebra and calculus
- To analyze the algebra and number theory in real life application from ages.

**UNIT I INTRODUCTION TO MATHEMATICS****12 Hrs**

The Ancient Greeks - Pythagoras - Introduction to Pythagorean Ideas - Euclid - Introduction to Euclid - Archimedes - The Genius of Archimedes-Zeno's Paradox and the Concept of Limit - The Context of the Paradox? - Consideration of the Paradoxes - Decimal Notation and Limits - Infinite Sums and Limits - Finite Geometric Series.

**UNIT II INTRODUCTION TO ALGEBRA****12 Hrs**

The Arabs and the Development of Algebra - The Development of Algebra Al-Khowarizmi and the Basics of Algebra - The Life of Al-Khwarizmi - Omar Khayyam and the Resolution of the Cubic - Cardano, Abel, Galois, and the Solving of Equations - A Particular Equation - The General Case - The Brief and Tragic

Lives of Abel and Galois in Context - Rene Descartes and the Idea of Coordinates - Introductory Remarks - The Life of Rene Descartes - The Real Number Line - The Cartesian Plane - Coordinates in Three- Dimensional Space.

### UNIT III CALCULUS

12 Hrs

The Invention of Differential Calculus - The Life of Fermat - Fermat's Method-Fermat's Lemma and Maximum/Minimum Problems - Complex Numbers and Polynomials - Progenitors of the Complex Number System - Cardano - Argand - Cauchy - Riemann - Complex Number Basics - The Fundamental Theorem of Algebra - Finding the Roots of a Polynomial - Cauchy and the Foundations of Analysis - Why Do We Need the Real Numbers?

### UNIT IV NUMBER THEORY

12 Hrs

The Prime Numbers - The Sieve of Eratosthenes - The Infinitude of the Primes - Dirichlet and How to Count - The Life of Dirichlet - The Pigeonhole Principle - Riemann and the Geometry of Surfaces - Introduction - Georg Cantor and the Orders of Infinity – Introductory Remarks - An Uncountable Set - Countable and Uncountable - The Existence of Transcendental Numbers.

### UNIT V ABSTRACT ALGEBRA

12 Hrs

Henri Poincare, Child Prodigy - Introductory Remarks - Emmy Noether and Algebra - The Life of Emmy Noether - Emmy Noether and Abstract Algebra: Groups - Emmy Noether and Abstract Algebra: Rings - The Idea of an Ideal - Cryptography - What is Cryptography?

**Course Outcome: At the end of the course, the student will be able to**

|     |                                                                    |
|-----|--------------------------------------------------------------------|
| CO1 | Recognizing the history of mathematics                             |
| CO2 | Summarizing the work in algebra                                    |
| CO3 | Executing about complex numbers and calculus                       |
| CO4 | Analyzing number theory                                            |
| CO5 | Experimenting abstract algebra                                     |
| CO6 | Designing cryptography and applying them in real time applications |

### REFERENCE BOOKS

1. Steven G.Krantz, An Episodic-history of mathematics, The Mathematical Association of America, 2010.
2. C.B. Boyer and U. Merzbach, History of Mathematics, John Wiley & Sons, 3rd edition, 2011.
3. E.T.Bell, Men of-mathematics, Published by Simon & Schuster, 1986.

Added Content