

SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

(Established under section 3 of UGC Act, 1956)

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai-600119.



MSC MATHEMATICS SYLLABUS

**SCHOOL OF SCIENCE AND HUMANITIES
DEPARTMENT OF MATHEMATICS**

SMTA5109	DIFFERENTIAL EQUATIONS	L	T	P	CREDIT
		3	0	0	3

UNIT 1 SECOND ORDER LINEAR EQUATIONS 9 Hrs

Second order linear equations- The general solution of the homogeneous equation- The use of known solution to find another- The homogeneous equation with constant coefficients- The method of variation of parameters

UNIT 2 OSCILLATION THEORY, BOUNDARY VALUE PROBLEMS AND POWER SERIES SOLUTION 9 Hrs

Oscillations and the Sturm separation theorem- The Sturm comparison theorem- Series solutions of first order equations- Second order linear equations -ordinary points.

UNIT 3 POWER SERIES SOLUTIONS 9 Hrs

Regular singular points- Regular singular points (continued)- Gauss's hypergeometric equation -The point at infinity.

UNIT 4 SPECIAL FUNCTIONS 9 Hrs

Legendre polynomials- Properties of Legendre polynomials- Bessel functions- The Gamma function- Properties of Bessel functions.

UNIT 5 SYSTEMS OF FIRST ORDER EQUATIONS, EXISTENCE AND UNIQUENESS OF SOLUTIONS 9 Hrs

Linear systems- Homogeneous linear systems with constant coefficients- The method of successive approximation -Picard's theorem.
Max Hrs: 45 hrs.

REFERENCE BOOKS

1. G.F. Simmons, Differential Equations with applications and Historical notes, Second edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1974.
2. Earl A. Coddington, An Introduction to Ordinary Differential Equations, PHI, 1961.
3. M.D. Raisinghania, Advanced Differential Equations, Seventh Revised Edition S. Chand and Company Ltd, New Delhi, 2000.

Course Outcome: At the end of the course, learners would acquire competency in the following skills.

CO1	Expertise in applying various methods to obtain non-trivial solutions to second order linear complete and reduced differential equations.
CO2	Ability to understand nature, Qualitative properties and Essential characterization of the solution of reduced second order linear differential equation by direct analysis of its equation.
CO3	Learn the procedure to obtaining power series solution to first and second order ordinary differential equation.
CO4	Proficiency in solving Gauss Hypergeometric equation, homogeneous differential equation for large values of the independent variable.
CO5	Familiarize some special functions of Mathematical Physics and their properties.
CO6	Acquaintance to system to first order linear differential equation, solution to homogeneous linear system with constant coefficients, Isoperimetric problems and method of successive approximation.

UNIVERSITY EXAM QUESTION PAPER PATTERN

Max. Marks : 70

Part A : 4 questions of 5 marks each – No choice -

Part B : 5 questions from each unit of internal choice, each carrying 10 marks -

Exam Duration : 3 Hrs

20 marks

50 marks

SMTA5204	ADVANCED DATA ANALYTICS	L	T	P	CREDIT
		3	0	0	3

UNIT I Introduction to R**9 Hrs**

Introduction: Introduction to R – Downloading and Installing R –. Getting Data into R: First Step in R: Typing in Small Datasets – Concatenating Data with c Function – Combining Variables with the c, cbind, rbind Functions - Vector Function –Matrix - data frame – List - Importing Excel Data – Accessing Data from other Statistical Packages – Accessing the Database. Functions - The Attach Function – Exporting Data - The Tapply Function – The Supply and Lapply Function – The Summary and Table Function.

UNIT II Data standardizing**9 Hrs**

Data standardizing – Z Score – Negative Z Score – Continuous Distributions - Compute proportions – Relative Frequency histogram - Normalized Distribution using Z table.

UNIT III Probability Distribution**9 Hrs**

Probability Distributions - Probability of mean – location of mean distribution - Sampling Distributions — Klout Sampling Distribution – Understanding Shape of Distribution – Standard Error - Standard Deviation of sampling distribution – Ratio of Sampling Distribution - Central Limit Theorem R – Mean of sample means Advanced Analytics Regression Analysis – Simple Regression Analysis - – Logistic Regression.

UNIT IV Introduction to time series**9 Hrs**

Introduction to time series data - application of time series from various fields -Modelling time series as deterministic function plus IID errors - Components of a time series (trend, cyclical and seasonal patterns, random error) Decomposition of time series - Estimation of trend: free hand curve method, method of moving averages, fitting various mathematical curves and growth curves.

UNIT V Analysis of time-series**9 Hrs**

Analysis of time-series: Different components of a time series. Determination of trend by free hand smoothing. Method of moving average and by fitting of a mathematical curve. Determination of seasonal indices by method of trend ratios and ratios to moving averages.

Max Hrs: 45 Hrs**REFERENCE BOOKS**

1. Chatfield C. (1980): The Analysis of Time Series – An Introduction, Chapman & Hall.
2. Brockwell and Davis (2010): Introduction to Time Series and Forecasting (Springer Texts in Statistics), 2nd Edition
3. Johnson, R.A. And Wichern, D.W. (2007): Applied Multivariate Analysis, 6th Edn., Pearson & Prentice Hall
4. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002): Fundamentals of Statistics, Vol. I, 8th Edn. The World Press, Kolkata.
5. Hadley Wickham, ggplot2: Elegant graphics for data analysis, Springer (2009)
<http://www.springerlink.com.proxy.lib.umich.edu/content/978-0-387-98140-6/contents/>
6. Phil Spector, Data Manipulation with R, Springer ,
(2008)<http://www.springer.com/statistics/computational+statistics/book/978-0-387-74730-9>
7. Leland Wilkinson, The Grammar of Graphics, Springer
(2005),<http://www.springerlink.com.proxy.lib.umich.edu/content/978-0-387-24544-7/contents/>

Course Outcome: At the end of the course, learners would acquire competency in the following skills.

CO1	Identify the command for exporting data and accessing data from other statistical packages using R software
CO2	Understand normalized distribution using Z table and standard error.
CO3	Apply the method of moving average in time series.
CO4	Analyze the components of time series and determination of trend.
CO5	Evaluate the proportion in data standardizing
CO6	Organize the data to fit a mathematical curve using time series.

UNIVERSITY EXAM QUESTION PAPER PATTERN**Max. Marks : 70****Exam Duration : 3 Hrs****PART A :** 4 questions of 5 marks each – No choice -

20 marks

PART B : 5 questions from each unit of internal choice, each carrying 10 marks -

50 marks

SMTA6201	R FOR DATA ANALYTICS – LAB	L	T	P	CREDITS
		0	0	4	2

LIST OF EXPERIMENTS

1. Basic fundamentals, installation and use of software
2. Data editing, use of R as a calculator
3. Functions and matrix operations, missing data and logical operators
4. Conditional executions and loops, data management with sequences.
5. Data management with repeats, sorting, ordering and lists.
6. Vector indexing, factors, Data management with strings, display and formatting.
7. Data management with display paste, split, find and replacement, manipulation with alphabets, evaluation of strings, data frames.
8. Handling of bivariate data through graphics, correlations, programming and illustration with examples.
9. Computation of Probabilities (Binomial, Poisson and Normal). Simple Correlation and Simple Regression.
10. Test of Significance (t test, F test, Z test and Chi square test). One way ANOVA and Two way ANOVA.

References

1. Introduction to Statistics and Data Analysis – with exercises , Solutions and Applications in R by Christian Heumann, Michael Schomaker and Shalabh, Springer 2016.
2. The R Software-Fundamentals of Programming and Statistical Analysis – Pierre Lafaye de Micheaux, Remy Drouihet, BenoitLiquet, Springer2013.
3. A Beginner's Guide to R (Use R) by Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, Springer 2009.
4. **Course Outcome:** At the end of the course, learners would acquire competency in the following skills.

CO1	Able to list operations, operators and fundamentals of R
CO2	Understand the concept of Conditional executions, loops, data management with sequences, Data management with repeats, sorting, ordering and lists
CO3	Examine program with examples
CO4	Analyze binomial, poisson and normal probabilities
CO5	Evaluate one way and two way ANOVA
CO6	Create visualizations using R

5.

SMTA6301	MATLAB PROGRAMMING LAB	L	T	P	Credits
		0	0	4	2

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 Runge kutta method

References

1. Fausett L.V. (2007) Applied Numerical Analysis using MATLAB, 2nd Edition, Pearson Education.
2. Chapra S.C. and Canale R.P. (2006) Numerical Methods for Engineers, 5th Edition, McGraw Hill

Course Outcome: At the end of the course, learners would acquire competency in the following skills.

CO1	Understand the basics of MAT lab
CO2	Applying MAT lab complex problems can be break up into simpler problem
CO3	Differentiate the study of vector and matrix operators
CO4	Determining the eigen values and eigen vectiors of a square matrix.
CO5	Evalute solution of numerical integration and differentiation
CO6	Produce the polynomial using MAT lab for least square curve fitting

3.