M.Sc (Mathematics)
Semester - I

	1. Name of the Department: Mathematics and Statistics						
2. Course Name	**Real Analysis**				**L**	**T**	**P**
3. Course Code	**MT406**				3	1	0
4. Type of Course (use tick mark)		**Core (□)**	**DSE ()**		**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	B. Sc. with Mathematics	**6. Frequency (use tick marks)**	Even ()		Odd (□)	Either Sem ()	Every Sem ()
	7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**			**Practical = Nil**		

8. COURSE OBJECTIVES: 1. To familiarize students with various concepts of Real Analysis.
2. The course will help the student to understand sequence and Series of functions (convergent and uniform convergent),
3.The course will also develop an understanding to solving Riemann Stieltjes integral and Power series.
4. The course will further develop understanding the concepts of Cauchy criterion for uniform convergence.

9. COURSE OUTCOMES (CO):
After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)		**ATTRIBUTES**
CO1		Students will gain an understanding of countability of Sets, Lebesgue measure on the real line, Length of intervals, open and closed sets on real line. They will also learn about outer and inner Lebesgue measure, Lebesgue measurable sets and properties of measurable sets
CO2		Students will be able to understand Sequence and Series of functions, Pointwise and uniform convergence, Cauchy criterion for uniform convergence. They will learn to define Weierstrass M test, Abel's and Dirichlet's test, for uniform convergence and differentiation, Uniform convergence and integration.
CO3		Students will create the own understanding of Weierstrass approximation theorem, The fundamental theorem of integral calculus, Definition and existence of Pointwise and uniform convergence, Properties and some important theorems on Reimann Stieltjes integral.
CO4		Students will be able to understand the concepts of Power series and Uniqueness theorem of power series. They will also learn about Abel's and Taylor's theorem, Riemann's theorem & Rearrangement of terms of series.
CO5		Students will create the own understanding of partial derivatives and total derivatives. They will learn about Jacobian, chain rule, interchange of the order of differentiation & higher derivatives. Students will also be able to understand inverse function theorem and implicit function. They will be able to know about Riemann's theorem, functions of several variables and linear transformation.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**		**Title of the unit:** Real No's & measurable sets
	Countability of Sets, Lebesgue measure on the real line, Length of intervals, Open and closed sets on real line, Outer and inner Lebesgue measure, Lebesgue measurable sets & Properties of measurable sets.		
Unit-2	**Number of lectures =08**		**Title of the unit:** convergence & uniform convergence
	Sequence and Series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M test, Abel's and Dirichlet's test, for uniform convergence and differentiation, uniform convergence and integration.		
Unit-3	**Number of lectures = 08**		**Title of the unit:** Reimann Stieltjes integral & properties

	Weierstrass approximation theorem, The fundamental theorem of integral calculus, Definition and existence of Pointwise and uniform convergence, Properties and some important theorems on Reimann Stieltjes integral.
Unit-4	**Number of lectures = 08** **Title of the unit:** Power series
	Power series, uniqueness theorem of power series, Abel's and Taylor's theorem, Rearrangement of terms of series & Riemann's theorem.
Unit-5	**Number of lectures = 08** **Title of the unit:** Partial and Total differentiations
	Partial derivatives, Total derivative, Jacobian, Chain rule, interchange of the order of differentiation, higher derivatives, inverse function theorem, implicit function, functions of several variables & linear transformation.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students will gain an understanding of countability of Sets, Lebesgue measure on the real line, Length of intervals, open and closed sets on real line. They will also learn about outer and inner Lebesgue measure, Lebesgue measurable sets and properties of measurable sets.	3	2	1	1	1	2	2	2
CO2	Students will be able to understand Sequence and Series of functions, Pointwise and uniform convergence, Cauchy criterion for uniform convergence. They will learn to define Abel's and Dirichlet's test, for uniform convergence and differentiation, Uniform convergence and integration & Weierstrass M test.	3	1	1	1	1	1	2	2
CO3	Students will create the own understanding of Weierstrass approximation theorem, The fundamental theorem of integral calculus. They will define existence of Pointwise and uniform convergence, Properties and some important theorems on Reimann Stieltjes integral.	3	1	1	1	1	2	2	2
CO4	Students will be able to understand about Power series and Uniqueness theorem of power series. They will also learn about. Riemann's theorem, Abel's, Taylor's theorem & Rearrangement of terms of series.	3	1	1	1	1	2	2	2
CO5	Students will create the own understanding of partial derivatives and total derivatives. They will learn about Jacobian, inverse function theorem and implicit function. Students will also be able to define chain rule, interchange of the order of differentiation & higher derivatives.	3	1	1	1	1	2	2	2

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. https://www.youtube.com/watch?v=Xx7ULr79fy0&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-&index=4
2. https://www.youtube.com/watch?v=Xx7ULr79fy0&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-&index=4
3. h https://www.youtube.com/watch?v=AqHxSRul-Ck

13. Books recommended:

Books Recommended:

1. W. Rudin: Principle of Mathematics Analysis
2. D. Somasundram and B. Choudhary: A First Course in Mathematical Analysis, Narosa, 1999.
3. S. C. Malik: Mathematical Analysis, Wiley Eastern, India.
4. Jain, P.K. & Gupta V.P., Lebesgue measure and Integration, Willey Eastern Ltd., New Age Int. Ltd., New Delhi, (1994).

1. Name of the Department: Mathematics and Statistics						
2. Course Name	**Modern Algebra**			**L**	**T**	**P**
3. Course Code	**MT407**			3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	B.Sc. with Mathematics as a major subject.	**6. Frequency (use tick**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: The objective is to discuss the basic concept to certain classes of groups and rings. The course deals with the some algebraic structures, their properties and some of the basic results related to group and ring theory. Modern algebra gives to student a good mathematical maturity and enables to build mathematical thinking and skill.

9. COURSE OUTCOMES (CO):
After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students will be able to explain the fundamental concept of Certain classes of groups.
CO2	Students will be able to describe Sylow's theorem and their applications.
CO3	Students will be an understanding of ideals and quotient of rings.
CO4	Students will be able to describe integral domains and divisibility in integral domains.
CO5	Students will be able to explain fields, splitting fields and field extensions.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit:**
Normal subgroups and Quotient groups, Permutation groups, Homomorphisms, Cayley's theorem.		
Unit-2	**Number of lectures =08**	**Title of the unit:**
Conjugate elements, Class equation, Cauchy theorem, Sylow's theorems and its Applications.		
Unit-3	**Number of lectures = 08**	**Title of the unit:**
Quotient of rings, Maximal and prime ideals, Homomorphisms, Polynomial rings.		
Unit-4	**Number of lectures = 08**	**Title of the unit:**
Integral domain, Divisibility in integral domains, Unique factorization domains, Principal ideal domains, Euclidean domains, Polynomial rings over UFD.		
Unit-5	**Number of lectures = 08**	**Title of the unit:**
Fields, Extension of fields, Splitting fields, Algebraic extensions of fields: Irreducible and reducible polynomials.		

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO
CO1	Students will be able to explain the fundamental concept of Certain classes of groups.	**3**	**2**	**1**	**2**	**3**	**1**	**3**	**3**
CO2	Students will be able to describe Sylow's theorem and their applications.	**3**	**2**	**1**	**2**	**3**	**1**	**3**	**2**
CO3	Students will be an understanding of ideals and quotient of rings.	**3**	**2**	**1**	**2**	**3**	**1**	**2**	**3**
CO4	Students will be able to describe integral domains and divisibility in integral domains.	**3**	**1**	**1**	**2**	**2**	**1**	**3**	**2**
CO5	Students will be able to explain fields, splitting fields and field extensions.	**3**	**1**	**1**	**2**	**2**	**1**	**2**	**3**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. https://nptel.ac.in/courses/111/105/111105112/
2. https://nptel.ac.in/courses/111/106/111106131/
3. https://nptel.ac.in/courses/111/105/111105112/

13. Books recommended:

1. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd.
2. Joseph A. Gallian: Contemporary Abstract Algebra, Narosa Publishing House.
3. Surjeet Singh and Qazi Zameeruddin: Mordern Algebra, Vikas Publishing House.

1. Name of the Department: Mathematics and Statistics						
2. Course Name	**Ordinary Differential Equations**			**L**	**T**	**P**
3. Course Code	**MT408**			3	1	0
4. Type of Course (use tick mark)		**Core (□)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	B.Sc (Mathematics)	**6. Frequency (use tick marks)**	Even (□)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: To put it briefly, the point of this class is to take your existing knowledge of calculus and apply it towards the construction and solution of mathematical models in the form of differential equations.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Student will be able to find the complete solution of a non homogeneous differential equation as a linear combination of the complementary function and a particular solution.
CO2	Student will be introduced to the complete solution of a non homogeneous differential equation with constant coefficients by the method of undetermined coefficients.
CO3	Students will be able to Use power series to solve first-order and second-order differential equations.
CO4	Successful students in Boundary Value Problems and Differential Equations will be knowledgeable about and will be able to analyze solutions to two-point boundary value problems
CO5	Students will gain an understanding of Stability of dynamical systems

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Topological spaces**

Linear differential equations of nth order, fundamental sets of solutions, Wronskian Abel's identity, theorem on linear dependence of solutions, adjoint, self adjoint linear operator, Green's formula.

Unit-2	**Number of lectures =08**	**Title of the unit: Homeomorphism and separation axioms**

Adjoint equations, the nth order non homogeneous linear equations, Variation of parameters, zeros of solutions, comparison and separation theorems.

Unit-3	**Number of lectures = 08**	**Title of the unit: Compactness**

Power series, solution of linear differential equations, ordinary and singular points of differential equations, Classification into regular and irregular singular points, series solution about an ordinary point and regular singular point.

Unit-4	**Number of lectures = 08**	**Title of the unit: Connectedness**

Existence and uniqueness of solutions: Lipschitz Condition , Successive Approximation, Picard's theorem for initial value problem, Homogeneous BVP, Non-Homogeneous BVP , Sturm Liouville's problem , Green's function, non-existence of solutions , Picard's theorem for BVP.

Unit-5	**Number of lectures = 08**	**Title of the unit: Product Topology**

Stability of Linear system, Stability of Quasi-linear system, Stability of autonomous system, Stability of non-autonomous system, a particular Lyapunav Function..

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Student will be able to find the complete solution of a non homogeneous differential equation as a linear combination of the complementary function and a particular solution.	**3**	**1**	**1**		**1**	**1**	**1**	**2**
CO2	Student will be introduced to the complete solution of a non homogeneous differential equation with constant coefficients by the method of undetermined coefficients.	**3**	**1**	**2**		**3**	**1**	**1**	**2**
CO3	Students will be able to Use power series to solve first-order and second-order differential equations.	**3**	**1**	**2**		**3**	**1**	**1**	**2**
CO4	Successful students in Boundary Value Problems and Differential Equations will be knowledgeable about and will be able to analyze solutions to two-point boundary value problems	**3**	**1**	**1**		**3**	**1**	**1**	**3**
CO5	Students will gain an understanding of Stability of dynamical systems	**3**	**1**	**1**		**2**	**2**	**1**	**3**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/video-lectures/
2. https://nptel.ac.in/courses/111/106/111106100/
3. http://www.math.iitb.ac.in/~siva/afs07.pdf

13. Books recommended:

1. M. D. Rai Singhania, Advance differential equations – S. Chand , 1995.
2. M. D. Rai Singhania, Ordinary differential equations – S. Chand .
3. P. Haitman: Ordinary Differential Equations, Wiley, New York, 1964.
4. E.A. Coddington and H. Davinson: Theory of Ordinary Differential Equations, McGraw Hill, NY, 1955.

	1. Name of the Department: Mathematics and Statistics						
2. Course Name	**Discrete Mathematics**				**L**	**T**	**P**
3. Course Code	**MT409**				3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DSE ()**		**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	B. Sc. with Mathematics	**6. Frequency (use tick marks)**	Even ()		Odd (✓)	Either Sem ()	Every Sem ()
	7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**			**Practical = Nil**		

8. COURSE OBJECTIVES: 1. To familiarize students with various concepts of Discrete mathematics.
2. The course will help the student to understand propositions and their truth values.
3.The course will also develop an understanding of the elements of Boolean algebra and its various aspects.
4. The course will further develop understanding of graphs & trees with its applications.

9. COURSE OUTCOMES (CO):
After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)		**ATTRIBUTES**
CO1		Students will gain an understanding of Statements, connectives, Truth tables, Tautologies & Contradictions, Equivalences & Implications. They will be able to understand and implement Normal forms. along with Quantifier, Predicates, Posets & Lattices and also about Lattices on Algebraic systems, Sub-lattices. Understand the formation of Hasse diagram.
CO2		Students will be able to understand Boolean identities, the switching algebra, sub-algebra, Direct product & homomorphism. Boolean forms & their equivalences. They will learn to form Sum of products & Product of sums form, Normal form, Canonical form, Boolean expression & Boolean functions with the help of Karnaugh map method.
CO3		Students will create the own understanding of Permutations & combinations, Pigeon hole principle. They will learn about Recurrence relation and also about their solution by characteristic roots and Generating function.
CO4		Students will be able to understand degree of a vertex different types of graphs including Eulerian & Hamiltonian graphs. They will also learn about representation of graphs with the help of matrix. and Graph colouring. They will be able to know about Trees, Binary tree, their types and their properties. They also learn about spanning tree and their formation by Kruskal's algorithm.
CO5		Students will create the own understanding of relations and their representation by matrix & Digraph. They will learn about Paths & connectivity, composition of relations. Students will also be able to understand Function, their Classification, their types & their composition, growth of functions, Recursive function.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**		**Title of the unit:** Mathematical logic & Lattices
	Statements, connectives, Truth tables, Tautologies & Contradictions. Equivalences & Implications. Normal forms, Quantifier & Predicates. Posets & Lattices, Hasse diagram, Lattices on Algebraic systems, Sub-lattices.		
Unit-2	**Number of lectures =08**		**Title of the unit:** Boolean Algebra
	Boolean identities, the switching algebra, sub-algebra, Direct product & homomorphism. Boolean forms & their equivalences. Sum of products & Product of sums form, Normal form, Canonical form, Boolean expression & Boolean functions-the Karnaugh map method.		
Unit-3	**Number of lectures = 08**		**Title of the unit:** Combinatorics
	Permutations & combinations, Pigeon hole principle, Recurrence relation, solution by characteristic roots, Generating function.		
Unit-4	**Number of lectures = 08**		**Title of the unit:** Graphs & Trees
	Degree of a vertex, types of graphs, Eulerian & Hamiltonian graphs, Matrix representation of graphs, Graph colouring. Trees: Properties, spanning tree, Kruskal's algorithm, Binary tree, tree reversal.		

Unit-5	Number of lectures = 08		Title of the unit: Relation & Functions

Properties, matrix & Digraph representation of relation, Paths & connectivity, composition of relations. Functions: Classification, types & composition of functions, growth of functions, Recursive function.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Students will gain an understanding of Statements, connectives, Truth tables, Tautologies & Contradictions, Equivalences & Implications. They will be able to understand and implement Normal forms. along with Quantifier, Predicates, Posets & Lattices and also about Lattices on Algebraic systems, Sub-lattices. Understand the formation of Hasse diagram.	3	2	1	1	1	2	2	2
CO2	Students will be able to understand Boolean identities, the switching algebra, sub-algebra, Direct product & homomorphism. Boolean forms & their equivalences. They will learn to form Sum of products & Product of sums form, Normal form, Canonical form, Boolean expression & Boolean functions with the help of Karnaugh map method.	3	1	1	1	1	1	2	2
CO3	Students will create the own understanding of Permutations & combinations, Pigeon hole principle. They will learn about Recurrence relation and also about their solution by characteristic roots and Generating function.	3	1	1	1	1	2	2	2
CO4	Students will be able to understand degree of a vertex different types of graphs including Eulerian & Hamiltonian graphs. They will also learn about representation of graphs with the help of matrix. and Graph colouring. They will be able to know about Trees, Binary tree, their types and their properties. They also learn about spanning tree and their formation by Kruskal's algorithm	3	1	1	1	1	2	2	2
CO5	Students will create the own understanding of relations and their representation by matrix & Digraph. They will learn about Paths & connectivity, composition of relations. Students will also be able to understand Function, their Classification, their types & their composition, growth of functions, Recursive function.	3	1	1	1	1	2	2	2

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. https://freevideolectures.com/course/3517/discrete-mathematics
2. http://home.iitk.ac.in/~arlal/book/mth202.pdf
3. https://www.cis.upenn.edu/~jean/discmath-root-b.pdf

13. Books recommended:

1. Elements of Discrete Mathematics, C.L.Liu, Tata McGraw-Hill Publishing Company Ltd, New Delhi.
2. Discrete Mathematical Structures, Kolman, Busby & Ross, 4e, Prentice Hall of India.
3. Discrete Mathematics with Graph theory, Goodaire & Parmenter, 2e, Pearson.
4. Discrete Mathematical Structures, J.P.Tremblay & R.Manohar, McGraw-Hill Book co.

1. Name of the Department: Mathematics						
2. Course Name	**Complex Analysis**			**L**	**T**	**P**
3. Course Code	**MT410**			3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	B.Sc. with Maths	**6. Frequency (use tick**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: The purpose of this postgraduate course is to impart basic and key knowledge of complex analysis. By using the principal of pure and applied mathematics to obtain quantitative relations which are very important for higher studies. After successfully completion of course, the student will able explore subject into their respective dimensions

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Find and interpret Analytic functions, Cauchy Riemann Equations, Harmonic function, velocity potential, Cauchy Integral Theorem and Cauchy integral formula
CO2	Evaluate and Interpret the Power series, Uniform convergence, Taylor's series, zeros of analytic functions, Laurent's series,Integration and differentiation of power series, multiplication and division of power series.
CO3	Describe and evaluate the Cauchy residue theorem, evaluation of real definite integration when function has no pole on real axis and pole lies on real axis, Integral involving many valued function, contours
CO4	State and explain Conformal bilinear exponential and trigonometric transformations, special bilinear and Schwarz,-Christoffel transformations
CO5	State and explain the Weierstrass's theorem, principle of maximum modulus, Schwarz's lemma, Picard's theorem, Jensen inequality and formula, Hadamard's three circle theorem and as a convexity

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit:**

Analytic functions, Cauchy Riemann Equations, Harmonic function, velocity potential, Milne's Thaomson method, Cauchy Integral Theorem and Cauchy integral formula

Unit-2	**Number of lectures =08**	**Title of the unit:**

Power series, Uniform convergence, Taylor's series, zeros of analytic functions, Laurent's series,Integration and differentiation of power series, multiplication and division of power series..

Unit-3	**Number of lectures = 08**	**Title of the unit:**

Cauchy residue theorem, evaluation of real definite integration when function has no pole on real axis and pole lies on real axis, Integral involving many valued function, rectangular contours

Unit-4	**Number of lectures = 08**	**Title of the unit:**

Conformal bilinear exponential and trigonometric transformations, special bilinear and Schwarz,-Christoffel transformations.

Unit-5	**Number of lectures = 08**	**Title of the unit:**

Weierstrass's theorem, principle of maximum modulus, Schwarz's lemma, Picard's theorem, Jensen inequality and formula, Hadamard's three circle theorem and as a convexity

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Find and interpret Analytic functions, Cauchy Riemann Equations, Harmonic function, velocity potential, Cauchy Integral Theorem and Cauchy integral	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**3**

CO2	Evaluate and Interpret the Power series, Uniform convergence, Taylor's series, zeros of analytic functions, Laurent's series,Integration and differentiation of power series, multiplication and division of power series.	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**
CO3	Describe and evaluate the Cauchy residue theorem, evaluation of real definite integration when function has no pole on real axis and pole lies on real axis, Integral involving many valued function, contours	**3**	**3**	**1**	**1**	**2**	**2**	**1**	**3**
CO4	State and explain Conformal bilinear exponential and trigonometric transformations, special bilinear and Schwarz,-Christoffel transformations	**3**	**2**	**3**	**1**	**1**	**1**	**1**	**3**
CO5	State and explain the Weierstrass's theorem, principle of maximum modulus, Schwarz's lemma, Picard's theorem, Jensen inequality and formula, Hadamard's	**3**	**2**	**1**	**2**	**1**	**1**	**3**	**3**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. http://www.bhojvirtualuniversity.com/slm/mscmath1p4.pdf
2. http://web.math.ku.dk/noter/filer/koman-12.pdf
3. https://www.youtube.com/watch?v=YORGYJKDDN0

13. Books recommended:

1. L.V.Alforse, Complex Analysis, McGraw-Hill Book Company
2. B. Chaudhary, The elements of Complex Analysis, Wiley Eastern
3. Shanti Narayan, Theory of Functions of a complex variable, S. Chand & Co.

1. Name of the Department: Mathematics						
2. Course	**Statistical Techniques**			**L**	**T**	**P**
3. Course	**MT411**			3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite		**6. Frequency (use tick marks)**	Even ()	Odd (✓)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials

Lectures = 30	**Tutorials = 10**	**Practical = Nil**

8. COURSE OBJECTIVES: To teach the basic concepts used to describe data. Probability theory and testing of hypothesis. This is a great beginner course for those interested in Data Science, Economics, Psychology, Machine Learning, Sports analytics and just about any other related field.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Understand of data, scales of measurement, presentation of data with the help of diagrams and graphs.
CO2	Description of data through its central value, variability and shape.
CO3	Understanding of bi-variate data, degree of its relationship and functional relationship between variables. Prediction of future values.
CO4	Explain the concept of weighted and unweighted index numbers, its applications to real life. Consumer Index number.
CO5	Understand the theory of attributes. Contingency tables, class frequencies and ultimate class frequencies, consistency of attributes, association of attributes, independence of attributes.

10. Unit wise detailed content

Unit-1	**Number of lectures = 06**	**Title of the unit:**

Discrete and continuous data, Frequency and non-frequency data, primary and secondary data, diagrammatic and graphical representation of grouped data, frequency and cumulative frequency distribution and their applications, histogram, frequency polygon, ogives. Concept of central tendency and its measures, partition values, dispersion and relative dispersion, moments, Sheppard's

Unit-2	**Number of lectures =06**	**Title of the unit:**

Scatter diagram, Karl Pearson's and spearman's rank correlation coefficients, coefficient of determination, correlation ratio, principle of least squares, fitting of linear regression and related results, partial and multiple correlations of three variables, their measures and related results.

Unit-3	**Number of lectures = 06**	**Title of the unit:**

Random experiment, trial, sample point, sample space, definitions of equally likely, mutually exclusive and exhaustive events, definition of probability, classical, relative frequency and axiomatic approaches to probability, conditional probability, independence of events, Bayes theorem and its applications.

Unit-4	**Number of lectures = 06**	**Title of the unit:**

Discrete and continuous random variable, expectation and variance of random variables, Probability mass/ density function, distribution function, joint density function of two continuous variables, marginal and conditional probability density functions, uniform, binomial, Poisson, geometric, negative binomial, hyper geometric and normal distributions.

Unit-5	**Number of lectures = 06**	**Title of the unit:**

null and alternative hypotheses, critical region, types of error, level of significance, p-value, size and power of a test, Z, t, chi-square & F tests, analysis of variance: one way and two way classifications.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	Understand of data, scales of measurement, presentation of data with the help of diagrams and graph, central values and variability of data.	**3**	**2**	**1**	**2**	**1**	**1**	**3**	**3**
CO2	Understanding the correlation and regression and forecasting of data values	**3**	**1**	**2**	**1**	**2**	**1**	**2**	**3**
CO3	Understand the concept of probability, prior and posterior probabilities.	**3**	**2**	**1**	**1**	**2**	**1**	**3**	**3**
CO4	Understand and apply special distribution functions of probability in real life situation.	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**3**
CO5	Understand and apply various tests for testing hypothesis.	**3**	**2**	**1**	**2**	**2**	**1**	**2**	**3**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. https://www.youtube.com/watch?v=PWbOq-Inmck
2. https://www.youtube.com/watch?v=KIBZUk39ncI
3. https://www.youtube.com/watch?v=jBQCwbHfKoM
4. https://www.youtube.com/channel/UCGT0pirandEMtvu-3JwePSw
5. https://www.youtube.com/watch?v=xTpHD5WLuoA
6. https://www.youtube.com/watch?v=KOEEZn2xR3k&list=PLOoogDtEDyvvw5bIV77qibe73XfdsM2lP
7. https://www.youtube.com/watch?v=L0zWnBrjhng
8. https://www.youtube.com/watch?v=SrEmzdOT65s
9. https://www.youtube.com/watch?v=HpWpIY2fhIo

Recommended Books:

1. Spiegel M.R. (1967): Theory and problem of Statistics, Schaum's Publishing Series.
2. Goon A.M., Gupta M.K. and Das Gupta B. (1991): Fundamental of Statistics, Vol. I, World Press, Calcutta.
3. Meyer P.L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.
4. Hogg R.V. and Craig A.T. (1972): Introduction to mathematical Statistics, Amerind Publishing Co.
5. Rohtagi, V.K. (1967): An Introduction to Probability and Statistics, Wiley Series in Probability and Statistics.