MASTER OF SCIENCE

(M.Sc.)

MATHEMATICS

***Scheme of Examination (CBCS/ELECTIVE)**

***Detailed Structure of Syllabus**

DR. C.V.RAMAN UNIVERSITY

KARGI ROAD, KOTA, BILASPUR,CHATTISGARH(C.G.)
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Session 2020-21

W.E.F. July:2020-21

MASTER OF SCIENCE (MATHS)

Duration: 24 Months (2Years)

Eligibility: Graduation with Science Subjects

COURSE STRUCTURE M.SC MATHEMATICS SEMESTER Ist													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distributin
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMMA101	Core Course	Advance Abstract Algebra-I	100	50	17	20	08	30	12	4	-	-	4
6SMMA102	Core Course	Real Analysis-I	100	50	17	20	08	30	12	4	-	-	4
6SMMA103	Core Course	Topology-I	100	50	17	20	08	30	12	4	-	-	4
6SMMA104	Core Course	Complex Analysis-I	100	50	17	20	08	30	12	4	-	-	4
6SMMA105	Core Course	Differential Equation-I	100	50	17	20	08	30	12	4	-	-	4
Grand Total			500							20	-	-	20

Minimum Passing Marks are equivalent to Grade D **L- Lectures T- Tutorials P- Practical**

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Lab Assignment 50%

W.E.F. July:2020-21

MASTER OF SCIENCE (MATHS)
Duration: 24 Months (2Years)
Eligibility: Graduation with Science Subjects

COURSE STRUCTURE M.SC MATHEMATICS SEMESTER IInd													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMMA201	Core Course	Advance Abstract Algebra-II	100	50	17	20	08	30	12	4	-	-	4
6SMMA202	Core Course	Real Analysis-II	100	50	17	20	08	30	12	4	-	-	4
6SMMA203	Core Course	Topology-II	100	50	17	20	08	30	12	4	-	-	4
6SMMA204	Core Course	Complex Analysis-II	100	50	17	20	08	30	12	4	-	-	4
6SMMA205	Core Course	Differential Equation-II	100	50	17	20	08	30	12	4	-	-	4
Skill Courses				Term End Practical Exam				Sessional					
****	Skill Enhancement	Skill Enhancement Elective Course-1	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		550							21		1	22

Minimum Passing Marks are equivalent to Grade D L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Lab Assignment 50%

Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

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MASTER OF SCIENCE (MATHS)
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COURSE STRUCTURE M.SC MATHEMATICS SEMESTER IIIrd													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distributio n
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMMA301	Core Course	Functional Analysis-I	100	50	17	20	08	30	12	4	-	-	4
6SMMA302	Core Course	Integral Transform-I	100	50	17	20	08	30	12	4	-	-	4
6SMMA303	Core Course	Special Function -I	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –I	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –II	100	50	17	20	08	30	12	4	-	-	4
Skill Courses				Term End Practical Exam				Sessional					
****	Skill Enhancement	Skill Enhancement Elective Course-1	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		550							21	-	1	22

Minimum Passing Marks are equivalent to Grade D L- Lectures T- Tutorials P- Practical
Major- Term End Theory / Practical Exam
Minor- Pre University Test
Sessional weightage – Attendance 50%, Three Class Tests/Lab Assignment 50%
Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

W.E.F. July:2020-21

MASTER OF SCIENCE (MATHS)
Duration: 24 Months (2Years)
Eligibility: Graduation with Science Subjects

COURSE STRUCTURE M.SC MATHEMATICS SEMESTER IVth													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMMA401	Core Course	Functional Analysis -I	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –III	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –IV	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
	Research Component	Project/Internship/Dissertation/Field work & Viva Voce	200	100	33	-	-	100	40	-	-	8	8
	Grand Total		500							12	-	8	20

Minimum Passing Marks are equivalent to Grade D **L- Lectures T- Tutorials P- Practical**
Major- Term End Theory / Practical Exam
Minor- Pre University Test
Sessional weightage – Attendance 50%, Three Class Tests/Lab Assignment 50%
Compulosory Project/Dessertation with choice in any Disciplinery specific elective. Compulsory one paper presentation certificate in related dicipline.

PROJECT

All the candidates of M.Sc. (Maths) are required to submit a project-report based on the work done by him/her during the project period. A detailed Viva shall be conducted by an external examiner based on the project report. Students are advised to see the detailed project related guidelines on the website of RNTU. (www.rntu.ac.in) under Project Guidelines for student section.

Outcome-The student will identify a problem on which he/she would be able to work, identify the scope of research on the chosen topic and will frame the objectives to be addressed in the project through a work plan.

W.E.F. July:2020-21

SPECILIZATION WITH ELECTIVE

***Note** - Students need to select any one group and choose any two subjects from selected group for third and fourth Semester.

Electives for Third Semester			Electives for Fourth Semester		
Course Code	**Course Type**	**List of Electives**	**Course Code**	**Course Type**	**List of Electives**
GROUP ELECTIV- I Name – M.Sc (Mathematics)			**GROUP ELECTIVE- III Name –M.Sc (Mathematics)**		
6SMMA304	Discipline Specific Elective-1	Advanced Discrete Mathematics	6SMMA402	Discipline Specific Elective-III	Advanced Graph Theory
6SMMA305	Discipline Specific Elective-1	Partial Differential Equations	6SMMA403	Discipline Specific Elective-III	Integral Transform-II
6SMMA306	Discipline Specific Elective-1	Numerical Analysis	6SMMA404	Discipline Specific Elective-III	Special Function-II
GROUP ELECTIVE -II NAME: M.Sc (Mathematics)			**GROUP ELECTIVE – IV Name – M.Sc (Mathematics)**		
6SMMA307	Discipline Specific Elective-II	Mathematical Statistics	6SMMA405	Discipline Specific Elective-IV	Operations Research
6SMMA308	Discipline Specific Elective-II	Number Theory	6SMMA406	Discipline Specific Elective-IV	Metric Spaces & Fixed Point Theory
6SMMA309	Discipline Specific Elective-II	Differential Geometry	6SMMA407	Discipline Specific Elective-IV	Measure & Integration Theory

W.E.F. July:2020-21

SKILL ENHANCEMENT ELECTIVE COURSES

Non-Technical			
Elective No.	**Department/ Faculty Name**		
	Faculty of Information Technology		
I	SCIT 201	Data Entry Operation	2(1+0+1)
II	SCIT 301	Multimedia	2(1+0+1)
III	SCIT 501	Web Designing with HTML	2(1+0+1)
IV	SCMIT 201	Web Development	2(1+0+1)
V	SCMIT 301	LINUX	2(1+0+1)
	Faculty of Management		
I	SMGT 201	Briefing and Presentation Skills	2(1+0+1)
II	SMGT 301	Resolving Conflicts and Negotiation Skills	2(1+0+1)
III	SMGT 802	Entrepreneurship Development	2(1+0+1)
	Faculty of Commerce		
I	SCOM 201	Tally ERP 9	2(1+0+1)
II	SCOM 302	Multimedia	2(1+0+1)
III	SCOM 803	Data Analyst	2(1+0+1)
	Faculty of Humanities		
I	SHBA 301	Pursuing Happiness	2(1+0+1)
II	SHBA302	Communication Skill and Personality Development	2(1+0+1)
III	SHMA301	Tourism in M.P	2(1+0+1)
	Faculty of Science		
I	SSBI 301	Mushroom Cultivation	2(1+0+1)
II	SSPH 301	House Hold Wiring	2(1+0+1)
III	SSPH 301	Basic Instrumentation	2(1+0+1)
IV	SSPH 301	DTP Operator	2(1+0+1)
V	SSCH 301	Graphic Designing	2(1+0+1)
	Faculty of Education		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)

W.E.F. July:2020-21

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 1st **Subject Code:** 6SMMA101
Course: M.Sc. Mathematics **Theory Max. Marks:** 50
SUBJECT: ADVANCED ABSTRACT ALGEBRA-I **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics.
- The focus of the course will be the study of certain structures called groups, rings, fields and some related structures.
- In particular to study in details the Sylow theorems and polynomials rings.
- This course helps to gain skill in problem solving and critical thinking.
- Abstract algebra is a classical field that is associated with the study of polynomials in several variables.

Unit	Unit Wise Course Contents	Methodology Adopted
Unit-I	Normal and subnormal series of group, composition series of group, Jordan- holder theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Solvable and Nilpotent groups,	ICT based & Green board based class room teaching Individual presentations
Unit-III	Field & subfield definition & Examples, Extension fields, Algebraic extensions, Separable and Inseparable extensions Normal extension, Perfect fields	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Class equation of finite group, Cauchy's theorem for finite groups, Sylow Theorem, Wilson's Theorem, Lagrange's Theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Polynomial Ring R[x] over a Ring R in an indeterminate X, Primitive polynomial .The ring of Gaussian integers as an Euclidean domain, Fermat's Theorem, Unique Factorization domain.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- The student will be able to define the concepts of group, ring, field, and will be able to readily give examples of each of these kinds of algebraic structures.
- The student will be able to define the concepts of coset and normal subgroup and to prove elementary propositions involving these concepts.
- The student will be able to define the concept of subgroup and will be able to determine (prove or disprove), in specific examples, whether a given subset of a group is a subgroup of the group.
- The student will be able to define and work with the concepts of homomorphism and isomorphism.
- The student will be able to apply the basic concepts of field theory, including field extensions and finite fields.

Text book:

- S.K. Jain, P.B. Bhattacharya and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University Press (1997)
- H.K Pathak, Advanced Abstract Algebra, Sahitya Prakashan Merath.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 1st | **Subject Code:** 6SMMA102
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: REAL ANALYSIS-I | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- The goal of this course is for students to gain proficiency in convergence, test of Sequences and series of real numbers.
- To familiarize the student with open set and closed set of real numbers.
- To make the student acquire sound knowledge of techniques in solving differential Calculus.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Sequences & subsequences, Convergent sequence, divergent sequence and some theorems, Real Valued function & Theorems, Cesaros's Theorem, Nested Interval theorem, Limit superior and Limit Inferior.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Series of Non-negative terms, comparison test, cauchy's condensation test, comparison of ratios, Logarithmic test, D'morgan and bertrand's test.	ICT based & Green board based class room teaching Individual presentations
Unit-III	General Principal of convergence, pringsheims Method, Merten's Theorem, Abel's Theorem, Euler's constant Theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Neighbourhoods, open set and closed set & properties, Bolzano-weierstranss Theorem, Baire category theorem for R, covering Theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Limit and continuity Theorems on continuity, Bolzano's theorem on continuity, continuity of inverse function, Geometrical meaning of a derivative, chain Rule of Derivative, Darboux Theorem and cauchy's mean value Theorems.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- Fluency in convergence test using standard methods, including the ability to find an appropriate test for a given sequence or series.
- Understanding ideas and concept of differential calculus and facility in solving standard examples.
- Understanding the ideas of open and closed sets and facility in solving standard examples.

Text book:

- H.K Pathak, Real Analysis, Siksha Sahitya Prakashan Meerut.
- J.N.Sharam & R. Vasisth, Real Analysis, Krishna Publication, Pvt. Ltd.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 1st | **Subject Code:** 6SMMA103
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: TOPOLOGY-I | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

The aim of this course is to provide students

- An introduction to theory of metric and topological spaces with emphasis on those topics that is important to higher mathematics.
- Basic notions of metric and topological spaces.
- Information about the properties of continuous mappings and convergence in topological spaces.
- The broader information of some selected types of topological spaces (compact, product, connected spaces) and countability, separation axioms including some basic theorems on topological spaces.
- Information about product invariance of certain separation and countability axioms.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Definition and examples of topological space, Open sets, Closed sets, Closure , Dense subsets.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Neighborhoods, Interiors, exteriors and boundary .Accumulation point and derived sets, bases and sub-bases, subspaces and relative topology.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Continuous Maps, Continuous Maps into R, open and closed maps, Homeomorphism, Finite product spaces, projection maps.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Connected space and disconnected spaces, separated sets, component, locally connected space, Path connectedness, separation axioms : T0, T1 and T2 Spaces.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Introduction of compactness, compact subspace, Finite intersection property, Bolzano-weierstrass property, countable, sequential and local compactness.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:
Upon successful completion of the program the students will be aware of:-

- The definitions of standard terms in topology.
- How to read and write proofs in topology with a variety of examples and counter examples.
- Some important concepts like continuity, compactness, connectedness, projection mapping etc
- Countability, separation axioms and convergence in topological spaces.
- Using new ideas in mathematics and also help them in communicating the subject with other subjects.

TEXT BOOK:

- J.N. Sharma, Topology, Krishan Prakashan Media (P) Ltd. Meerut Delhi.
- J.M. Munkers, Topology, Publication Tata McGraw Hill.
- H.K. Pathak, Topology, Shiksha Sahitya Prakashan Meerut.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 8 **(**Quality Education	academician

Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 1st | **Subject Code:** 6SMMA104
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: COMPLEX ANALYSIS-I | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- Tell more about complex numbers and complex valued function to the students.
- To introduce the concept of conformal mapping and Bilinear transformation of different kind.
- To introduce the concept of complex integration on simply connected region and multiple connected regions.
- To introduce three main and important theorem of Complex Analysis namely Liouvilles theorem, Morera's theorem and Cauchy's integral formula.
- To introduce Taylor's series and Laurent's series to the students.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Complex Number, Analytic Functions, Cauchy – Riemann Equations, Harmonic Functions, Conjugate functions.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Conformal mappings, Bi-linear transformations, Geometrical interpretations of the transformations $\omega = z+\alpha$, $\omega = \beta z$, $\omega = \gamma z$. Bi-linear transformation of a circle.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Complex integration, complex integrals as sum of two real line integrals, Cauchy's Theorem, Extension of cauchy's Theorem to multi – connected region Cauchy.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Cauchy integral formula, Extension of cauchy's integral formula to multiconnected regions, Liouville's Theorem, Morea's theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Taylor's Theorem, Laurent's Theorem with examples.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:-

- Understanding about complex number and complex valued function will enable them to deal with function of multi variable.
- Students will able to transform the region /object of one plane onto another plane easily.
- Cauchy theorem will help them to find the integration of function on the region where function is analytic and where it is not Analytic.
- Cauchy integral formula with help students to find the value of function at inside point of the region.
- Students will able to expand function in series of positive and negative power of variable in a given region.

Text book:

- Dr. H. K. Pathak, Complex Analysis, Shiksha Sahitya Prakashsn Meerut.
- J.N. Sharma, Complex Functions, Krishan Prakashan Media (P) Ltd. Meerut Delhi.

Job opportunities	**Employability Skill Developed**	**Local/National/UNDP Goal Achieved**	**Entrepreneurship Opportunity**
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work), Goal 8 **(**Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 1st **Subject Code:** 6SMMA105
Course: M.Sc. Mathematics **Theory Max. Marks:** 50
SUBJECT: DIFFERENTIAL EQUATION-I **Theory Min. Marks:** 17

COURSE OBJECTIVE

- This course helps the students to study elementary concepts.
- To introduce the concept of simultaneous differential equations.
- Understanding the concept of integration in series.
- To understand the Existence and Uniqueness theorem.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Elementary Concepts: Linear equations of second order, Transformation of the equation to the normal form, Transformation of the equation by changing the independent variable, Method of variation of parameters.	ICT based & Green board based class room teaching Individual presentations.
Unit-II	Ordinary simultaneous differential equations, Differential equations in different form, Total differential equation	ICT based & Green board based class room teaching Individual presentations
Unit-III	Integration in series : Roots of indicial equation equal, Roots of indicial equation unequal and differing by a quantity not an integer, Roots of indicial equation equal differing by an integer making coefficient of y-infinity.	ICT based & Green board based class room teaching Individual presentations.
Unit-IV	Roots of indicial equation differing by an integer ; making a coefficient of y indeterminate, Some cases where the method fails, The particular integral, Method of differentiation.	ICT based & Green board based class room teaching Individual presentations.
Unit-V	Picard's iteration method, The Lipschitz condition, Existence theorem, Uniqueness theorem, Existence and Uniqueness theorem (The general case)..	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- The student will be able to define the elementary concept of differential equations.
- The student will be able to define and work with the concept of simultaneous differential equations.
- The student will be able to define and work with the concept of integration in series.
- The student will be able to apply the iteration method.

TEXT BOOK:

- Sharma-Gupta, Differential Equation, Krishan Prakashan Media (P) Ltd. Meerut Delhi.
- H.K Pathak, Differential Equation, Shiksha Sahitya Prakashan Meerut.

Job opportunities	**Employability Skill Developed**	**Local/National/UNDP Goal Achieved**	**Entrepreneurship Opportunity**
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education)	Academician

Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 2nd | **Subject Code:** 6SMMA201
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: ADVANCED ABSTRACT ALGEBRA-II | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- The focus of the course will be the study of modules over a ring.
- In particular to study in details the Noetherian and Artinian modules and rings.
- This course helps to study the Linear transformations, Algebra of Linear transformations & Linear operators.
- In particular to study in details the Nilpotent transformations, Jordan blocks & forms.
- This course helps to study the fundamental structure theorem of modules over PID and also helps to gain knowledge about its application to finitely generated abelian group.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Introduction to modules- Examples, sub modules, quotient modules. Module homomorphism, and isomorphism.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Finite generate modules, Fundamental structure theorem for finitely generated moduls over a principal ideal domain its application of finitely generated abelian group. cyclic modules.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Simple modules, semi simple modules, free modules, Schurs lemma. Neotherian & artinian modules and ring	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Schroeder- Bernstion Theorem, Hillebert basic Theorem, Wedderburn - Artin Theorem,	ICT based & Green board based class room teaching Individual presentations
Unit-V	Uniform modules, primary modules, Noether - Laskar Theorem. Fundamental structure theorem of module over a principle ideal domain and its application to finitely generated abelian groups.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- The student will be able to define the concepts of module over a ring and will be able to readily give examples of this kinds of algebraic structures.
- The student will be able to define and work with the concepts of Noetherian and Artinian modules and rings.
- The student will be able to define the concept of Linear transformations, Algebra of Linear transformations & Linear operators, Nilpotent transformations, Jordan blocks & forms.
- The student will be able to give detail proof and work with the concepts of Schur's Lemma.
- The student will be able to apply the basic concepts of modules, including uniform and primary modules.

TEXT BOOK:

- S.K. Jain, P.B. Bhattacharya and S.R. Nagpaul, Basic Abstract Algebra, Cambridge University Press (1997)
- H.K Pathak, Advanced Abstract Algebra, Sahitya Prakashan Merath.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

W.E.F. July:2020-21

Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 2nd | **Subject Code:** 6SMMA202
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: REAL ANALYSIS -II | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- To make familiarize the student with Riemann-Stieltjes integral and their application.
- To make the student acquire sound knowledge of techniques in solving problems on function of several variable and Jacobian.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Definition of Riemann-Stieltses Integral & theorems, The Rs-Integral as limit of sums, Some classes of Rs-Integrable function, Algebra of Rs-Integrable function, The Interval of integration, The Rs-Integrability of composite function.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Relation between R- Integral & Rs-Integral, Integration of vector valued function, some more Theorems on integration.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Continuity of function of two variables, Partial Derivatives, Differentiability of two variables, Differentiability of composite function.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Differentiation, Differentiation of vector-valued function, Differentiation in Rn, The implicit function Theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Definition of Jacobians', Case of function of function, Jacobian of implicit functions, Necessary and Sufficient condition for a Jacobian to Vanish Identically.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- Understanding ideas and concept of Riemann – Stieltjes integral and facility in solving standard examples.
- Fluency in solving standard methods, including the ability to find an appropriate method for a given function of several variables.
- Understanding the ideas of Jacobian and facility in solving standard examples.

TEXT BOOK:

- H.K. Pathak, Real Analysis, Siksha Sahitya Prakashan Meerut.
- J.N. Sharma & R. Vasisth, Real Analysis, Krishna Publication, Pvt. Ltd.

Job opportunities	**Employability Skill Developed**	**Local/National/UNDP Goal Achieved**	**Entrepreneurship Opportunity**
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 2nd | **Subject Code:** 6SMMA203
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: TOPOLOGY-II | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- An introduction to theory of metric and topological spaces with emphasis on those topics that are important to higher mathematics.
- Basic notions of metric and topological spaces.
- Information about the properties of continuous mappings and convergence in topological spaces.
- The broader information of some selected types of topological spaces (compact, product, connected spaces) and countability, separation axioms including some basic theorems on topological spaces.
- Information about product invariance of certain separation and countability axioms.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Separation Axioms: Regular and T3 spaces, normal and T4 spaces, Urysohn's Lemma, Tietze's, Extension theorem, completely regular and Tychonoff spaces, completely normal and T5 spaces..	ICT based & Green board based class room teaching Individual presentations
Unit-II	Count ablility Axioms: First and second axioms of countablility, Lindelof spaces , Separable spaces , Coutably compact spaces, Limit point compact spaces.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Convergence in Topology: Sequences and subsequences, convergence in topology, sequential compactness, local compactness, one point compactification, Stone-Cech compactification.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Metric Spaces and Metrizability: Separation and countability axioms in metric spaces, convergence in metric spaces, complete metric spaces.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Product Spaces: Arbitrary product spaces, product invariance of certain separation and countability axioms, Tychonoff's Theorem, product invariance of connectedness.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

Upon successful completion of the program the students will be aware of:-

- The definitions of standard terms in topology.
- How to read and write proofs in topology with a variety of examples and counter examples.
- Some important concepts like continuity, compactness, connectedness, projection mapping etc
- Countability, separation axioms and convergence in topological spaces.
- Using new ideas in mathematics and also help them in communicating the subject with other subjects.

TEXT BOOK:

- J.N. Sharma, Topology, Krishan Prakashan Media (P) Ltd. Meerut Delhi.
- J.M. Munkers, Topology, Publication Tata McGraw Hill.
- H.K.Pathak, Topology, Shisksha Sahitya Prakashan Meerut.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 2nd **Subject Code:** 6SMMA204
Course: M.Sc. Mathematics **Theory Max. Marks:** 50
SUBJECT: COMPLEX ANALYSIS-II **Theory Min. Marks:** 17

COURSEOBJECTIVES:

- To introduce the concept of zero is and singularities of a complex valued function.
- To introduce residues theorem as well as some definite integral round the unit circle.
- To introduce the concept of integral of rational function on the semi circular region.
- To introduce the concept of fixed point and bilinear transformation and their special from.
- To introduce the concept of analytic function and multiple valued function.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Fundamental theorem of integral calculus for complex functions, uniqueness theorem, The zero of an analytic function, Singularities of an analytic function.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Residues, Cauchy's residue theorem, Evaluation of real definite integrals by contour integration, Integration round the unit circle.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Evaluation of the integral Evaluation of the integrals of the form m>0, where P(x),Q(x) are polynomials,deg Q(x) > deg P(x) Q(x)=0 has no real roots.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Fixed points or Invariant points of a Bilinear transformation, Normal form of a Bilinear transformation, Elliptic, Hyperbolic and parabolic transformations, some special Bilinear transformations	ICT based & Green board based class room teaching Individual presentations
Unit-V	Analytic, Holomorphic and Regular function, Polar form of Cauchy-Riemann Equations, Derivative of w = f(z) in polar form, orthogonal System, Multiple Valued function.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- Understanding the concept of singularities will help student to find integral of complex valued function on some simple connected region and multi connected region.
- Students will able to solve definite integral easily which is quite difficult by analytical method.
- Understanding fixed point would help students to learn more about those type of function which posses fixed point.
- Students will learn more about everywhere differentiable function and they will learn how it helps them to decide analyticity of function.

TEXT BOOK:

- Dr. H.K. Pathak, Complex Analysis, Shiksha Sahitya Prakashsn Meerut.
- J.N. Sharma, Complex Functions, Krishan Prakashan Media (P) Ltd. Meerut Delhi.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd | **Subject Code:** 6SMMA205
Course: M.Sc. Mathematics | **Theory Max. Marks:** **50**
SUBJECT: DIFFERENTIAL EQUATION-II | **Theory Min. Marks:** 17

COURSE OBJECTIVE

- This course helps the students to study Linear and Nonlinear differential equations.
- To introduce the concept of boundedness of solutions.
- Understanding the concept of Legendre polynomials.
- To understand the Legendre's function of the second kind.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Linear and Non-linear differential equation, Independence of constants of integration, some theorems on second order linear differential equations, Linear dependence and independence of solutions of an equations.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Boundedness of solutions, L^2- Boundedness, Oscillatory equations, Number of zeros, The adjoint equation, Lagrange's identity, Greens formula, Lagrange's identity in case of second order, Self-adjoing..	ICT based & Green board based class room teaching Individual presentations
Unit-III	Legendre polynomials, Solution of Legendre's equation, Definition of $P_n(x)$ and $Q_n(x)$, Orthogonality, Recurrence formulae, Christoffel's summation formula.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Rodrigue's formula, Even and Odd functions, Expansion of x^n in Legendre's polynomials, General results.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Legendre's function of the second kind, Neumann's Integral, Recurrence formulae for $Q_n(x)$, Relation between $P_n(x)$ and $Q_n(x)$, Christoffel's second summation formula.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- The student will be able to define the elementary concept of Linear and non linear differential equations.
- The student will be able to define and work with the concept of Boundedness of solutions and Langrange's identity.
- The student will be able to define and work with the concept of Legendre's polynomial.
- The student will be able to apply the Neumann's integral and Christoffel's summation formula.

TEXT BOOK:

- Sharma-Gupta, Differential Equation, Krishan Prakashan Media (P) Ltd. Meerut Delhi.
- H.K Pathak and J. P. Chauhan, Differential Equation, Shiksha Sahitya Prakashan Meerut.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd | **Subject Code:** 6SMMA301
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: FUNCTIONAL ANALYSIS-I | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- Understand the Normed linear spaces and Banach spaces.
- Be familiar with the sub space and Quotient space of Banach Space.
- Understand compactness, Equivalent norms Hahn Banach theorem.
- Understand the concept of Natural imbedding theorem and Riesz lemma.
- Get exposed to the conjugate space and the conjugate of an operator.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Normed linear space, Banach spaces examples and theorems, Holders inequality, Minkowski's inequality, Cauchy's inequality.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Completeness of c^n , the space l_p^n , completeness of l_p^n ,the space l_p ,Riesz – Fisher theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Sub space and Quotient spaces of Banach space , Norm of Bounded (continuous) linear transformation , basic properties of finite dimensional normed linear space.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Compactness, Equivalent norms, Riesz –lemma, Convexity theorem, the natural imbedding of N in N**, Reflexibility.	ICT based & Green board based class room teaching Individual presentations
Unit-V	The conjugate space of l_p ,weak convergence , the conjugate of an operator , dual spaces with examples , uniform boundedness theorem .	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- To learn to recognize the fundamental properties of normed linear space and to learn classify the standard examples.
- To understand the Banach space.
- Demonstrate accurate and efficient use of compactness.
- To explain the conjugate space and learn to use properly the specific techniques for conjugate of an operators over the Banach space.

TEXT BOOK:

- J.N. Sharma A.R.Vashishtha, Functional Analysis, Krishna Prakashan Media (P) Ltd. Meerut Delhi.
- P.K.Jain & O.P. Ahuja & K. Ahamad, Functional Analysis, New Age International (P) Ltd. Wiley Eastern Ltd. New Delhi, 1997.
- K.K.Jha, Functional Analysis, Students Friends 1986.
- H.K.Pathak, Functional Analysis, Shiksha Sahitya Prakashan Meerut.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd | **Subject Code:** 6SMMA302
Course: M.Sc. Mathematics | **Theory Max. Marks:** **50**
SUBJECT: INTEGRAL TRANSFORM-I | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- To expose students to learn Laplace and Fourier transform.
- To equip students with the methods of finding Laplace transform and Fourier transform of different functions.
- To make students familiar with the methods of solving IVP and BVP using laplace and fourier transform.
- To make students informative to complex fourier transform.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Definition and Properties .Sufficient Conditions for the existence of Laplace Transform. Laplace Transform of some elementary functions. Laplace Transform of the derivatives. Inverse of Laplace Transform. Initial and final theorems..Learch's theorem . Heaviside's expansion theorem. Convolution theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Some of ordinary Differential Equations with Constant Coefficients, Solution of ordinary differential equation with variable coefficients, Solution of Simultaneous ordinary differential equation, Solution of Partial differential equations, Application to electrical equations, Application to mechanics, Application of Laplace transform to integral equations.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Application of Laplace transform in initial Boundary value problems, Heat conduction equation, Wave equation, Laplace equation Application to Beams.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Dirichlet's condition, Fourier series, Fourier integral formula, Fourier transform or complex Fourier transform, Inversion theorem for complex Fourier transfor, Fourier Sine and Cosine Transform. Change of Scale Property, Shifting Property, Modulation theorem, Multiple Fourier transform, Convolution, The Convolution or Falting theorem for Fourier transform, Parseval's identity for Fourier transform	ICT based & Green board based class room teaching Individual presentations
Unit-V	Finite Fourier sine transform, Inversion formula for sine transform, Finite Fourier cosine transform, Inversion formula for cosine transform, Multiple finite Fourier transform theorems on operational properties of finite sine and cosine transform, Combined properties of finite Fourier sine and cosine transform.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES: Upon successful completion of this course, students will be able

- To calculate the Laplace transform and Inverse Laplace Transform of standard functions.
- To select and use the appropriate shift theorems in finding laplace and inverse laplace transform.
- To combine the necessary Laplace transform techniques to solve second order differential equations.
- To find the complex Fourier transform of some functions .
- To find the Fourier transform of some elementary and standard functions with properties of finite Fourier sine and cosine transform.

TEXT BOOK:

- D.C. Agrawal, Advance Integral Transforms,
- Goel & Gupta, Integral Calculus,

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd | **Subject Code:** 6SMMA303
Course: M.Sc. Mathematics | **Theory Max. Marks**: 50
SUBJECT: Special Function - I | **Theory Min. Marks:** 17

- To study the Gamma function and related functions.
- To introduce Hyper geometric differential equations and generalized Hyper geometric differential equation.
- This course helps to solve Hermit's differential equation**.**
- To introduce the Laguerre Polynomials**.**
- To introduce the Jacobi Polynomials.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Special Functions, Infinite series , ortho gonal Polynomials, eulerian definition Weistrass Defination, Eulerian Product rz Evaluation of r(i) and F'(1/2)/ r(1/2) Equivalence of Weierstrass and Euler Defination , Factorial Function Gauss' Multiplication Formula .	ICT based & Green board based class room teaching Individual presentations
Unit-II	Hypergeometric Function , Integral Represention of f(a,b ; c,z) Relation of contigulity , Hypergeometric differential equation , transformation of f(a,b ; c,z)	ICT based & Green board based class room teaching Individual presentations
Unit-III	Introduction of generalized Hypergeometric Function , Differential Equation Satisfied by pfq , saalsehutz Theorem , whipples Theorem , Dixon's Theorems	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Integrals involving Generalized hypergeometric Functions, Kummers Theorems, Ramanujans Theorems.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Generating Function for Jn(z) , Alternative Form of Generating Function Recurrence relation for Jn(z) , Bessel's integral , Spherical Bessel Functions , Neumann Polynomials & series .	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- The student will be able to solve the Gamma function and related functions.
- The student will be able to solve the Hypergeometric Function.
- The student will be able to solve the Hermit Polynomials.
- The student will be able to solve the Laguerre Polynomials.
- The student will be able to study the Jacobi Polynomials .

TEXT BOOK:

- J. N. Sharma, Special function, Pragati Prakashan Meerut.
- H.K. Pathak, Special Function, Shiksha Sahitya Prakashan Meerut

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer	Able to Improve Decision making and problem-solving skills	Goal 4 (Decent work),Goal 8 (Quality Education	

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code:** 6SMMA304
Course: M.Sc. Mathematics **Theory Max. Marks:** 50
SUBJECT: Advanced Discrete Mathematics (DSE - I) **Theory Min. Marks:** 17

COURSE OBJECTIVE:-The aim of the course is to develop students

- A solid understanding of algebraic structure and also the advanced concepts covered in the course.
- to use techniques from algebra, analysis and probability to solve problems in discrete mathematics.
- A solid understanding about semi groups, monodies, lattices and trees.
- A good grasp of the applications of this subject in other areas of mathematics and to real world problems.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Algebraic Structures: Introduction, Algebraic Systems: Examples and General Properties: Definition and Examples, Some Simple Algebraic Systems and General Properties, Homomorphism and Isomorphism congruence relation.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Semi group & Monodies : Definition & Examples , Homomorphism of semigroups and Monoids	ICT based & Green board based class room teaching Individual presentations
Unit-III	Lattices: Lattices as Partially ordered Sets: Definition and Examples, Principle of duality, some Properties of Lattices, Lattices as Algebraic Systems, Sublatttices, Direct Product and Homomorphism.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Some special Lattices e.g. complete Complemented and Distributive Lattices, Boolean Algebra: definition and Examples, Sub algebra, Direct product and Homomorphism, Join irreducible, atoms and antiatoms.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Trees : Trees and its properties, minimally connected graphs pendant vertices in a tree, distance and centers in a tree , rooted and binary tree Levels in a binary tree , height of a tree , Spanning tress , rank and Nullity.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOME:-
Upon successful completion of this course, the students will be able to:

- Understand the basic principles of sets and operations in sets.
- Demonstrate different traversal methods for trees and graphs.
- Write model problems in mathematical science using trees and graphs.
- Evaluate Boolean functions and simply expressions using the properties of Boolean algebra.

TEXT BOOK:

- Swapan Kumar Sarkar, Discrete Mathematics, S. Chand & company Ltd. Ram Nagar ,New Delhi.
- H. K. Pathak, Advanced Discrete Mathematics, Shiksha Sahitya Prakashan, Meerut.
- Udit Agrawal , Discrete mathematical Structure, Dhanpat Rai & Co.(P) Ltd, Delhi.
- M. K. Gupta, Discrete Mathematics, Krishna Prakashan Media (P) Ltd. , Meerut.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician, Researcher, Civil Officer, Bank P.O Bank clerk, etc.	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education)	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd | **Subject Code:** 6SMMA305
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: Partial Differential Equations (DSE - I) | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- Learn to solve Partial Differential Equation of Second Order.
- To make students familiar with Green's Function and Harmonic Function.
- Understand the application of Partial Differential Equations.
- Learn to solve fundamental solution of Laplace equation.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Partial Differential Equation of Second Order**: Introduction, Classification of Linear partial differential equations of second order, canonical forms, The solution of linear Hyperbolic equations, Riemann method of solution of general hyperbolic equation of the second order.	ICT based & Green board based class room teaching Individual presentations
Unit-II	**Green's Function and Harmonic Function**: Introduction, Green's function for Laplace equations, The method of images, The Eigen function method, Green's function for the Wave equation- Helmholtz theorem, Green's function for diffusion equation, Properties of harmonic functions, The spherical mean,Mean value theorem for Harmonic function.	ICT based & Green board based class room teaching Individual presentations
Unit-III	**Application of Partial Differential Equations**: Introduction, Practical problems involving PDE, One dimensional wave equation, Two dimensional wave equation, Heat equation, One and two dimensional Heat equation, Diffusion equation, Method of separation of variable or product method.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Solution of Laplace's equation in polar coordinates, Vibration of a circular membrance, Laplace's equation in terms of spherical coordinates, Laplace's equation in terms of sylindrical co-ordinates.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Fundamental solution of Laplace equation, Poisson's equation, Regularity, Local estimates for harmonic functions, Maximum-Minimum principle, Green's identities, Applications of Green's identities, Dirichlet condition, Representation formula, Harnack's inequalities, energy methods.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:
After completion the students will be able to:

- Solve Partial Differential Equation of Second Order.
- Solve some problems of Green's Function and Harmonic Function.
- Understand the application of Partial Differential Equations
- Find the solutions of Laplace equation and Poisson's equation.

Text Book:

- Singh & Chauhan ,Introduction of Partial Differential Equations, Shiksha Sahitya Prakashan ,Meerut.
- K. Shankar Rao, Introduction of Partial Differential Equations, Prentice Hall of India P.Ltd.New Delhi.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers,Statistician,Researcher,Civil Officer, Bank P.O Bank clerk, etc.	Able to Improve Decision making and problem solving skills.	Goal 4 (Decent work),Goal 08 (Quality Education)	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code**: 6SMMA306
Course: M.Sc. Mathematics **Theory Max. Marks:** 50
SUBJECT: Numerical Analysis (DSE - I) **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- This course aims to provide the information about systems of linear equations.
- This course helps to study the different methods of Interpolation, Differentiation and Integration.
- To understand the concept of approximation of functions.
- To introduce the concept of Ordinary and Partial differential equations.
- This course helps to gain skill in problem solving and critical thinking.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Systems of Linear equations and Algebraic Eigen value Problems Direct Method: Gauss elimination method, Error analysis, Iterative methods: Gauss Jacobi and Gauss-Seidel method, Convergence considerations, Eigen value problem: Power method.	ICT based & Green board based class room teaching Individual presentations
Unit-II	**Interpolation Differentiation and Integration** **Interpolation**: Lagrange's and Newton's interpolation, Errors in interpolation, Optimal points for interpolation, Numerical differentiation by finite differences, **Numerical integration**: Trapezoidal, Simpson's and Gaussian quadratures, Error in quadratures	ICT based & Green board based class room teaching Individual presentations
Unit-III	**Approximation of functions** Norms of functions, **Best approximations**: Least squares polynomial approximation, Approximation with Chebyshev polynomials, Piecewise linear and cubic spline approximation	ICT based & Green board based class room teaching Individual presentations
Unit-IV	**Ordinary Differential Equations** **Single step methods**: Euler's method, Taylor series method, Runge-Kutta method of fourth order, **Multistep methods**: Adam's Bashforth and Milne's Thomson method, Stability considerations, **Linear two point BVPs**: Finite difference method.	ICT based & Green board based class room teaching Individual presentations
Unit-V	**Partial Differential Equations** **Elliptic Equations:** Five point finite difference formula in rectangular region, Truncation error; **One dimensional parabolic equation**: Explicit and Crank – Nicholson schemes; Stability of the above schemes,	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- The student will be able to solve the system of linear equations and algebraic eigen value problems.
- Understanding the ideas of solving interpolation, differentiation and integration.
- Fluency in solving approximation of functios.
- The student will be able to solve ordinary differential equation by various methods.
- The student will be able to solve elliptic,one dimensional parabola and hyperbola equations.

TEXT BOOK:

- Brian Bradie, " A friendly introduction to numerical analysis", Pearson education, New Delhi, First edition,2007.
- Kincaid D. and Chenney W., "Numerical Analysis: Mathematics of scientific computing", Brooks/Coles Publication of second edition, 2002.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers,Statistician,Researcher,Civil Officer, Bank P.O Bank clerk, etc.	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd | **Subject Code:** 6SMMA307
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: Mathematical Statistics (DSE-II) | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- To tell sampling distributions and estimation theory.
- To introduce the concept of testing of hypothesis.
- To introduce the concept of correlation and regression.
- In particular to study the design of experiments.
- This course helps to study multivariate analysis.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Sampling Distributions and Estimation Theory** Sampling distributions, Characteristics of good estimators, Method of moments, Maximum likelihood estimation, Interval estimates for mean, Variance and Proportions.	ICT based & Green board based class room teaching Individual presentations
Unit-II	**Testing of Hypothesis** Type I and Type II errors, Tests based on normal, t, χ^2 and F distributions for testing of mean, variance and proportions, Tests for independence of attributes and goodness of fit.	ICT based & Green board based class room teaching Individual presentations
Unit-III	**Correlation and Regression** Method of least squares, Linear regression, Normal regression analysis, Normal correlation analysis, Partial and multiple correlation, Multiple linear regression.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	**Design of Experiments** Analysis of variance, One way and two way classifications, Completely randomized design, Randomized block design, Latin square design.	ICT based & Green board based class room teaching Individual presentations
Unit-V	**Multivariate Analysis** Covariance matrix, Correlation matrix, Normal density function, Principal components, Sample variation by principal components, Principal components by graphing.	ICT based & Green board based class room teaching Individual presentations

COYURSE OUTCOMES:

- The student will be able to solve the Mean, Variance and Proportions.
- The student will be able to find Type I and Type II errors by various distributions methods.
- The student will be able to apply method of least squares.
- The student will be able to study the analysis of variance.
- The student will be able to study covariance matrix, correlation matrix and principal components by graphing.

Text Book:

- J.E. Freund, "Mathematical Statistics", Prentice Hall of India, 5th Edition, 2001. (Chapters; 8,10,11,12,13,14,15 R.A. Johnson and D.W. Wichem, "Applied Multivariate Statistical Analysis", Pearson Education Asia, 5th Edition, 2002.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer,	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code:** 6SMMA308
Course: M.Sc. Mathematics **Theory Max. Marks:** 50
SUBJECT: Number Theory (DSE-II) **Theory Min. Marks:** **17**

COURSE OBJECTIVES:

- To introduce the concept Binomial theorem.
- To introduce the concept of Congruences and Techniques of Numerical calculations.
- To introduce the concept of Publickey cryptography.
- In particular to study the Combinational number theory.
- This course helps to study Farey sequences and functions.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Divisibility:** Introduction, Divisibility, Primes, The Binomial theorem.	ICT based & Green board based class room teaching Individual presentations
Unit-II	**Congruence's:** Congruence's, Solutions of congruence's, The Chinese remainder theorem, Techniques of numerical calculations	ICT based & Green board based class room teaching Individual presentations
Unit-III	**Application of Congruence and Quadratic Reciprocity** Publickey cryptography, Prime power moduli, Prime modulus, Primitive roots and Power residues, Quadratic residues, The Gaussian reciprocity law.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	**Functions of Number Theory** Greatest integer function, Arithmetic functions, Mobius inversion formula, Recurrence functions, Combinational number theory.	ICT based & Green board based class room teaching Individual presentations
Unit-V	**Diophantine Equations and Farey fractions** The equations $ax + by = c$ Pythagorean triangle, Shortest example, Farey sequences, Rational approximations.	ICT based & Green board based class room teaching Individual presentations

COURSEOUTCOMES:

- The student will be able to solve Divisibility.
- The student will be able to find solutions of congruence's.
- The student will be able to apply method of Congruence and Quadratic Reciprocity.
- The student will be able to study the analysis of Functions of Number Theory.
- The student will be able to study Diophantine Equations and Farey fractions.

Text book:

- Niven I., Zuckerman H.S. and Montgomery H.L., An introduction to the theory of numbers, John Wiley and Son's, 5th edition, 2004.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer,	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 3rd **Subject Code:** 6SMMA309
Course: M.Sc. Mathematics **Theory Max. Marks:** **50**
SUBJECT: Differential Geometry (DSE-II) **Theory Min. Marks:** **17**

COURSEOBJECTIVES:

- To introduce the theory of space curves.
- To introduce the concept of surface in R^3.
- To introduce the concept of Envelopes.
- To introduce the concept of Asymptotic lines and the fundamental equations of surface theory.
- To introduce the concept of Geodesics theorem and mappings.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Theory of space curves, arc length, tangent and normal's, Curvature and torsion of curve given as the intersection of two surfaces, Involute and Evolute .	ICT based & Green board based class room teaching Individual presentations
Unit-II	The first and second fundamental form of a surface, Weingarton equation, Orthogonal trajectories, Mensuier theorem, Gaussian curvature, Euler's theorem, Dupin's theorem, Rodrigue's theorem, Dupin's indicatrix.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Envelopes, Edge of regression, Ruled surface, Developable surface, Monge's theorem, Conjugate directions.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Asymptotic lines, The fundamental equations of surface theory, Gauss's formulae, Gauss characteristics equations, Mainardi Codazzi equations, Weingarton equations, Bonnet's theorem on parallel surface.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Geodesics, Clairaut's theorem, Gauss Bonnet theorem, Conformal mapping and Geodesic mappings, Tissot's theorem, Dini's theorem.	ICT based & Green board based class room teaching Individual presentations

COURSEOUTCOMES:

- The student will be able to solve the theory of space curves.
- The student will be able to solve the fundamental form of surface.
- Fluency in solving Envelopes and regression.
- The student will be able to solve the fundamental equations of surface theory.
- The student will be able to apply Geodesics theorem .

TEXT BOOK:

- T .J. Willmore, An introduction to differential geometry, oxford University Press, New York,1959.
- L.P. Eiscnhart, An introduction to differential geometry, Princeton University Press, Priceton, New jersey,1940.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer,	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 4th **Subject Code:** 6SMMA401
Course: M.Sc. Mathematics **Theory Max. Marks:** **50**
SUBJECT: FUNCTIONAL ANALYSIS-II **Theory Min. Marks:** **17**

COURSE OBJECTIVES:

- Understand the Inner product space and Hilbert space.
- Understand the Orthogonality .
- Be familiar with the concept of Riesz representation theorem for continuous linear functional on Hilbert space .
- Get exposed to the adjoint, self adjoint, Normal and Unitary operators.
- Understand Finite dimensional Spectral theory.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Open mapping theorem ,Closed graph theorem , Hahn –Banach theorem for linear spaces .	ICT based & Green board based class room teaching Individual presentations
Unit-II	Inner product spaces , Hilbert spaces , some properties of Hilbert spaces ,Schwarz inequality.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Orthogal complements , projection theorem , Ortthonarmel sets , Bessel's inequality ,complete Orthonarmal set .	ICT based & Green board based class room teaching Individual presentations
Unit-IV	The conjugate space H* ,Riesz representation theorem for continuous linear functional on a Hilbert space.	ICT based & Green board based class room teaching Individual presentations
Unit-V	The Adjoint of an Oprtator , self adjoint operator ,Normal and operators.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

To be able to understand the method of application of Open mapping theorem ,Closed graph theorem , Hahn –Banach theorem for linear spaces , Inner product spaces, Orthogonal complements & Adjoint of an Oprtator

- To understand Hilbert space and the fundamental properties of it.
- To learn the application of Bessel's and Schwarz inequality.
- To explain the conjugate space of Hilbert space.
- To learn to use properly the specific techniques for operators over Hilbert space.
- To learn to use finite dimensional spectral theory .

Text book:

- J.N. Sharma A.R.Vashishtha, Functional Analysis, Krishna Prakashan Media (P) Ltd. Meerut Delhi.
- P.K.Jain & O.P. Ahuja & K. Ahamad, Functional Analysis, New Age International (P) Ltd. Wiley Eastern Ltd. New Delhi, 1997.
- K.K.Jha, Functional Analysis, Students Friends 1986.
- H.K.Pathak, Functional Analysis, Shiksha Sahitya Prakashan Meerut.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer,	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 4th | **Subject Code:** 6SMMA402
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: ADVANCED GRAPH THEORY | **Theory Min. Marks:** 17

COURS EOBJECTIVES: The aim of the course is to develop students:

- A solid understanding of the perfect graph and other class of perfect graphs.
- To understand Ramsey theory.
- A solid understanding about External graph.
- A solid understanding about Connectedness in diagraph.
- To learn properties of Tournaments.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Perfect Graphs** The perfect graph theorem, Chordal graphs, Other class of perfect graphs, Imperfect graphs, The strong perfect graph conjecture.	ICT based & Green board based class room teaching Individual presentations
Unit-II	**Ramsey Theory** Ramsey's theorem, Ramsey number, Graph Ramsey theory, Sperner's lemma and Bandwidth.	ICT based & Green board based class room teaching Individual presentations
Unit-III	**3 Extremal Graphs** Encodings of graphs, Branchings and gossip, List coloring and choosability, Partitions using Paths and Cycles.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	**Connectedness in Digraphs** Digraphs, Connected and disconnected graphs, Strong digraphs, Digraphs and matrices	ICT based & Green board based class room teaching Individual presentations
Unit-V	**Tournaments** Properties of tournaments, Hamiltonian tournaments, Score sequences.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES: Upon successful completion of this course, the students will be able to: 2010413201

- Apply the perfect graph theorem.
- Apply Ramsey theory.
- Encode the graphs.
- Understand the connected and disconnected graphs.
- Understand the Hamiltonian tournaments.

TEXT BOOK:

- M. Bezhad, G. Chartrand, L. Lesneik Foster, "Graphs and Digraphs", Wadsworth International Groups, 1995
- Douglas B. Waste, "Introduction to Graph Theory", Prentice Hall of India, 2002.

REFERENCES BOOK

- Martin Charles Golumbic, "Algorithmic Graph Theory and Perfect Graphs", Academic Press, 1980.
- Bela Bollabas, "Extremal Graph Theory", Dover Publications, 2004.
- Jorgan Bang-Jensen and Gregory Gutin, "Digraphs-Theory, Algorithms and Applications", Springer and Verlag London, 2001.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 4th **Subject Code:** **6SMMA403**
Course: M.Sc. Mathematics **Theory Max. Marks:** 50
SUBJECT: INTEGRAL TRANSFORM-II (DSE - III) **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- To apply the Fourier transform method for solving IVP and BVP.
- To learn Hankel transform and its properties.
- To apply Hankel transform in IVP and BVP.
- To understand the basic concept of Mellin transform and its properties.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Application of Fourier transform in initial and boundary value problems: Application of infinite Fourier transform, Choice of infinite sine or cosine transforms, Applications of finite Fourier transform, Finite Fourier transform of partial derivatives.	ICT based & Green board based class room teaching Individual presentations
Unit-II	Definition of Hankel transform, Inversion formula for the Hankel transforms, Some important results for Bessel functions, Linearity property, Hankel transform of the Derivatives of a Function.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Hankel transform of (d^2 f)/〖dx〗^2 +1/x df/dx-n^2/x^(2) f. Parseval's Theorem .Definition of finite Hankel transform. Another form ofHankel transform.Hankel transform ofdf/dx.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Hankel transformof(d^2 f)/〖dx〗^2 +1/x df/dx,where p is the root of the equationJ_n (ap) =0.Applications of HankelTransform in initial and boundary value problems.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Definition of Mellin transforms. The Mellin Inversion theorem. Linearity property. Some elementary properties & Mellin transform.Mellin transform of derivatives. Mellin transform of integrals. Convolution (or falting).	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

Upon successful completion of course the students will be able :

- To find the Hankel transform of some functions
- To apply the Fourier transform methods for solving functions.
- To demonstrate accurate and efficient use of Hankel transform techniques.
- To understand the application of Hankel transform
- To get exposed how to use the properties of Mellin transform in solving various functions.

TEXT BOOK:

- D.C.Agrawal, Advance Integral Transforms,
- Goel & Gupta, Integral Calculus,

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 4th | **Subject Code:** 6SMMA404
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: SPECIAL FUNCTION-II (DSE - III) | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

Explain the method of application of Hermit Polynomials solution of Hermites differential equation , Bateman's Generating Relation , Laguerre Polynomials Solution of Laguerres differentials Equation & Jacobi Polynomials.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Introduction of Hermit Polynomials solution of Hermites differential equation , Generating Function of Hermites Polynomials Rodrigues Formula for Hn(x), Recurrence relations for Hn(x)	ICT based & Green board based class room teaching Individual presentations
Unit-II	Bateman's Generating Relation Integral Representation of Hermite Polynomial ortnagonal Properties of Hn(x), Expansions of Polynomials.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Introduction of Laguerre Polynomials Solution of Laguerres differentials, Equation, Generating Function of Laguerre Polynomilas, Rodrigues Formula, Recurrence Releations of Rodrigues Formula	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Generlised Laguerre Polynomial ,Recurrence Releation .	ICT based & Green board based class room teaching Individual presentations
Unit-V	Introduction of Jacobi Polynomials, Generating Functions of Jacobi Functions Rodrigues Formula , Orthogonal Properties Recurrence Releation .	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

To be able to understand the method of application of Hermit Polynomials solution of Hermites differential equation, Bateman's Generating Relation, Laguerre Polynomials Solution of Laguerres differentials Equation & Jacobi Polynomials.

TEXT BOOK:

- R.K. Gupta Operations Research, Krishna Public House
- A. P. Verma Operetions Research, S.K. Kataria & Sons.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 4th **Subject Code:** **6SMMA405**
Course: M.Sc. Mathematics **Theory Max. Marks**: 50
SUBJECT: OPERATIONS RESEARCH (DSE-IV) **Theory Min. Marks:** 17

Course Objective

The aim of this course is to introduce students :-

- To establish theories and algorithms to model and solve mathematical optimization problems that translates to real life decisions making problems.
- To get exposed to the concept of linear programming problems and algorithm of linear programming problems.
- With some key topics such as, goal programming, transportation and assignment problems, network analysis and dynamic programming that will enable students to analyze the real life problems to reach at optimality.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Operation research and its Scope , Necessity of Operation Research in Industry , Linear Programming – Simplex Method, theory of the Simplex Method , Duality and Sensitivity Analysis .	ICT based & Green board based class room teaching Individual presentations
Unit-II	Algorithms for Linear Programming- Dual Simplex Method, Parametric Linear Programming, Upper – Bound Technique , Interior Point Algorithm, Linear Goal Programming.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Transportation and Assignment Problems.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Networks Analysis – Shortest Path Problem, Minimum Spanning Tree Problem , Maximum Flow Problem , Minimum cost Flow Problem , Network Simplex Method , Project Planning.	ICT based & Green board-based class room teaching Individual presentations
Unit-V	Dynamic Programming- Deterministic and Probabilistic Dynamic Programming.	ICT based & Green board-based class room teaching Individual presentations

COURSE OUTCOMES :

On completion of this course students will be able to:-

- Define and formulate linear programming problems and appreciate their limitations
- Solve LPP using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for s.
- Conduct and interpret post-optimal and sensitivity analysis and explain their primal-dual relationships.
- Develop mathematical skills to analyze and solve integer programming, parametric linear programming and network models arising from wide range of applications.
- Find maximum (of profit or yield) or minimum (of loss or cost) in real world objective.

TEXT BOOK:

- R.K. Gupta Operations Research, Krishna Public House
- A. P. Verma Operetions Research, S.K. Kataria & Sons.

Job opportunJob opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 4th **Subject Code:** 6SMMA406
Course: M.Sc. Mathematics **Theory Max. Marks:** **50**
SUBJECT: Metric Spaces and Fixed-Point Theory (DSE-IV) **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- To introduce the concept of metric contraction principles.
- To introduce hyperconvex spaces and normal structure in metric spaces.
- To introduce continuous mapping in Banach spaces.
- This course helps to provide the basic information of metric fixed-point theory.
- To introduce the Banach space ultra-powers.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Metric Contraction Priciples** Banach contraction Principle, Further extension of Banach's principle, Caristis, Ekeland principle, Equivalence of the Caristis, Ekeland principle, Set values contraction, Generalized contractions.	ICT based & Green board based class room teaching Individual presentations
Unit-II	**Hyperconvex spaces and Normal structures in metric spaces** Hyperconvexity, Properties of Hyperconvex spaces, a fixed point theorem, Approximate fixed poits. Normal structures in metric spaces: a Fixed point theorem, Structure of the fixed point set, Fixed point set structure, Separable case.	ICT based & Green board based class room teaching Individual presentations
Unit-III	**Continuous mapping in Banach spaces** Brouwer's theorem, Further comments on Brouwer's theorem, Schauder's theorem, Stability of Schauder's theorem, Banach algebra's: Stone Weierstrass theorem, Leray, Schauder degree, Condensing mappings, Continuous mappings in hyperconvex spaces.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	**Metric fixed point theory** Contraction mappings, Basic theorem for non expansive mapping, Structure of the fixedpoint set, Asymptotically regular mapping, Set valued mappings.	ICT based & Green board based class room teaching Individual presentations
Unit-V	**Banach space ultra powers** Some fixed point theorem, Asymptotically non expansive mappings, the Dami closedness principle).	ICT based & Green board based class room teaching Individual presentations

COURSE **OUTCOMES:**

- The student will be able to understand the concept of Banach contraction principle.
- Understanding the concept of hyperconvexity and normal structure in metric spaces.
- The student will be able to apply Brouwer's theorem and Schauder's theorem.
- The student will be able to apply the basic concepts contraction mappings.
- The student will be able to apply the Demi closedness principle.

Text book:

- Mohamed A., Khamsi and William A. Kirk, " An introduction of metric spaces and fixed point theory", John Wiley and Son's, 201.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER- 4th | **Subject Code:** 6SMMA407
Course: M.Sc. Mathematics | **Theory Max. Marks:** 50
SUBJECT: Measure and Integration Theory (DSE-IV) | **Theory Min. Marks:** 17

COURSE OBJECTIVES:

- To gain understanding of the abstract Measure Theory and definition and main properties .
- To construct Lebesgue Measure on the real line and in n- dimensional Euclidean space.
- To explain the basic advanced directions of the theory.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	Measure of set, Lebesgue outer measure (Caratheodory), measurable sets, Algebra of measurable set, Measures of locally compact, Regularity, Housdroff space .	ICT based & Green board based class room teaching Individual presentations
Unit-II	Measure space, measurable space , Lebesgue measure ,algebras, monotone classes.	ICT based & Green board based class room teaching Individual presentations
Unit-III	Borel sets and their measurability, Measureable functions, Algebras of measurable functions.	ICT based & Green board based class room teaching Individual presentations
Unit-IV	Continuous function functions, Simple function, The structure of measurable functions, Lusin theorem. Sequence of miserable function, Convergence in measure.	ICT based & Green board based class room teaching Individual presentations
Unit-V	Riesz theorem, Lebesgues monotone convergence theorem. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue integral.	ICT based & Green board based class room teaching Individual presentations

COURSE OUTCOMES:

- Students acquired basic knowledge of measure and integration theory .
- Analyze measurable sets and Lebesgue measure.
- Describe the Borel sets and Measureable functions.
- The student will be able to describe the structure of measurable functions.
- The student will be able to apply Riesz theorem and Lebesgues monotone convergence theorem.

TEXT BOOK :

- H.K. Pathak ,Real analysis, Shiksha Sahitya Prakashan ,Meerut.
- P. K. Jain and V.P. Gupta ,Lebesgue Measure and Integration , New Age International (P) ltd.

Job opportunities	Employability Skill Developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teachers, Statistician Civil Officer	Able to Improve Decision making and problem solving skills	Goal 4 (Decent work),Goal 08 (Quality Education	Academician