Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, B.Sc. Mathematics વિષયના શૈક્ષણિક વર્ષ ૨૦૧૮–૧૯, ૨૦૧૯–૨૦, ૨૦૨૦–૨૧, ૨૦૨૧–૨૨ અને ૨૦૨૨–૨૩ ના PO, PSO અને CO અંગે ચર્ચા કરતા ગણિતશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૩૦/૦૩/૨૦૨૪ ની સભાનાં ઠરાવ ક્રમાંકઃ ૩ અન્વયે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૧/૦૩/૨૦૨૪ ની સભાના ઠરાવ ક્રમાંકઃ૧૦૪ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત માનનીય કુલપતિશ્રી દ્વારા મંજૂર કરેલ છે.જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંકઃએસ./ગણિતશાસ્ત્ર/પરિપત્ર/૯૨૪૭/૨૦૨૪
તા.૨૬–૦૪–૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા,
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ.ગુ.યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

Bachelor of Science (Mathematics)
CO-PO-2018-19

Name of Program	**Bachelor of Science (Mathematics)**
Abbreviation	**B.Sc.- Mathematics**
Duration	**3 Years**
Eligibility Criteria	Passed 12th Science with mathematics or equivalent Degree.
Objective of Program	The core objective of the B.Sc. in Mathematics is to prepare the students for productive career by providing a solid education in the basic subjects of mathematical knowledge and its applications with outstanding environment of teaching and research in the core and emerging areas of the discipline.
Program Outcome	**PO1 : Fundamental Knowledge Enrichment** Program trains students with the core Mathematics knowledge domains. It also makes students capable of using core concepts in the conceptualization of domain specific application. **PO2 : Critical Thinking Development** The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem. **PO3 : Develop arguments in a logical manner** The program trains students to formulate and develop arguments in a logical manner and make them ready to prepare real world problem solution mathematically. **PO4 : Develop decision making ability** The program develop the skill in students to take decisions at intellectual, organizational and personal from different perspectives of life using analysis **PO5 : Computational Skill Development** The program develop basic computational skill in students for planning and managing process of complex real world. **PO6 :Provides an effective Mathematical communication skill**

Chairman
DR. M.R. Tailor
B.O.S Mathematics
30/3/2024

	The program develop an effective Mathematical communication skill in the students. **PO7 : Team Work and Leadership Development** Trains students to work in a team and also to take leadership.
Program Specific Outcomes	PSO1 : Develop and strengthen the fundamental core concepts that are required to solve complex problems PSO2 : Develop the skills that needs independent logical and analytical thinking, teamwork and leadership PSO3 : Nurture the students to investigate and development of a workable solution for a real world problem PSO4 : Develop students for self-learning and practicing challenging problem solution PSO5 : Train students to apply mathematical skills for new investigation. PSO6 : Train students to expand their knowledge of fields related to their current areas of professional specialization. PSO7 : Train students to take-up the real world challenges to develop workable solution to a domain specific problem. PSO8 : Inculcate the passion for continuous learning and doing research for making a successful professional career.
Mapping between POs and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
PO1	■	■	■	■		■	■	
PO2	■	■	■	■	■		■	■
PO3		■	■	■			■	■
PO4	■	■	■	■		■	■	■
PO5	■	■	■	■	■	■	■	
PO6		■		■				■
PO7		■	■	■	■	■	■	

Medium of Instruction	English
Program Structure	Semester 1

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-	Trigonometry	3	0	3	2Hrs	50	20	

101								70
MTH-102	Calculus	3	0	3	2Hrs	50	20	70
	Total	6	0	6				

Program Structure	Semester 2

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-201	Theory of Matrices	3	0	3	2Hrs	50	20	70
MTH-202	Integral Calculus and Differential Equations	3	0	3	2Hrs	50	20	70
	Total	3	0	3				

Program Structure	Semester 3

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-301	Advanced Calculus-I	3	0	3	2Hrs	50	20	70
MTH-302	Numerical Analysis-I	3	0	3	2Hrs	50	20	70
MTH-303	Differential-Equations	3	0	3	2Hrs	50	20	70

E.G.	3001-MathematicalMethods	2	0	2	2Hrs	50	20	70
	3002-GroupofSymmetries–I	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 4

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-401	Advanced Calculus-II	3	0	3	2Hrs	50	20	70
MTH-402	Numerical Analysis-II	3	0	3	2Hrs	50	20	70
MTH-403	Introduction to Abstract Algebra	3	0	3	2Hrs	50	20	70
E.G.	4001-MathematicalModeling	2	0	2	2Hrs	50	20	70
	4002-GroupofSymmetries–II	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 5

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-VI	GroupTheory	3	0	3	2Hrs	50	20	70
MTH-VII	LinearAlgebra-I	3	0	3	2Hrs	50	20	70
MTH-VIII	RealAnalysis-I	3	0	3	2Hrs	50	20	70
MTH-IX	RealAnalysis-II	3	0	3	2Hrs	50	20	70
MTH-X	GraphTheory	3	0	3	2Hrs	50	20	70
MTH-XI	NumberTheory-I	3	0	3	2Hrs	50	20	70
E.G.	OperationsResearch– I	2	0	2	2Hrs	50	20	70
	Mechanics– I	2	0	2	2Hrs	50	20	70
	ComputerOriented NumericalMethods –I	2	0	2	2Hrs	50	20	70

	Fourier Series	2	0	2	2Hrs	50	20	70
	Total	**20**	**0**	**20**				

Program Structure	Semester 6

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-VI	RingTheory	3	0	3	2Hrs	50	20	70
MTH-VII	LinearAlgebra–II	3	0	3	2Hrs	50	20	70
MTH-VIII	RealAnalysis–III	3	0	3	2Hrs	50	20	70
MTH-IX	RealAnalysis–IV	3	0	3	2Hrs	50	20	70
MTH-X	DiscreteMathematics	3	0	3	2Hrs	50	20	70
MTH-XI	NumberTheory–II	3	0	3	2Hrs	50	20	70
E.G.	6001-OperationsResearch– II	2	0	2	2Hrs	50	20	70
	Mechanics-II	2	0	2	2Hrs	50	20	

								70
	6002-ComputerOriented NumericalMethods –II	2	0	2	2Hrs	50	20	70
	6003-FourierTransforma nditsApplications	2	0	2	2Hrs	50	20	70
	Total	**20**	**0**	**20**				

B.Sc.Mathematics 1st Semester

Course: MTH-101: **Trigonometry**

Course Code	**MTH-101**
Course Title	Trigonometry
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Trigonometry .
Course Objective	To make students acquainted with concepts of Trigonometry
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the fundamental aspects of the Trigonometry . CO2 : Assimilate the De' Moivre's theorem and its applications,

<table>
<tr><td></td><td>Trigonometric functions for multiple arguments.
CO3 : Calculate the Indeterminate forms by using Euler's expressions, Hyperbolic functions..
CO4 : Understand the Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.
CO5 : Sketch curves in Trigonometric and hyperbolic functions.
CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit –I
De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments.

Unit-II
Euler's expressions, Evaluation of Indeterminate forms by using Euler's expressions, Hyperbolic functions for real arguments and their inverses.

Unit-III
Exponential, Circular and Hyperbolic functions of complex variables and their identities, Euler's Theorem, Relations between circular and Hyperbolic functions.

Unit-IV
Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.</td></tr>
</table>

Reference Books	1. S. L. Loney: Plane Trigonometry, Part I and II, McMillan and Co. London. 2. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd. Allahabad. 3. E. Kreyszig: Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 4. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc.Mathematics 1st Semester

Course: MTH-102: **Calculus**

Course Code	**MTH-102**
Course Title	Calculus
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of calculus and learn its applications.
Course Objective	To make students acquainted with concepts of calculus.
Course Outcomes	This course will enable the students to CO1 : Explain the insight of the historical and fundamental aspects the Calculus. CO2 : Assimilate the Successive differentiation, Leibnitz theorem and its applications CO3 : Understand the consequences of various mean value theorems for differentiable functions , Asymptotes, Concavity, Convexity and reduction function. CO4 : Calculate the Curvature and radius of curvature.

	CO5 : Apply concept of Increasing and Decreasing functions, Asymptotes, Concavity and Convexity CO6 : Apply calculus in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit –I Successive differentiation, Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions), Leibnitz theorem and its applications Unit-II Rolle's Theorems and its geometrical interpretation, Lagrange's Theorem and its geometrical interpretation, Cauchy theorem, Maclaurin and Taylor series expansions Unit-III Curvature and radius of curvature (except Polar form), Increasing and Decreasing functions, Asymptotes, Concavity and Convexity Unit-IV Reduction formulae for integration of $sin^n x, cos^n x, tan^n x, cot^n x, sec^n x, cosec^n x, sin^p x cos^q x, x^m cosnx, x^m sinnx.$
Reference Books	1. Shantinarayan: Differential Calculus, Revised EditionDecember-2004 , S. Chand and Co. New Delhi. 2. Shantinarayan: Integral Calculus, S. Chand and Co. New Delhi. 3. Gorakhprasad: Differential Calculus, Pothishala Pvt. Ltd. Allahabad. 4. M. R. Spigel: Theory and Problems of Advanced Calculus, Schaum's Publishing Co., New York. 5. N. P. Bhamore and et al: College AadhunikGanit shastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-201: **Theory of Matrices**

Course Code	**MTH-201**
Course Title	Theory of Matrices
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the theory of matrices with its applications.
Course Objective	To make students acquainted with concepts of Theory of matrices.
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of fundamental aspects the theory of matrices. CO2 : Understand the genesis of theory of matrices.. CO3 : Learn elementary raw operations, rank theory and matrix properties. CO4 : Find eigen values and corresponding eigenvectors for a square matrix. CO5 : Calculate solution of linear system of equation. CO6 : Apply matrix theory in social sciences, physical sciences, life sciences and a host of other disciplines.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	CO4 CO5 CO6
Pre-requisite	Basics of Matrices
Course Content	Unit-I Prerequisite of matrices (Different types of matrices, Operations on matrices, Properties of operations of matrices), Elementary row operations, Row-reduced echelon forms, Inverse of matrix by row –reduced echelon form. Unit-II Linear independence and dependence of rows, Row rank of a matrix, Quadratic forms. Unit-III Trace of matrix and its properties, Solution of homogeneous system of linear equations using row –reduced echelon forms. Unit-IV Characteristic equation of a matrix, Method to find Characteriastic equation using determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix, Cayley-Hamilton theorem and its application to find an inverse of a matrix, Method of diagonalization.
Reference Books	1. Krishnamurthy, Mainra and Arora: An Introduction to linear Algebra, Affiliated West Press Pvt. Ltd., New Delhi. 2. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India (P) Ltd., 2009. 3. B.S.Vasta and SuchiVasta: Theory of Matrices; 4rd Edition -2014, New Age International (P) Ltd. Publishers, New Delhi. 4. Shantinarayan: Text book of Matrices, S. Chand and Co., New Delhi. 5. H. K. Dass, H. C. Saxena, M. D. Raisinghania: Simplified course in Matrices, S. Chand and Co., NewDelhi. 6. N.P.Bhamore and et al: College AadhunikGanit shastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-202: **Integral Calculus and Differential Equations**

Course Code	**MTH-202**
Course Title	Integral Calculus and Differential Equations
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Objective	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Outcomes	The course will enable the students to: CO1 : Understand the genesis of Integral Calculus and ordinary differential equations. CO2 : Sketch curves in Cartesian coordinate systems. CO3 :To solve first order first degree and first order higher degree differential equation. CO4 : Grasp the concept of a general solution of a higher order linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations. CO5 : To solve initial and boundary value problem. CO6 : Apply Integral Calculus and Differential Equations in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	CO4 CO5 CO6
Pre-requisite	Basics of Derivative
Course Content	Unit-I Curve Tracing : Equation of the form $y = f(x)$,Equation of the form $y^2 = f(x)$,Parametric equations, Tracing of Polar curves. Unit-II Application of Integral calculus: Length of a curve, Intrinsic equation (except polar coordinates). Unit:III Bernoulli's equation, Exact differential equation, Differential equations of first order and higher degree : Solvable for x, y, p and Lagrange's equation, Clairaut's equation. Unit-IV Linear Differential Equations with constant coefficients: Complimentary functions, Particular Integral, General Solution, Method for finding Particular Integral specially for e^{ax}, sinax, cosax, polynomial in terms of x, $e^{ax}V$ and xV, where V is a function of x.
Reference Books	1. 1.Shantinarayan : Differential calculus ,4th edition -2001,Shyamlal Charitable Trust,Ramnagar New Delhi, S. Chand and Company LTD. 2. Shantinarayan: Integral Calculus, Revised Edition-2009, S.Chand and Co., New Delhi. 3. Gorakhprasad: Integral Calculus, PothishalaPvt.Ltd., Allahabad. 4. D.A.Murray: Differential Equations, Tata Mc Graw Hills. 5. Frank Ayres: Theory and problems on Differential Equations, Mc Graw Hill Book Co., New York. 6. N.P.Bhamore and et al: College AadhunikGanit shastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: MTH-301: **Advanced Calculus-I**

Course Code	**MTH-301**
Course Title	Advanced Calculus-I
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the function of two variable and their calculus.
Course Objective	To make students acquainted with concepts of the function of two variable and their calculus.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the function of two variable and their calculus. CO2 : Understand the Limits and Continuity of a function of two variables, Partial Differentiation. CO3 : Find surface integral of the surfaces. CO4 : Understand basics of vector calculus. CO5 : Apply multivariable calculus to solve function of two variable problems. CO6 : Apply Integral calculus of function of two variable and vector calculus in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of calculus
Course Content	Unit I: Limits and Continuity of a function of two variables, Partial Differentiation, Total Differential, Composite function, Homogeneous functions. Unit II: Taylor's theorem for functions of two variables, Maclaurian's expansions in power series, Jacobian. Unit III: Vector point function, Differentiation of a Vector point function, Gradient, Divergence and Curl and their properties, Line Integral. Unit III: Unit IV: Surface Integral, Green's, Gauss'andStoke'stheorems (Only for Cartesian coordinates).
Reference Books	1. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 2. Hari Kishan : Vector Algebra and Calculus, Atlantic Pub. & Distributors(P) Ltd., New Delhi. 3. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 4. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi. 5. N. P. Bhamore& et el : Mathematics Paper III–IV, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: MTH-302: **Numerical Analysis-I**

Course Code	**MTH-302**

Course Title	Numerical Analysis-I
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of basics of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 : Understand the errors and their numerical computation CO3 : Obtain numerical solutions of algebraic and transcendental equations. CO4 : Learn about various interpolating and extrapolating methods. CO5 : predict future trend by interpolating and extrapolating methods. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Error estimation: Errors and their computations, A general error formula. Unit II: Numerical Solutions of Algebraic and Transcendental Equations: Bisection Method, Method of False position, Iteration Method, Newton-Raphson's Method.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■		■	■		■		
CO3	■	■	■	■	■			
CO4	■	■	■	■				■
CO5	■	■	■		■	■	■	■
CO6	■	■	■	■	■	■	■	■

	Unit III: Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols, Differences of Polynomials. Unit IV: Newton's Forward and Backward Formulae, Gauss' Interpolation formulae.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 5th Edition. 2. M. K. Jain, Iyenger, Jain : Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, Pragati Prakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, Mc Graw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods and Analysis, Mc Graw Hill Book Co., London. 6. P. C. Biswal:NumericalAnalysis,Prentice-HallofIndia, 2008. 7. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chandand Co., 2005.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: MTH-303: **Differential-Equations**

Course Code	**MTH-303**
Course Title	Differential-Equations
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the higher order differential equation and basics of partial differential equation.

<table>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of higher order differential equation and basics of partial differential equation.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:

CO1 : Explain the insight of the Linear Differential Equations with variable coefficients.

CO2 : Understand Second order Differential Equations

CO3 : Learn about Formation of Partial Differential Equation.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of ordinary differential equation and partial derivative</td></tr>
<tr><td>Course Content</td><td>Unit I:

Linear Differential Equations with variable coefficients, Homogeneous Differential Equations, Legendre's Differential Equation.

Unit II:

Second order Differential Equations: Solution in terms of known Integral, Solution by method of removal of first order derivatives, Method of Changing Independent Variable.

Unit III:

Formation of Partial Differential Equation, Solution of Partial Differential Equations, Equations solvable by direct integral.

Unit IV:

Partial Differential Equations of first order, Nonlinear Partial Differential Equations of first order, Some special methods.</td></tr>
</table>

Reference Books	1. D. A. Murray: An Introductory Course in Differential Equations, Orient Longmans, Bombay. 2. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company. 3. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi. 4. Gorakhprasad : Differential Equations, Pothishala Pvt. Ltd., Allahabad. 5. M. D. Rai Singhania : Differential Equations, S. Chand & Co., New Delhi. 6. Nita H. Shah : Ordinary and Partial Differential Equations : Theory and Applications, PHI Learning Pvt. Ltd, New Delhi. 7. N. P. Bhamore& et el. : Mathematics Paper III–IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: E.G.-3001: Mathematical Methods

Course Code	**E.G.-3001**
Course Title	**Mathematical Methods**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the difference method
Course Objective	To make students acquainted with concepts of Mathematical difference Method.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the difference calculus. CO2 : Understand Finite difference and Method of unknown coefficients CO3 : Learn about Difference equation. CO4 : Solve problem of Difference equation. CO5 : Obtain solution of Homogeneous difference equations with constant

<table>
<tr><td></td><td>coefficients.

CO6 : Apply difference calculus in social sciences, physical sciences, life

sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:

Notations of finite difference calculus, Operators E, Δ , Relations between different operators and their prosperities, Relation between difference and differential operators, Method of constructing difference tables, Finding the missing terms.

Unit II:

Factorial notation, Expression of polynomials in factorial notation by using finite differences, Method of unknown coefficients.

Unit III:

Difference equations: Order and degree of a difference equation, Solution of difference equations, Homogeneous difference equations with constant coefficients.</td></tr>
<tr><td>Reference Books</td><td>1. S.S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition.
2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd.
3. Goel, Mittal : Numerical Analysis, Pragati Prakashan, Meerut.
4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London.
5. James I. Buchanan, Peter R. Turner : Numerical Methods & Analysis, McGraw Hill Book Co., London.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

B.Sc. Mathematics 3nd Semester

Course: E.G.-3002: Group of Symmetries-I

Course Code	**E.G.-3002**
Course Title	**Group of Symmetries-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Group theory. CO2 : Understand Sub group and their properties CO3 : Learn about Symmetry planes and reflection symmetry. CO4 : Solve problem of Product of symmetry operations. CO5 :Analyze consequences of Rotation axes and rotation symmetry CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Definition of a group and its elementary properties, Order of a group, Order of an element of a group, Group multiplication tables, Examples of groups including finite groups and infinite groups, Abelian groups, Cyclic groups. Unit II: Subgroup, Condition that a subset is a subgroup, Examples of subgroups, Basic concept of symmetry, Symmetry elements and symmetry operations in a space, Identity symmetry operation. Unit III: Symmetry planes and reflection symmetry, Inversion centre and inversion symmetry, Rotation axes and rotation symmetry, Improper axes and improper rotation symmetry, Product of symmetry operations.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi. 2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-401: Advanced Calculus-II

Course Code	**MTH-401**
Course Title	Advanced Calculus-II
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Special function, double Triple integral and Laplace transform

Course Objective	To make students acquainted with concepts of the Special function, double Triple integral and Laplace transform.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the beta gamma function and Maxima- Minimafor functionsoftwovariables. CO2 : Understand Double and triple integrals CO3 : Learn about Laplace transform . CO4 : Realize importance of Laplace transform. CO5 : Determine various Inverse Laplace transform. CO6 : Apply the Special function, double Triple integral and Laplace transform in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Maxima- Minimaforfunctionsoftwovariables:Necessaryandsufficientconditionsfor extreme points. Unit II: DoubleandTripleIntegrals:Changeoforder of Doubleintegrals, Area. Unit III: Beta-Gamma functions: Relation between Beta and Gamma functions, Properties, Applications of Beta-Gamma function. Unit IIV: Laplace Transforms: Laplace Transform of elementary functions, Properties of Laplace Transform, Differentiation and Integration of Laplace Transform, Laplace Transform of derivatives and integrals.Inverse of Laplace Transform: Method of Partial fractions,

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Properties of inverse Laplace Transform.
Reference Books	1. David V. Widder : Advanced Calculus, PHI Learning Pvt. Ltd, New Delhi 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 4. N. P. Bhamore& et al : Mathematics Paper III-IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-402: Numerical Analysis-II

Course Code	**MTH-402**
Course Title	Numerical Analysis-II
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 : Understand the Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula CO3 : Obtain numerical Differentiation. CO4 : Learn about Numerical Integration.

	CO5 :Determine Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Finite difference with unequal interval, Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula. Unit II: Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae. Unit III: Numerical Integration: General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule. Unit IV: Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition. 2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, Pragati Prakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner: Numerical Methods and Analysis, McGraw Hill Book Co., London
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■		■	■		■		
CO3	■	■	■	■	■			
CO4	■	■	■	■				■
CO5	■	■	■		■	■	■	■
CO6	■	■	■	■	■	■	■	■

Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-403: Introduction to Abstract Algebra

Course Code	**MTH-403**
Course Title	Introduction to Abstract Algebra
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Basic real analysis and basic of number theory .
Course outcomes	To make students acquainted with concepts of Basic real analysis and basic of number theory.
Course Objective	The course will enable the students to: CO1 : Explain the insight of the Divisors GCD and LCM. CO2 : Understand the basics of group and elementary properties of group CO3 : Recognize Subgroups, CyclicGroups, Orderofanelement. CO4 : Learn about basics of Ring theory. CO5 :Determine Least Common multiple, Prime numbers, Fundamental theorem of Arithmetic. CO6 : Apply Basic of number theory in social sciences, physical sciences, life sciences and a host of other disciplines.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	CO4 CO5 CO6
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Divisors,Greatestcommondivisor,LeastCommonmultiple,Primenumbers, Fundamentaltheoremof Arithmetic, Congruence relation, Equivalenceclasses. Unit II: DefinitionofaGroup,ExamplesofGroup,elementarypropertiesofaGroup, FiniteGroups. Unit III: Subgroups, CyclicGroups, Orderofanelement. Unit IV: DefinitionofaRing,ExamplesofRing,IntegralDomain, Field,BooleanRing.
Reference Books	1. I. N. Herstein:Topics in Algebra, Wiley Eastern Ltd., New Delhi, 2006. 2. I. H. Sheth:AbstractAlgebra,NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan :UniversityAlgebra, WileyEastern Ltd. 4. P.R.Bhattacharya,S.K.JainandS.R.Nagpaul:BasicAbstractAlgebra, Cambridge UniversityPress, Indian Edition, 1997. 5. Shantinarayan:ModernAlgebra,S. Chand and Co., New Delhi. 6. SergeLang :Algebra, AdditionWesley, 1993. 7. Surjeet, KaziZameeruddin:Modern Algebra, VikasPublishingHouse.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: E.G.-4001: Mathematical Modelling

Course Code	**E.G.-4001**

Course Title	**Mathematical Modelling**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Mathematical Modelling .
Course Objective	To make students acquainted with concepts Mathematical Modelling.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Mathematical Modelling. CO2 : explain the concept of mathematical modelling CO3 : formulate the real world problem into Mathematical form. CO4 :analyze the mathematical model. CO5 : Predict the future by using mathematical modelling. CO6 : Apply Mathematical modelling in social sciences, physical sciences, life sciences and a host of other disciplines

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics Ordinary differential equation
Course Content	Unit I: Mathematical modelling through ordinary differential equation of first order, Linear growth models; Linear decay models, Models for growth of Science and scientists. Unit II: Non-linear growth and decay models, Model of Logistic law of population, Spread of

	technological innovation, Spread of infectious diseases. Unit III: Mathematical models of geometrical problems through ordinary differential equation of first order, Simple geometrical problems, Orthogonal trajectories.
Reference Books	1. J. N. Kapoor: Mathematical Modelling, New Age International Publishers, New Delhi. 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. J. K. Sharma: OR Theory & Applications, Mac Milian India Ltd., 1998. 4. G.Hadley:Linear Programming, Narosa Publishing House, New Delhi,1995. 5. G. Paria : Linear Programming, Transportation, Assignment, Game, Books & Allied Pvt. Ltd. Calcutta.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: E.G.-4002: Group of Symmetries-II

Course Code	**E.G.-4002**
Course Title	**Group of Symmetries-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.

Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of groups of symmetries. CO2 : Understand formation of groups of symmetries of the Chemical Molecules CO3 : Learn about Concept of isomorphism of groups. CO4 : Recognize Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3. CO5 :Determine Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Group of Symmetries
Course Content	Unit I: Formation of groups of symmetries (in space) of the following Plane figures (regarded as rigid objects): An isosceles triangle (cyclic group C2 of order 2) An equilateral triangle (the group S3 of order 6) A rectangle (the group V4) A square (the group D4) Unit II: Formation of groups of symmetries of the following Chemical Molecules (Configuration of atoms). H2O (the group V4) H2O2 Trans- N2 – F2 (the group V4)

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■		■					
CO3	■	■	■		■		■	
CO4		■	■	■		■	■	■
CO5	■		■		■	■		
CO6	■	■		■		■	■	■

	NH3, PCl3, CHCl3(the group S3) Unit III: Concept of isomorphism of groups, Isomorphism of multiplicative group with the group C2 of the symmetries of an isosceles triangle, Isomorphism of multiplicative group with the group V4 of the symmetries of a rectangle, Isomorphism of group V4 of the symmetries of a rectangle with the group of symmetries of H2O, Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi. 2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-VI: Group Theory

Course Code	**MTH-VI**
Course Title	**Group Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group theory.
Course Objective	To make students acquainted with concepts of group theory.
Course Outcomes	The course will enable the students to:

	CO1 : Explain the insight of the Formation of group theory. CO2 : Understand Cosets, Lagrange's theorem, Euler's theorem, Fermat's theorem, counting principle CO3 : Learn about Concept of Normal subgroup & Quotient groups, Homomorphism with their properties. CO4 : Recognize Automorphisms, Cayley's theorem and its applications CO5 :Determine different permutation and Permutation Groups, even permutation, odd permutation. CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Group theory
Course Content	Unit 1: Cosets, Congruence Relation in Group Lagrange's theorem, Euler's theorem, Fermat's theorem, Counting principle. Unit 2: Normal subgroups &Quotientgroups, Homomorphism, Isomorphism, Isomorphic groups, Fundamental theorem ofhomomorphism. Unit 3: Automorphisms, Cayley's theorem and its applications. Unit 4: Permutation Groups, Even permutation, Odd permutation.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-VII: Linear Algebra - I

Course Code	**MTH-VII**
Course Title	**Linear Algebra - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theLinearAlgebra.
Course Objective	To make students acquainted with concepts of LinearAlgebra.
Course Outcomes	The course will enable the students to:
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of algebraic system
Course Content	Unit 1: Definition and examples of Vector space, Subspace, Necessary and sufficient condition for a subspace, Illustrations.

	Unit 2: Span of a set, union and intersection of subspaces, sum and direct sum of subspaces. Unit 3: Linearly dependent and independent vectors, checking of Linear dependence or independence. Unit 4: Dimension and Basis of a vector space, extension of a linearly independent set to a basis, dimension of sum.
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-VIII: Real Analysis - I

Course Code	**MTH-VIII**
Course Title	**Real Analysis - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016

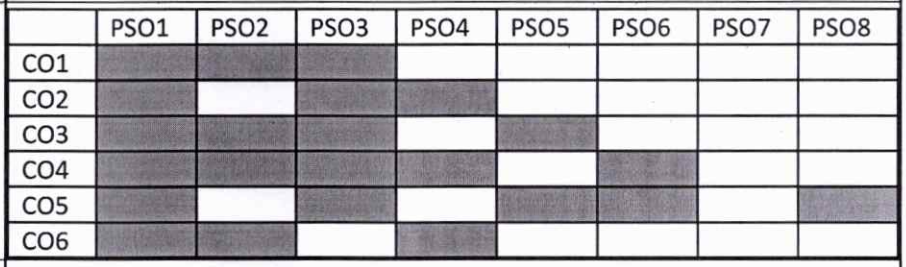
<table>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Real analysis.</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Real analysis.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the real analysis.
CO2 : Understand the Countable & Uncountable sets, Greatest lower bound and least upper bound
CO3 : Recognize Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences.
CO4 : Learn about operations on convergent sequences.
CO5 :Analyze Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence.
CO6 : Apply Basic of real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td><table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Countable & uncountable sets, greatest lower bound and least upper bound.
Unit 2:
Sequences of real numbers, sub-sequences, limit of a sequence, convergent sequences, divergent sequences.
Unit 3:
Bounded sequences, monotone sequences, operations on convergent sequences.</td></tr>
</table>

	Unit 4: Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence.
Reference Books	1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-IX: Real Analysis - II

Course Code	**MTH-IX**
Course Title	**Real Analysis - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Limit and Continuity of a function on the real line, Definition & examples of Metric spaces CO3 : Recognize Open ball in R1, open ball in metric space, functions continuous

	on metric spaces. CO4 : Learn about Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics.. CO5 :Analyze Open sets and their properties. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Revision of Limit and Continuity of a function on the real line, Definition & examples of Metric spaces. Unit 2: Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics. Unit 3: Open ball in R1, open ball in metric space, functions continuous on metric spaces. Unit 4: Open sets, more about open sets.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. D. SomSundaram& B. Chaudhari : A first course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997. 5. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.

Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-X: Graph Theory

Course Code	**MTH-X**
Course Title	**Graph Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Graph theory
Course Objective	To make students acquainted with concepts of Graph Theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the graph theory. CO2 : Understand the graph theory and relevant term CO3 : Recognize Subgraphs, Isomorphism between two graphs. CO4 : Learn about Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs and Components of graphs . CO5 :Analyze Euler graph and their properties. CO6 : Apply graph .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

	CO3 CO4 CO5 CO6
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphs, various type of graphs, incidence and degree, isolated and pendent vertices, Subgraphs, Isomorphism between two graphs. Unit 2: Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs, Components of graphs. Unit 3: Euler graphs, Arbitrary traceable graph, Hamiltonian Graphs, Applications of graphs: Konigsberg Bridge Problem, Seating Arrangement Problem, Utility Problem. Unit 4: Trees, Properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and Diameter of a Tree, Rooted & Binary trees.
Reference Books	1. NarsinghDeo : Graph Theory with applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd., 2000. 2. R. J. Wilson : Introduction to Graph Theory, Academic Press, New York, 1972. 3. E. Harray : Graph Theory, Addison Wesley Pub. Co., 1969. 4. C. Berge : The Theory of Graphs and its Applications, John Wiley & Sons, 1962.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-XI: Number Theory - I

Course Code	**MTH-XI**
Course Title	**Number Theory - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Understand the Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm CO3 : Compute the solutions of linear Diophantine equations in two variables CO4 :Learn about Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences CO5 :Analyze Basic properties of Congruence, divisibility tests. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm, relation between greatest common divisor and least common multiple of two integers. Unit 2: Computation of the solutions of linear Diophantine equations in two variables, Primes and composite numbers, the fundamental theorem of arithmetic, Pythagorean theorem for the irrationality of √2 . Unit 3: Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences. Unit 4: Basic properties of Congruence, divisibility tests of 9 and 11.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.: Operations Research-I(ElectiveGeneric)

Course Code	**E.G.**
Course Title	**Operations Research-I**
Credit	2

Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operations research.
Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research. CO2 : Understand Linear programming problem and their Graphical solution. CO3 : Compute the solutions LPP by dual simplex method CO4 :Learn about Definition of the dual problem and their properties CO5 : Find the solution of LPP by Big-M method. CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphical Solution of Linear programming problem (LPP). Definition of the dual problem, General rules for converting any primal problem into it's dual, The symmetric dual problems. Unit 2: Basic concept of basic, non-basic, degenerate, non-degenerate and basic feasible solutions of LPP, slack & surplus variables, LPP in the standard matrix form, Slack & surplus variables, Solution of LPP using Simplex method.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Unit 3: Solution of LPP using Two Phase Simplex method and Big-M method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-: **Mechanics-I** (ElectiveGeneric)

Course Code	**E.G.**
Course Title	**Mechanics-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theMechanics.
Course Objective	To make students acquainted with concepts of Mechanics.
Course Outcomes	The course will enable the students to:

	CO1 : Explain the insight of the Mechanics. CO2 : Understand Sufficient condition for the equilibrium of a rigid body. CO3 : Compute the centreofarigidbody CO4 :Learn about Pappus'theorems,Gravitationalforces CO5 : Find the Infinitesimal displacement of arigidbodyparalleltoafixed plane. CO6 : Apply Mechanics in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Methods of plane statics, triangle offorces, Lamy's theorem, work and potential energy, forces which do no work, virtual work, Infinitesimal displacement of a rigid body parallel to a fixed plane. Unit 2: Sufficient condition for the equilibrium of a rigid body moving parallel to a fixed plane, potential energy, mass centre, methods of decomposition and symmetries for finding mass centre of a rigid body. Unit 3: Pappus' theorems, Gravitational forces, Laws of friction, Flexible Cable, Suspension bridge, Equation of common catenary.
Reference Books	1. Synge &Grifith: Principles of Mathematics, McGraw Hill Book Co. 2. A. G. Takwal& P. S. Puranil: Introduction to Classical Mechanics, Tata McGraw Hill. 3. S. L. Loney : Statics, SurjeetPrakashan. 4. S. L. Loney : Dynamics, SurjeetPrakashan.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment

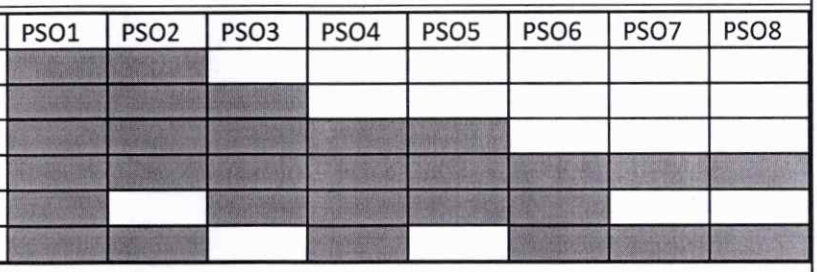
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.: Computer Oriented Numerical Methods – I(ElectiveGeneric)

Course Code	**E.G.**
Course Title	**Computer Oriented Numerical Methods – I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 : Understand Flow charts and symbols, More flow charting examples and FORTRAN language CO3 : Compute the operations in expressions CO4 :Learn about Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries. CO5 : Familiarize with Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program.

	CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Flow charts and symbols, More flow charting examples. FORTRAN language, character used in FORTRAN, FORTRAN constants, FORTRAN variable names, Type declaration for integer and real, Arithmetic expression (real and integer expressions), Hierarchy of operations in expressions, Examples of Arithmetic expression. Unit 2: Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries. Unit 3: Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program, FORTRAN programming examples.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.: Fourier Series (ElectiveGeneric)

Course Code	**E.G.**
Course Title	**Fourier Series**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Series.
Course Objective	To make students acquainted with concepts of Fourier Series.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Series. CO2 : Understand the Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion CO3 : Compute the Fourier series of functions CO4 :Learn about Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. CO5 : Familiarize with Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series. CO6 : Apply Fourier series in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■	■	■					
CO3	■	■	■	■	■			
CO4	■	■	■	■	■	■	■	
CO5	■		■	■	■	■		

	CO6
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion. Unit 2: Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. Unit 3: Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series.
Reference Books	1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi. 2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi. 3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE. 5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-VI: Ring Theory

Course Code	**MTH-VI**
Course Title	**Ring Theory**
Credit	3

Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Ring theory.
Course Objective	To make students acquainted with concepts of ring theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of Ring theory. CO2 : Understand Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal CO3 : Learn about different kinds of ring and their properties.. CO4 : Recognize Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. CO5 : Link theParticular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial. CO6 : Apply Ring theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of group theory
Course Content	Unit 1: Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal. Unit 2: Euclidean rings, divisibility in commutative ring, gcd of two elements in a ring, units

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	and associates in rings. Unit 3: Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. Unit 4: Particular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-VII: Linear Algebra - II

Course Code	**MTH-VII**
Course Title	**Linear Algebra - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theLinearAlgebra.

<table>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of LinearAlgebra.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Linear algebra.
CO2 : Understand Linear Transformation and their properties
CO3 : Learn about rank nullity and their properties
CO4 : Recognize Matrix associated with linear transformations.
CO5 :Analyze Inner product spaces, Norm of a vector and properties.
CO6 : Apply linear algebra in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td><table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Pre-requisite</td><td>Basics of linear algebra</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Definition and examples of Linear transformation, Range and kernel of a linear transformation.
Unit 2:
Rank-Nullity Theorem, Inverse of a linear transformation, Consequences of Rank-Nullity Theorem, Composition of linear transformations.
Unit 3:
Matrix associated with linear transformations, linear transformation associated with a matrix, Application of Rank-Nullity Theorem for matrix.
Unit 4:
Inner product spaces, Norm of a vector, Cauchy-Schwarz's inequality, Triangular inequality, Orthogonalvectors.</td></tr>
</table>

Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-VIII: Real Analysis - III

Course Code	**MTH-VIII**
Course Title	**Real Analysis - III**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Convergence and divergence of series of real numbers CO3 : Recognize Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral.

	CO4 : Learn about different type of series . CO5 :Analyze Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Convergence and divergence of series of real numbers, Series with non-negative terms, Alternating series, Conditional and absolute convergence. Unit 2: Tests for absolute convergence, Series whose terms form a non-increasing sequence. Unit 3: Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. Unit 4: Non Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus, Mean-value Theorems of Integral Calculus.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. Louis Leithold : Calculus with analytic Geometry, Harper and Collins Pub. Co. 5. J. B. Thomas and Finney : Calculus with analytic Geometry. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■	■	■				
CO2	■		■	■				
CO3	■	■	■		■			
CO4	■	■	■	■		■		
CO5	■		■		■	■		■
CO6	■	■		■				

Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-IX: Real Analysis - IV

Course Code	**MTH-IX**
Course Title	**Real Analysis - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand Limit points, closure of a set, closed sets, homeomorphism of metric spaces CO3 : Recognize Connected sets, Bounded sets, Totally bounded sets. CO4 : Learn about Complete metric spaces, Contraction mapping, Picard's fixed point theorem. CO5 :Analyze Open covering, Heine-Borel property. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	CO4 ■ ■ ■ ■ ■ ■ ■ ■ CO5 ■ ■ ■ ■ ■ ■ ■ ■ CO6 ■ ■ ■ ■ ■ ■ ■ ■
Pre-requisite	Basics of real analysis
Course Content	Unit 1: Limit points, closure of a set, closed sets, homeomorphism of metric spaces, dense set. Unit 2: Connected sets, Bounded sets, Totally bounded sets. Unit 3: Complete metric spaces, Contraction mapping, Picard's fixed point theorem. Unit 4: Compact metric spaces, Open covering, Heine-Borel property, Finite Intersection property.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 5. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company. 6. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: X: Discrete Mathematics

<table>
<tr><td>Course Code</td><td>MTH-X</td></tr>
<tr><td>Course Title</td><td>Discrete Mathematics</td></tr>
<tr><td>Credit</td><td>3</td></tr>
<tr><td>Teaching per Week</td><td>3 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2016</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Discrete Mathematics</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Discrete Mathematics.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Discrete Mathematics.
CO2 : Understand the relation , lattice and relevant term
CO3 : Recognize Lattices as algebraic systems, Lattice homomorphism, Different types of lattices.
CO4 : Learn about Boolean Algebra as an algebraic system, Boolean expressions.
CO5 :Determine Minimization of Boolean functions by Karnaugh Map method.
CO6 : Apply Discrete Mathematics .in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:</td></tr>
</table>

	Binary relations, Properties of binary relations, Equivalence relation, Partial ordered relation, Partially ordered sets, Upper bounds, Lower bounds, GLB & LUB of sets, Totally ordered sets, Well ordered sets, Hasse Diagram, Lattices and its properties. Unit 2: Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. Unit 3: Boolean Algebra as an algebraic system, Boolean expressions (forms), Different representation of Boolean forms, Sum of products canonical form and product of sums canonical forms of Boolean expressions. Unit 4: Minimization of Boolean functions by Karnaugh Map method and Quine- McCluskey algorithm, AND, OR & NOT gates, Reduction of switching circuit diagram.
Reference Books	1. J. P. Tremblay & R. Manohar : Discrete mathematical Structures with Applications to Computer Science., McGraw Hill Book Co., 1999. 2. B. Kolman, R. C. Busby & S. Ross : Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd., 3rd ed. 2001. 3. Elements of Discrete Mathematics, C. L. Liu, D. P. Mohapatra, Tata McGraw Hill, 2008. 4. Discrete Mathematics with Applications, Thomas Koshy, Academic Press, 2004.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-XI: Number Theory - II

Course Code	**MTH-XI**
Course Title	**Number Theory - II**
Credit	3

<table>
<tr><td>Teaching per Week</td><td>3 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2016</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Number theory</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Number theory.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the number theory.
CO2 : Understand Fermat's little theorem, Pseudo-primes, Wilson's theorem
CO3 : Compute the solutions of linear congruence , the Chinese Remainder Theorem
CO4 :Learn about The number of positive divisors, multiplicative nature of functions, The Möbius Inversion formula
CO5 :Analyze Euler's Phi-function and related theorem.
CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of number theory</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Computation of the solutions of linear congruence , the Chinese Remainder Theorem.
Unit 2:
Fermat's little theorem, Pseudo-primes, Wilson's theorem.
Unit 3:</td></tr>
</table>

	The number of positive divisors and sum of all positive divisors of an integer, basic properties and multiplicative nature of these functions, The Möbius Inversion formula (without proof), the greatest integer function. Unit 4: Introduction of Euler's Phi-function , multiplicative nature of (statement only), Euler's Theorem.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G. : Operations Research-II (ElectiveGeneric)

Course Code	**E.G.-**
Course Title	**Operations Research-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operation research.
Course Objective	To make students acquainted with concepts of Operations research.

<table>
<tr><td>Course Outcomes</td><td>The course will enable the students to:

CO1 : Explain the insight of the Operations research.

CO2 : Understand the transportation problem and their solutions.

CO3 : Compute the solutions of Assignment problem

CO4 :Learn about Competitive games theory

CO5 : Find the solution Game theory problem by graphical method

CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:

Transportation problem, methods for finding initial basic feasible solution,

solution of Transportation problem by MODImethod, Unbalanced Transportation problem.

Unit 2: Assignment problems, The Hungarian method, balanced & unbalance assignment problems.

Unit 3: Competitive games, two-person zero-sum game, maximin and minimax principle, saddle points and the value of the game (based on pure strategies), mixed strategies, solution of games with saddle point, Game without saddle points, Dominance rule, solution of m×2 and 2×n games using graphical method.</td></tr>
<tr><td>Reference Books</td><td>1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998.
2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998.
3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995.
4. S. D. Sharma: Operations Research, KedarnathRamnath& Co.
5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9.
6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications.
7. Goel&Mittal : O.R., PragatiPrakashan, Meerut</td></tr>
</table>

Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.-: Mechanics-II (ElectiveGeneric)

Course Code	**E.G.-**
Course Title	**Mechanics-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theMechanics.
Course Objective	To make students acquainted with concepts of Mechanics.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the advance Mechanics. CO2 : Understand Plane Kinematics, Tangential & Normal components of velocity. CO3 : Compute the Linear and angular momentum CO4 :Learn about Application in plane dynamics CO5 : Find the Radial and Transverse components of velocity & acceleration CO6 : Apply Mechanics in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								
Pre-requisite	Basics of Mathematics								
Course Content	Unit 1: Plane Kinematics, Tangential & Normal components of velocity and acceleration, Radial and Transverse components of velocity & acceleration, Hodograph. Unit 2: Methods of plane dynamics, Motion of a particle, Linear and angular momentum of a particle and a system of particles, Principle of Conservation of Energy. Unit 3: Application in plane dynamics, Projectile without resistance, Parabolic trajectory, Limits of range of trajectory, The Harmonic Oscillator, Simple Pendulum.								
Reference Books	1. Synge &Grifith: Principles of Mathematics, McGraw Hill Book Co. 2. A. G. Takwal& P. S. Puranil: Introduction to Classical Mechanics, Tata McGraw Hill. 3. A. S. Ramsey : Statics, Cambridge University Press. 4. A. S. Ramsey : Dynamics, Cambridge University Press. 5. R. I. Steins : Mechanics, Berncs&Nibweinc. 6. S. L. Loney : Statics, SurjeetPrakashan. 7. S. L. Loney : Dynamics, SurjeetPrakashan.								
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment								
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination								

B.Sc. Mathematics 6th Semester

Course: E.G.-: Computer Oriented Numerical Methods – II (ElectiveGeneric)

Course Code	**E.G.-**
Course Title	**Computer Oriented Numerical Methods – II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 : Understand Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement CO3 : Apply the Statement labels, GO TO statement and DO statement CO4 :Learn about Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted expression, Dimension statement, DO type notation for input / output statement. CO5 : Familiarize with FORMAT specification and FORMAT specification for a numerical data. CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

	CO3 CO4 CO5 CO6
Pre-requisite	Basics of Computer Oriented Numerical Methods
Course Content	Unit 1: Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement. Unit 2: Statement labels, GO TO statement, Example of use of Logical IF statement, Nested logical IF statement, Computed GO TO statement, DO statement, Examples of DO statement. Unit 3: Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted expression, Dimension statement, DO type notation for input / output statement. FORMAT specification and FORMAT specification for a numerical data.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.: Fourier Transform and its Applications (ElectiveGeneric)

Course Code	**E.G.**
Course Title	**Fourier Transform and its Applications**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2016
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Transform and its Applications.
Course Objective	To make students acquainted with concepts of Fourier Transform and its Applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Transform and its Applications. CO2 : Understand the Integral transforms, Fourier Transforms, Properties of Fourier Transform CO3 : Compute the Fourier Transform CO4 :Learn about Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform CO5 : Familiarize with Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function CO6 : Apply Fourier Transform in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Fourier series

Course Content	Unit 1: Integral transforms, Fourier Transforms, Properties of Fourier Transform and its application. Unit 2: Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform. Unit 3: Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function, Fourier transform and its applications.
Reference Books	1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi. 2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi. 3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE. 5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

Bachelor of Science (Mathematics)
CO-PO-2019-20

Name of Program	**Bachelor of Science (Mathematics)**
Abbreviation	**B.Sc.- Mathematics**
Duration	**3 Years**
Eligibility Criteria	Passed 12th Science with mathematics or equivalent Degree.
Objective of Program	The core objective of the B.Sc. in Mathematics is to prepare the students for productive career by providing a solid education in the basic subjects of mathematical knowledge and its applications with outstanding environment of teaching and research in the core and emerging areas of the discipline.
Program Outcome	**PO1 : Fundamental Knowledge Enrichment** Program trains students with the core Mathematics knowledge domains. It also makes students capable of using core concepts in the conceptualization of domain specific application. **PO2 : Critical Thinking Development** The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem. **PO3 : Develop arguments in a logical manner** The program trains students to formulate and develop arguments in a logical manner and make them ready to prepare real world problem solution mathematically. **PO4 : Develop decision making ability** The program develop the skill in students to take decisions at intellectual, organizational and personal from different perspectives of life using analysis **PO5 : Computational Skill Development** The program develop basic computational skill in students for planning and managing process of complex real world. **PO6 : Provides an effective Mathematical communication skill** The program develop an effective Mathematical communication skill in the students. **PO7 : Team Work and Leadership Development** Trains students to work in a team and also to take leadership.
Program Specific Outcomes	PSO1 : Develop and strengthen the fundamental core concepts that are required to solve complex problems

Chairman
DR.M.R.Tale
B.O.S. Mathematics

	PSO2 : Develop the skills that needs independent logical and analytical thinking, teamwork and leadership PSO3 : Nurture the students to investigate and development of a workable solution for a real world problem PSO4 : Develop students for self-learning and practicing challenging problem solution PSO5 : Train students to apply mathematical skills for new investigation. PSO6 : Train students to expand their knowledge of fields related to their current areas of professional specialization. PSO7 : Train students to take-up the real world challenges to develop workable solution to a domain specific problem. PSO8 : Inculcate the passion for continuous learning and doing research for making a successful professional career.

Mapping between POs and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
PO1								
PO2								
PO3								
PO4								
PO5								
PO6								
PO7								

Medium of Instruction: English

Program Structure: Semester 1

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-101	Trigonometry	3	0	3	2Hrs	50	20	70
MTH-102	Calculus	3	0	3	2Hrs	50	20	70
	Total	6	0	6				

Program Structure: Semester 2

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-201	Theory of Matrices	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-202	Integral Calculus and Differential Equations	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
	Total	3	0	3				

Program Structure: Semester 3

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-301	Advanced Calculus-I	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-302	Numerical Analysis-I	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-303	Differential-Equations	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**

E.G.	3001-MathematicalMethods	2	0	2	2Hrs	50	20	70
	3002-GroupofSymmetries–I	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 4

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-401	Advanced Calculus-II	3	0	3	2Hrs	50	20	70
MTH-402	Numerical Analysis-II	3	0	3	2Hrs	50	20	70
MTH-403	Introduction to Abstract Algebra	3	0	3	2Hrs	50	20	70
E.G.	4001-MathematicalModeling	2	0	2	2Hrs	50	20	70
	4002- Group of Symmetries–II	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 5

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-501	Group Theory	3	0	3	2Hrs	50	20	70
MTH-502	Linear Algebra-I	3	0	3	2Hrs	50	20	70
MTH-503	Real Analysis-I	3	0	3	2Hrs	50	20	70
MTH-504	Real Analysis-II	3	0	3	2Hrs	50	20	70
MTH-505	Graph Theory	3	0	3	2Hrs	50	20	70
MTH-506	Number Theory-I	3	0	3	2Hrs	50	20	70
E.G.	5001-Operations Research– I	2	0	2	2Hrs	50	20	70
	5002-Computer Oriented NumericalMethods –I	2	0	2	2Hrs	50	20	70
	5003-Fourier Series	2	0	2	2Hrs	50	20	70

	Total	**20**	**0**	**20**				
Program Structure		Semester 6						
Course Code	**Title**	**Teaching per week**		**Course Credits**	**University Examination**		**Internal Marks**	**Total Marks**
		Theory	**Practical**		**Duration**	**Marks**		
MTH -601	Ring Theory	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH -602	Linear Algebra–II	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH -603	Real Analysis–III	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH -604	Real Analysis–IV	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH -605	Discrete Mathematics	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH -606	Number Theory–II	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
E.G.	6001-OperationsResearch– II	**2**	**0**	**2**	**2Hrs**	**50**	**20**	**70**
	6002-ComputerOriented NumericalMethods –II	**2**	**0**	**2**	**2Hrs**	**50**	**20**	**70**
	6003-FourierTransformanditsApplications	**2**	**0**	**2**	**2Hrs**	**50**	**20**	**70**
	Total	**20**	**0**	**20**				

B.Sc.Mathematics 1st Semester Course: MTH-101: Trigonometry

Course Code	**MTH-101**
Course Title	Trigonometry
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Trigonometry .
Course Objective	To make students acquainted with concepts of Trigonometry
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the fundamental aspects of the Trigonometry . CO2 : Assimilate the De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments. CO3 : Calculate the Indeterminate forms by using Euler's expressions, Hyperbolic functions.. CO4 : Understand the Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into

	real and imaginary parts. CO5 : Sketch curves in Trigonometric and hyperbolic functions. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit –I De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments. Unit-II Euler's expressions, Evaluation of Indeterminate forms by using Euler's expressions, Hyperbolic functions for real arguments and their inverses. Unit-III Exponential, Circular and Hyperbolic functions of complex variables and their identities, Euler's Theorem, Relations between circular and Hyperbolic functions. Unit-IV Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.
Reference Books	1. S. L. Loney: Plane Trigonometry, Part I and II, McMillan and Co. London. 2. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd. Allahabad. 3. E. Kreyszig: Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 4. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc.Mathematics 1st Semester
Course: MTH-102: Calculus

Course Code	**MTH-102**
Course Title	Calculus
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of calculus and learn its applications.
Course Objective	To make students acquainted with concepts of calculus.
Course Outcomes	This course will enable the students to CO1 : Explain the insight of the historical and fundamental aspects the Calculus. CO2 : Assimilate the Successive differentiation, Leibnitz theorem and its applications CO3 : Understand the consequences of various mean value theorems for differentiable functions , Asymptotes, Concavity, Convexity and reduction

	function. CO4 : Calculate the Curvature and radius of curvature. CO5 : Apply concept of Increasing and Decreasing functions, Asymptotes, Concavity and Convexity CO6 : Apply calculus in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit –I Successive differentiation, Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions), Leibnitz theorem and its applications Unit-II Rolle's Theorems and its geometrical interpretation, Lagrange's Theorem and its geometrical interpretation, Cauchy theorem, Maclaurin and Taylor series expansions Unit-III Curvature and radius of curvature (except Polar form), Increasing and Decreasing functions, Asymptotes, Concavity and Convexity Unit-IV Reduction formulae for integration of $sin^n x, cos^n x, tan^n x, cot^n x, sec^n x, cosec^n x, sin^p x cos^q x, x^m cosnx, x^m sinnx.$
Reference Books	1. Shantinarayan: Differential Calculus, Revised EditionDecember-2004 , S. Chand and Co. New Delhi. 2. Shantinarayan: Integral Calculus, S. Chand and Co. New Delhi. 3. Gorakhprasad: Differential Calculus, Pothishala Pvt. Ltd. Allahabad. 4. M. R. Spigel: Theory and Problems of Advanced Calculus, Schaum's Publishing Co., New York. 5. N. P. Bhamore and et al: College Aadhunik Ganit shastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester Course: MTH-201: Theory of Matrices

Course Code	**MTH-201**
Course Title	Theory of Matrices
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the theory of matrices with its applications.

Course Outcomes	This course will enable the students to: CO1 : Explain the insight of fundamental aspects the theory of matrices. CO2 : Understand the genesis of theory of matrices.. CO3 : Learn elementary raw operations, rank theory and matrix properties. CO4 : Find eigen values and corresponding eigenvectors for a square matrix. CO5 : Calculate solution of linear system of equation. CO6 : Apply matrix theory in social sciences, physical sciences, life sciences and a host of other disciplines.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Matrices
Course Content	Unit-I Prerequisite of matrices (Different types of matrices, Operations on matrices, Properties of operations of matrices), Elementary row operations, Row-reduced echelon forms, Inverse of matrix by row –reduced echelon form. Unit-II Linear independence and dependence of rows, Row rank of a matrix, Quadratic forms. Unit-III Trace of matrix and its properties, Solution of homogeneous system of linear equations using row –reduced echelon forms. Unit-IV Characteristic equation of a matrix, Method to find Characteriastic equation using determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix, Cayley-Hamilton theorem and its application to find an inverse of a matrix, Method of diagonalization.
Reference Books	1. Krishnamurthy, Mainra and Arora: An Introduction to linear Algebra, Affiliated West Press Pvt. Ltd., New Delhi. 2. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India (P) Ltd., 2009. 3. B.S.Vasta and Suchi Vasta: Theory of Matrices; 4rd Edition -2014, New Age International (P) Ltd. Publishers, New Delhi. 4. Shantinarayan: Text book of Matrices, S. Chand and Co., New Delhi. 5. H. K. Dass, H. C. Saxena, M. D. Raisinghania: Simplified course in Matrices, S. Chand and Co., NewDelhi. 6. N.P.Bhamore and et al: College Aadhunik Ganit shastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester Course: MTH-202: Integral Calculus and Differential Equations

Course Code	**MTH-202**
Course Title	Integral Calculus and Differential Equations
Credit	3
Teaching per Week	3 Hrs

Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2017
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Objective	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Outcomes	The course will enable the students to: CO1 : Understand the genesis of Integral Calculus and ordinary differential equations. CO2 : Sketch curves in Cartesian coordinate systems. CO3 :To solve first order first degree and first order higher degree differential equation. CO4 : Grasp the concept of a general solution of a higher order linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations. CO5 : To solve initial and boundary value problem. CO6 : Apply Integral Calculus and Differential Equations in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Derivative
Course Content	Unit-I Curve Tracing : Equation of the form $y = f(x)$,Equation of the form $y^2 = f(x)$,Parametric equations, Tracing of Polar curves. Unit-II Application of Integral calculus: Length of a curve, Intrinsic equation (except polar coordinates). Unit:III Bernoulli's equation, Exact differential equation, Differential equations of first order and higher degree : Solvable for x, y, p and Lagrange's equation, Clairaut's equation. Unit-IV Linear Differential Equations with constant coefficients: Complimentary functions, Particular Integral, General Solution, Method for finding Particular Integral specially for e^{ax}, sinax, cosax, polynomial in terms of x, $e^{ax}V$ and xV, where V is a function of x.
Reference Books	1. 1.Shantinarayan : Differential calculus ,4th edition -2001,Shyamlal Charitable Trust,Ram nagar New Delhi, S. Chand and Company LTD. 2. Shantinarayan: Integral Calculus, Revised Edition-2009, S.Chand and Co., New Delhi. 3. Gorakhprasad: Integral Calculus, Pothishala Pvt.Ltd., Allahabad. 4. D.A.Murray: Differential Equations, Tata Mc Graw Hills. 5. Frank Ayres: Theory and problems on Differential Equations, Mc Graw Hill Book Co., New York. 6. N.P.Bhamore and et al: College Aadhunik Ganit shastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester Course: MTH-301: Advanced Calculus-I

Course Code	**MTH-301**
Course Title	Advanced Calculus-I
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the function of two variable and their calculus.
Course Objective	To make students acquainted with concepts of the function of two variable and their calculus.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the function of two variable and their calculus. CO2 : Understand the Limits and Continuity of a function of two variables, Partial Differentiation. CO3 : Find surface integral of the surfaces. CO4 : Understand basics of vector calculus. CO5 : Apply multivariable calculus to solve function of two variable problems. CO6 : Apply Integral calculus of function of two variable and vector calculus in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of calculus
Course Content	Unit I: Limits and Continuity of a function of two variables, Partial Differentiation, Total Differential, Composite function, Homogeneous functions. Unit II: Taylor's theorem for functions of two variables, Maclaurian's expansions in power series, Jacobian. Unit III: Vector point function, Differentiation of a Vector point function, Gradient, Divergence and Curl and their properties, Line Integral. Unit III: Unit IV: Surface Integral, Green's, Gauss'and Stoke's theorems (Only for Cartesian coordinates).
Reference Books	1. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 2. Hari Kishan : Vector Algebra and Calculus, Atlantic Pub. & Distributors(P) Ltd., New Delhi. 3. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 4. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi. 5. N. P. Bhamore & et el : Mathematics Paper III–IV, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3rd Semester Course: MTH-302:

Numerical Analysis-I

Course Code	**MTH-302**
Course Title	Numerical Analysis-I
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of basics of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 : Understand the errors and their numerical computation CO3 : Obtain numerical solutions of algebraic and transcendental equations. CO4 : Learn about various interpolating and extrapolating methods. CO5 : predict future trend by interpolating and extrapolating methods. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Error estimation: Errors and their computations, A general error formula. Unit II: Numerical Solutions of Algebraic and Transcendental Equations: Bisection Method, Method of False position, Iteration Method, Newton-Raphson's Method. Unit III: Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols, Differences of Polynomials. Unit IV: Newton's Forward and Backward Formulae, Gauss' Interpolation formulae.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 5th Edition. 2. M. K. Jain, Iyenger, Jain : Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, Pragati Prakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, Mc Graw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods and Analysis, Mc Graw Hill Book Co., London. 6. P. C. Biswal:NumericalAnalysis,Prentice-HallofIndia, 2008. 7. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chandand Co., 2005.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment

Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester Course: MTH-303:

Differential-Equations

Course Code	**MTH-303**
Course Title	Differential-Equations
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the higher order differential equation and basics of partial differential equation.
Course Objective	To make students acquainted with concepts of higher order differential equation and basics of partial differential equation.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Linear Differential Equations with variable coefficients. CO2 : Understand Second order Differential Equations CO3 : Learn about Formation of Partial Differential Equation. CO4 : Solve Partial Differential Equations by direct integral methods. CO5 : Obtain solution Nonlinear Partial Differential Equations of first order. CO6 : Apply differential equation in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of ordinary differential equation and partial derivative
Course Content	Unit I: Linear Differential Equations with variable coefficients, Homogeneous Differential Equations, Legendre's Differential Equation. Unit II: Second order Differential Equations: Solution in terms of known Integral, Solution by method of removal of first order derivatives, Method of Changing Independent Variable. Unit III: Formation of Partial Differential Equation, Solution of Partial Differential Equations, Equations solvable by direct integral. Unit IV: Partial Differential Equations of first order, Nonlinear Partial Differential Equations of first order, Some special methods.
Reference Books	1. D. A. Murray: An Introductory Course in Differential Equations, Orient Longmans, Bombay. 2. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company.

	3. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi. 4. Gorakh prasad : Differential Equations, Pothishala Pvt. Ltd., Allahabad. 5. M. D. Rai Singhania : Differential Equations, S. Chand & Co., New Delhi. 6. Nita H. Shah : Ordinary and Partial Differential Equations : Theory and Applications, PHI Learning Pvt. Ltd, New Delhi. 7. N. P. Bhamore & et el. : Mathematics Paper III–IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester Course: E.G.-3001: Mathematical Methods

Course Code	**E.G.-3001**
Course Title	**Mathematical Methods**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the difference method
Course Objective	To make students acquainted with concepts of Mathematical difference Method.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the difference calculus. CO2 : Understand Finite difference and Method of unknown coefficients CO3 : Learn about Difference equation. CO4 : Solve problem of Difference equation. CO5 : Obtain solution of Homogeneous difference equations with constant coefficients. CO6 : Apply difference calculus in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Notations of finite difference calculus, Operators E, Δ , Relations between different operators and their prosperities, Relation between difference and differential operators, Method of constructing difference tables, Finding the missing terms. Unit II: Factorial notation, Expression of polynomials in factorial notation by using finite differences, Method of unknown coefficients. Unit III: Difference equations: Order and degree of a difference equation, Solution of difference equations, Homogeneous difference equations with constant coefficients.
Reference Books	1. S.S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition.

	2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, Pragati Prakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods & Analysis, McGraw Hill Book Co., London.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3rd Semester Course: E.G.-3002: Group of Symmetries-I

Course Code	**E.G.-3002**
Course Title	**Group of Symmetries-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Group theory. CO2 : Understand Sub group and their properties CO3 : Learn about Symmetry planes and reflection symmetry. CO4 : Solve problem of Product of symmetry operations. CO5 : Analyze consequences of Rotation axes and rotation symmetry CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Definition of a group and its elementary properties, Order of a group, Order of an element of a group, Group multiplication tables, Examples of groups including finite groups and infinite groups, Abelian groups, Cyclic groups. Unit II: Subgroup, Condition that a subset is a subgroup, Examples of subgroups, Basic concept of symmetry, Symmetry elements and symmetry operations in a space, Identity symmetry operation. Unit III: Symmetry planes and reflection symmetry, Inversion centre and inversion symmetry, Rotation axes and rotation symmetry, Improper axes and improper rotation symmetry, Product of symmetry operations.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi.

	2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester Course: MTH-401: Advanced Calculus-II

Course Code	**MTH-401**
Course Title	Advanced Calculus-II
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Special function, double Triple integral and Laplace transform
Course Objective	To make students acquainted with concepts of the Special function, double Triple integral and Laplace transform.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the beta gamma function and Maxima- Minimafor functionsoftwovariables. CO2 : Understand Double and triple integrals CO3 : Learn about Laplace transform . CO4 : Realize importance of Laplace transform. CO5 : Determine various Inverse Laplace transform. CO6 : Apply the Special function, double Triple integral and Laplace transform in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Maxima- Minimaforfunctionsoftwovariables:Necessaryandsufficientconditionsfor extreme points. Unit II: DoubleandTriple Integrals:Changeoforder of Doubleintegrals, Area. Unit III: Beta-Gamma functions: Relation between Beta and Gamma functions, Properties, Applications of Beta-Gamma function. Unit IIV: Laplace Transforms: Laplace Transform of elementary functions, Properties of Laplace Transform, Differentiation and Integration of Laplace Transform, Laplace Transform of derivatives and integrals.Inverse of Laplace Transform: Method of Partial fractions, Properties of inverse Laplace Transform.
Reference Books	1. David V. Widder : Advanced Calculus, PHI Learning Pvt. Ltd, New Delhi 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi.

	4. N. P. Bhamore & et al : Mathematics Paper III-IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester Course: MTH-402: Numerical Analysis-II

Course Code	**MTH-402**
Course Title	Numerical Analysis-II
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 : Understand the Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula CO3 : Obtain numerical Differentiation. CO4 : Learn about Numerical Integration. CO5 :Determine Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Finite difference with unequal interval, Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula. Unit II: Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae. Unit III: Numerical Integration: General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule. Unit IV: Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition. 2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering

	Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, Pragati Prakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner: Numerical Methods and Analysis, McGraw Hill Book Co., London
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester Course: MTH-403: Introduction to Abstract Algebra

Course Code	**MTH-403**
Course Title	Introduction to Abstract Algebra
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Basic real analysis and basic of number theory .
Course outcomes	To make students acquainted with concepts of Basic real analysis and basic of number theory.
Course Objective	The course will enable the students to: CO1 : Explain the insight of the Divisors GCD and LCM. CO2 : Understand the basics of group and elementary properties of group CO3 : Recognize Subgroups, CyclicGroups, Orderof anelement. CO4 : Learn about basics of Ring theory. CO5 :Determine Least Common multiple, Prime numbers, Fundamental theorem of Arithmetic. CO6 : Apply Basic of number theory in social sciences, physical sciences, life sciences and a host of other disciplines.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Divisors,Greatestcommondivisor,LeastCommonmultiple,Primenumbers, Fundamentaltheoremof Arithmetic, Congruence relation, Equivalenceclasses. Unit II: DefinitionofaGroup,ExamplesofGroup,elementarypropertiesofaGroup, FiniteGroups. Unit III: Subgroups, CyclicGroups, Orderof anelement. Unit IV: Definitionof aRing,Examplesof Ring,IntegralDomain, Field,BooleanRing.
Reference Books	1. I. N. Herstein:Topics in Algebra, Wiley Eastern Ltd., New Delhi, 2006. 2. I. H. Sheth:Abstract Algebra,NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan :UniversityAlgebra, WileyEastern Ltd.

	4. P.R.Bhattacharya,S.K.JainandS.R.Nagpaul:BasicAbstractAlgebra, Cambridge UniversityPress, Indian Edition, 1997. 5. Shantinarayan:Modern Algebra,S. Chand and Co., New Delhi. 6. SergeLang :Algebra, AdditionWesley, 1993. 7. Surjeet, KaziZameeruddin:Modern Algebra, VikasPublishingHouse.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester Course: E.G.-4001: Mathematical Modeling

Course Code	**E.G.-4001**
Course Title	**Mathematical Modelling**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Mathematical Modelling .
Course Objective	To make students acquainted with concepts Mathematical Modelling.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Mathematical Modelling. CO2 : explain the concept of mathematical modelling CO3 : formulate the real world problem into Mathematical form. CO4 : analyze the mathematical model. CO5 : Predict the future by using mathematical modelling. CO6 : Apply Mathematical modelling in social sciences, physical sciences, life sciences and a host of other disciplines

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics Ordinary differential equation
Course Content	Unit I: Mathematical modelling through ordinary differential equation of first order, Linear growth models; Linear decay models, Models for growth of Science and scientists. Unit II: Non-linear growth and decay models, Model of Logistic law of population, Spread of technological innovation, Spread of infectious diseases. Unit III: Mathematical models of geometrical problems through ordinary differential equation of first order, Simple geometrical problems, Orthogonal trajectories.
Reference Books	1. J. N. Kapoor: Mathematical Modelling, New Age International Publishers, New Delhi. 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. J. K. Sharma: OR Theory & Applications, Mac Milian India Ltd., 1998. 4. G.Hadley:Linear Programming, Narosa Publishing House, New

	Delhi,1995. 5. G. Paria : Linear Programming, Transportation, Assignment, Game, Books & Allied Pvt. Ltd. Calcutta.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester Course: E.G.-4002: Group of Symmetries-II

Course Code	**E.G.-4002**
Course Title	**Group of Symmetries-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of groups of symmetries. CO2 : Understand formation of groups of symmetries of the Chemical Molecules CO3 : Learn about Concept of isomorphism of groups. CO4 : Recognize Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3. CO5 :Determine Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

Pre-requisite	Basics of Group of Symmetries
Course Content	Unit I: Formation of groups of symmetries (in space) of the following Plane figures (regarded as rigid objects): An isosceles triangle (cyclic group C2 of order 2) An equilateral triangle (the group S3 of order 6) A rectangle (the group V4) A square (the group D4) Unit II: Formation of groups of symmetries of the following Chemical Molecules (Configuration of atoms). H2O (the group V4) H2O2 Trans- N2 – F2 (the group V4) NH3, PCl3, CHCl3(the group S3) Unit III:

	Concept of isomorphism of groups, Isomorphism of multiplicative group with the group C2 of the symmetries of an isosceles triangle, Isomorphism of multiplicative group with the group V4 of the symmetries of a rectangle, Isomorphism of group V4 of the symmetries of a rectangle with the group of symmetries of H2O, Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi. 2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: MTH-501: Group Theory

Course Code	**MTH-501**
Course Title	**Group Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group theory.
Course Objective	To make students acquainted with concepts of group theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of group theory. CO2 : Understand Cosets, Lagrange's theorem, Euler's theorem, Fermat's theorem, counting principle CO3 : Learn about Concept of Normal subgroup & Quotient groups, Homomorphism with their properties. CO4 : Recognize Automorphisms, Cayley's theorem and its applications CO5 :Determine different permutation and Permutation Groups, even permutation, odd permutation. CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Group theory
Course Content	Unit 1: Cosets, Congruence Relation in Group Lagrange's theorem, Euler's theorem, Fermat's theorem, Counting principle. Unit 2: Normal subgroups & Quotient groups, Homomorphism, Isomorphism, Isomorphic groups, Fundamental theorem of homomorphism.

	Unit 3: Automorphisms, Cayley's theorem and its applications. Unit 4: Permutation Groups, Orbit& Cycles, Even permutation, Odd permutation, Alternating Group.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: MTH-502: Linear Algebra - I

Course Code	**MTH-502**
Course Title	**Linear Algebra - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Linear Algebra.
Course Objective	To make students acquainted with concepts of Linear Algebra.
Course Outcomes	The course will enable the students to:
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of algebraic system
Course Content	Unit 1: Definition and examples of Vector space, Subspace, Necessary and sufficient condition for a subspace, Illustrations. Unit 2: Span of a set, union and intersection of subspaces, sum and direct sum of subspaces. Unit 3: Linearly dependent and independent vectors, checking of Linear dependence or independence. Unit 4: Dimension and Basis of a vector space, extension of a linearly independent set to a basis, dimension of sum.

Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: MTH-503: Real Analysis - I

Course Code	**MTH-503**
Course Title	**Real Analysis - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Countable & Uncountable sets, Greatest lower bound and least upper bound CO3 : Recognize Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences. CO4 : Learn about operations on convergent sequences. CO5 :Analyze Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence. CO6 : Apply Basic of real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Countable & uncountable sets, greatest lower bound and least upper bound. Unit 2: Sequences of real numbers, sub-sequences, limit of a sequence, convergent sequences, divergent sequences. Unit 3: Bounded sequences, monotone sequences, operations on convergent sequences. Unit 4: Operations on divergent sequences, concepts of limit superior and inferior, Cauchy

	sequence.
Reference Books	1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: MTH-504: Real Analysis - II

Course Code	**MTH-504**
Course Title	**Real Analysis - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Limit and Continuity of a function on the real line, Definition & examples of Metric spaces CO3 : Recognize Open ball in R1, open ball in metric space, functions continuous on metric spaces. CO4 : Learn about Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics.. CO5 :Analyze Open sets and their properties. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Revision of Limit and Continuity of a function on the real line, Definition & examples of Metric spaces. Unit 2: Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics. Unit 3: Open ball in R1, open ball in metric space, functions continuous on metric spaces. Unit 4: Open sets, more about open sets.

Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. D. SomSundaram& B. Chaudhari : A first course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997. 5. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: MTH-505: Graph Theory

Course Code	**MTH-505**
Course Title	**Graph Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Graph theory
Course Objective	To make students acquainted with concepts of Graph Theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the graph theory. CO2 : Understand the graph theory and relevant term CO3 : Recognize Subgraphs, Isomorphism between two graphs. CO4 : Learn about Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs and Components of graphs . CO5 :Analyze Euler graph and their properties. CO6 : Apply graph .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphs, various type of graphs, incidence and degree, isolated and pendent vertices, Subgraphs, Isomorphism between two graphs. Unit 2: Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs, Components of graphs. Unit 3: Euler graphs, Arbitrary traceable graph, Hamiltonian Graphs, Applications of graphs:

	Konigsberg Bridge Problem, Seating Arrangement Problem, Utility Problem. Unit 4: Trees, Properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and Diameter of a Tree, Rooted & Binary trees.
Reference Books	1. NarsinghDeo : Graph Theory with applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd., 2000. 2. R. J. Wilson : Introduction to Graph Theory, Academic Press, New York, 1972. 3. E. Harray : Graph Theory, Addison Wesley Pub. Co., 1969. 4. C. Berge : The Theory of Graphs and its Applications, John Wiley & Sons, 1962.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: MTH-506: Number Theory - I

Course Code	**MTH-506**
Course Title	**Number Theory - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Understand the Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm CO3 : Compute the solutions of linear Diophantine equations in two variables CO4 :Learn about Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences CO5 :Analyze Basic properties of Congruence, divisibility tests. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm, relation between greatest common divisor and least common multiple of two integers.

	Unit 2: Computation of the solutions of linear Diophantine equations in two variables, Primes and composite numbers, the fundamental theorem of arithmetic, Pythagorean theorem for the irrationality of $\sqrt{2}$. Unit 3: Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences. Unit 4: Basic properties of Congruence, divisibility tests of 9 and 11.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: E.G.-5001: Operations Research- I (Elective Generic)

Course Code	**E.G.-5001**
Course Title	**Operations Research-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operations research.
Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research. CO2 : Understand Linear programming problem and their Graphical solution. CO3 : Compute the solutions LPP by dual simplex method CO4 :Learn about Definition of the dual problem and their properties CO5 : Find the solution of LPP by Big-M method. CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1:

	Graphical Solution of Linear programming problem (LPP). Definition of the dual problem, General rules for converting any primal problem into it's dual, The symmetric dual problems. Unit 2: Basic concept of basic, non-basic, degenerate, non-degenerate and basic feasible solutions of LPP, slack & surplus variables, LPP in the standard matrix form, Slack & surplus variables, Solution of LPP using Simplex method. Unit 3: Solution of LPP using Two Phase Simplex method and Big-M method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: E.G.-5002: Computer Oriented Numerical Methods– I(Elective Generic)

Course Code	**E.G.-5002**
Course Title	**Computer Oriented Numerical Methods – I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 : Understand Flow charts and symbols, More flow charting examples and FORTRAN language CO3 : Compute the operations in expressions CO4 :Learn about Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries. CO5 : Familiarize with Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program. CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs									
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								

	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Flow charts and symbols, More flow charting examples. FORTRAN language, character used in FORTRAN, FORTRAN constants, FORTRAN variable names, Type declaration for integer and real, Arithmetic expression (real and integer expressions), Hierarchy of operations in expressions, Examples of Arithmetic expression. Unit 2: Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries. Unit 3: Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program, FORTRAN programming examples.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester Course: E.G.-5003: Fourier Series (Elective Generic)

Course Code	**E.G.-5003**
Course Title	**Fourier Series**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Series.
Course Objective	To make students acquainted with concepts of Fourier Series.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Series. CO2 : Understand the Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion CO3 : Compute the Fourier series of functions CO4 :Learn about Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. CO5 : Familiarize with Half range series, Typical waveforms, Parseval's formula,

	Root mean square value, Complex form of Fourier series. CO6 : Apply Fourier series in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion. Unit 2: Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. Unit 3: Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series.
Reference Books	1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi. 2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi. 3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE. 5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 6th SemesterCourse: MTH-601: Ring Theory

Course Code	**MTH-601**
Course Title	**Ring Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Ring theory.
Course Objective	To make students acquainted with concepts of ring theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of Ring theory. CO2 : Understand Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal CO3 : Learn about different kinds of ring and their properties.. CO4 : Recognize Prime element in a Euclidean Ring, Unique factorization theorem

	in a Euclidean ring. CO5 : Link the Particular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial. CO6 : Apply Ring theory in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of group theory
Course Content	Unit 1: Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal. Unit 2: Euclidean rings, divisibility in commutative ring, gcd of two elements in a ring, units and associates in rings. Unit 3: Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. Unit 4: Particular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester Course: MTH-602: Linear Algebra - II

Course Code	**MTH-602**
Course Title	**Linear Algebra - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Linear Algebra.
Course Objective	To make students acquainted with concepts of Linear Algebra.

Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Linear algebra. CO2 : Understand Linear Transformation and their properties CO3 : Learn about rank nullity and their properties CO4 : Recognize Matrix associated with linear transformations. CO5 : Analyze Inner product spaces, Norm of a vector and properties. CO6 : Apply linear algebra in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of linear algebra
Course Content	Unit 1: Definition and examples of Linear transformation, Range and kernel of a linear transformation. Unit 2: Rank-Nullity Theorem, Inverse of a linear transformation, Consequences of Rank-Nullity Theorem, Composition of linear transformations. Unit 3: Matrix associated with linear transformations, linear transformation associated with a matrix, Application of Rank-Nullity Theorem for matrix. Unit 4: Inner product spaces, Norm of a vector, Cauchy-Schwarz's inequality, Triangular inequality, Orthogonal vectors, Vector Projection, Gram-Schmidt Orthogonalization Process, Orthonormal Set.
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester Course: MTH-603: Real Analysis - III

Course Code	**MTH-603**
Course Title	**Real Analysis - III**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019

Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Convergence and divergence of series of real numbers CO3 : Recognize Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. CO4 : Learn about different type of series . CO5 :Analyze Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Convergence and divergence of series of real numbers, Series with non-negative terms, Alternating series, Conditional and absolute convergence. Unit 2: Tests for absolute convergence, Series whose terms form a non-increasing sequence. Unit 3: Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. Unit 4: Non Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus, Mean-value Theorems of Integral Calculus.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. Louis Leithold : Calculus with analytic Geometry, Harper and Collins Pub. Co. 5. J. B. Thomas and Finney : Calculus with analytic Geometry. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester Course: MTH-604: Real Analysis - IV

Course Code	**MTH-604**
Course Title	**Real Analysis - II**
Credit	3

Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand Limit points, closure of a set, closed sets, homeomorphism of metric spaces CO3 : Recognize Connected sets, Bounded sets, Totally bounded sets. CO4 : Learn about Complete metric spaces, Contraction mapping, Picard's fixed point theorem. CO5 :Analyze Open covering, Heine-Borel property. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of real analysis
Course Content	Unit 1: Limit points, closure of a set, closed sets, homeomorphism of metric spaces, dense set. Unit 2: Connected sets, Bounded sets, Totally bounded sets. Unit 3: Complete metric spaces, Contraction mapping, Picard's fixed point theorem. Unit 4: Compact metric spaces, Open covering, Heine-Borel property, Finite Intersection property.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 5. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company. 6. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 6th Semester Course: 605: Discrete Mathematics

Course Code	**MTH-605**

Course Title	**Discrete Mathematics**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Discrete Mathematics
Course Objective	To make students acquainted with concepts of Discrete Mathematics.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Discrete Mathematics. CO2 : Understand the relation , lattice and relevant term CO3 : Recognize Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. CO4 : Learn about Boolean Algebra as an algebraic system, Boolean expressions. CO5 :Determine Minimization of Boolean functions by Karnaugh Map method. CO6 : Apply Discrete Mathematics .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Binary relations, Properties of binary relations, Equivalence relation, Partial ordered relation, Partially ordered sets, Upper bounds, Lower bounds, GLB & LUB of sets, Totally ordered sets, Well ordered sets, Hasse Diagram, Lattices and its properties. Unit 2: Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. Unit 3: Boolean Algebra as an algebraic system, Boolean expressions (forms). Different representation of Boolean forms, Sum of products canonical form and product of sums canonical forms of Boolean expressions. Unit 4: Minimization of Boolean functions by Karnaugh Map method and Quine- McCluskey algorithm, AND, OR & NOT gates, Reduction of switching circuit diagram.
Reference Books	1. J. P. Tremblay & R. Manohar : Discrete mathematical Structures with Applications to Computer Science., McGraw Hill Book Co., 1999. 2. B. Kolman, R. C. Busby & S. Ross : Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd., 3rd ed. 2001. 3. Elements of Discrete Mathematics, C. L. Liu, D. P. Mohapatra, Tata McGraw Hill, 2008. 4. Discrete Mathematics with Applications, Thomas Koshy, Academic Press, 2004.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester Course: MTH-606: Number Theory - I

Course Code	**MTH-606**
Course Title	**Number Theory - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Understand Fermat's little theorem, Pseudo-primes, Wilson's theorem CO3 : Compute the solutions of linear congruence , the Chinese Remainder Theorem CO4 :Learn about The number of positive divisors, multiplicative nature of functions, The Möbius Inversion formula CO5 :Analyze Euler's Phi-function and related theorem. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of number theory
Course Content	Unit 1: Computation of the solutions of linear congruence , the Chinese Remainder Theorem. Unit 2: Fermat's little theorem, Pseudo-primes, Wilson's theorem. Unit 3: The number of positive divisors and sum of all positive divisors of an integer, basic properties and multiplicative nature of these functions, The Möbius Inversion formula (without proof), the greatest integer function. Unit 4: Introduction of Euler's Phi-function , multiplicative nature of (statement only), Euler's Theorem.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester Course: E.G. 6001: Operations Research-II (Elective Generic)

Course Code	**E.G.- 6001**
Course Title	**Operations Research-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operation research.
Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research. CO2 : Understand the transportation problem and their solutions. CO3 : Compute the solutions of Assignment problem CO4 :Learn about Competitive games theory CO5 : Find the solution Game theory problem by graphical method CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Transportation problem, methods for finding initial basic feasible solution, solution of Transportation problem by MODI method. Unbalanced Transportation problem. Unit 2: Assignment problems, The Hungarian method, balanced & unbalance assignment problems. Unit 3: Competitive games, two-person zero-sum game, maximin and minimax principle, saddle points and the value of the game (based on pure strategies), mixed strategies, solution of games with saddle point, Game without saddle points, Dominance rule, solution of m×2 and 2×n games using graphical method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut

Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester Course: E.G.-6002: Computer Oriented Numerical Methods –II (Elective Generic)

Course Code	**E.G.-6002**
Course Title	**Computer Oriented Numerical Methods – II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 : Understand Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement CO3 : Apply the Statement labels, GO TO statement and DO statement CO4 :Learn about Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted expression, Dimension statement, DO type notation for input / output statement. CO5 : Familiarize with FORMAT specification and FORMAT specification for a numerical data. CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Computer Oriented Numerical Methods
Course Content	Unit1: Controlstatements,Relationaloperators,LogicalIFstatement,ArithmeticIFstatement,BlockIFstatement. Statement labels, GO TO statement, Example of use of Logical IF statement. Unit2: Nested logical IF statement, Computed GO TO statement, DO statement, Examples of DO statement. Rules to be followed in utilizing DO loops, Subscripted variables, Sub scripted Expression. Dimension statement, DO type notation for input/output statement. FORMAT specification. Unit3: FORMAT specification for a numerical data, Iterative methods. Numerical integrations and differentiations. Numerical solution of ordinary differential equations.

Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester Course: E.G.-6003: Fourier Transform and its Applications (Elective Generic)

Course Code	**E.G.-6003**
Course Title	**Fourier Transform and its Applications**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Transform and its Applications.
Course Objective	To make students acquainted with concepts of Fourier Transform and its Applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Transform and its Applications. CO2 : Understand the Integral transforms, Fourier Transforms, Properties of Fourier Transform CO3 : Compute the Fourier Transform CO4 :Learn about Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform CO5 : Familiarize with Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function CO6 : Apply Fourier Transform in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Fourier series
Course Content	Unit 1: Integral transforms, Fourier Transforms, Properties of Fourier Transform and its application. Unit 2: Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform. Unit 3:

	Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function, Fourier transform and its applications.
Reference Books	1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi. 2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi. 3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE. 5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

Bachelor of Science (Mathematics)
CO-PO-2020-21

Name of Program	**Bachelor of Science (Mathematics)**
Abbreviation	**B.Sc.- Mathematics**
Duration	**3 Years**
Eligibility Criteria	Passed 12th Science with mathematics or equivalent Degree.
Objective of Program	The core objective of the B.Sc. in Mathematics is to prepare the students for productive career by providing a solid education in the basic subjects of mathematical knowledge and its applications with outstanding environment of teaching and research in the core and emerging areas of the discipline.
Program Outcome	**PO1 : Fundamental Knowledge Enrichment** Program trains students with the core Mathematics knowledge domains. It also makes students capable of using core concepts in the conceptualization of domain specific application. **PO2 : Critical Thinking Development** The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem. **PO3 : Develop arguments in a logical manner** The program trains students to formulate and develop arguments in a logical manner and make them ready to prepare real world problem solution mathematically. **PO4 : Develop decision making ability** The program develop the skill in students to take decisions at intellectual, organizational and personal from different perspectives of life using analysis **PO5 : Computational Skill Development** The program develop basic computational skill in students for planning and managing process of complex real world. **PO6 : Provides an effective Mathematical communication skill**

Chairman
DR. M R Tale
B.Sc Mathematics

	The program develop an effective Mathematical communication skill in the students. **PO7 : Team Work and Leadership Development** Trains students to work in a team and also to take leadership.
Program Specific Outcomes	PSO1 : Develop and strengthen the fundamental core concepts that are required to solve complex problems PSO2 : Develop the skills that needs independent logical and analytical thinking, teamwork and leadership PSO3 : Nurture the students to investigate and development of a workable solution for a real world problem PSO4 : Develop students for self-learning and practicing challenging problem solution PSO5 : Train students to apply mathematical skills for new investigation. PSO6 : Train students to expand their knowledge of fields related to their current areas of professional specialization. PSO7 : Train students to take-up the real world challenges to develop workable solution to a domain specific problem. PSO8 : Inculcate the passion for continuous learning and doing research for making a successful professional career.
Mapping between POs and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
PO1								
PO2								
PO3								
PO4								
PO5								
PO6								
PO7								

Medium of Instruction	English
Program Structure	Semester 1

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-	Mathematics-1	3	0	3	2Hrs	50	20	

101								70
MTH-102	Mathematics-2	3	0	3	2Hrs	50	20	70
	Total	6	0	6				

Program Structure	Semester 2

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-201	Mathematics-3	3	0	3	2Hrs	50	20	70
MTH-202	Mathematics-4	3	0	3	2Hrs	50	20	70
	Total	6	0	6				

Program Structure	Semester 3

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-301	Advanced Calculus-I	3	0	3	2Hrs	50	20	70
MTH-302	Numerical Analysis-I	3	0	3	2Hrs	50	20	70
MTH-303	Differential-Equations	3	0	3	2Hrs	50	20	70

E.G.	3001-MathematicalMethods	2	0	2	2Hrs	50	20	70
	3002-GroupofSymmetries–I	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 4

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-401	Advanced Calculus-II	3	0	3	2Hrs	50	20	70
MTH-402	Numerical Analysis-II	3	0	3	2Hrs	50	20	70
MTH-403	Introduction to Abstract Algebra	3	0	3	2Hrs	50	20	70
E.G.	4001-MathematicalModeling	2	0	2	2Hrs	50	20	70
	4002-GroupofSymmetries–II	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 5

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH -501	GroupTheory	3	0	3	2Hrs	50	20	70
MTH -502	LinearAlgebra-I	3	0	3	2Hrs	50	20	70
MTH -503	RealAnalysis-I	3	0	3	2Hrs	50	20	70
MTH -504	RealAnalysis-II	3	0	3	2Hrs	50	20	70
MTH -505	GraphTheory	3	0	3	2Hrs	50	20	70
MTH -506	NumberTheory-I	3	0	3	2Hrs	50	20	70
E.G.	5001-OperationsResearch– I	2	0	2	2Hrs	50	20	70
	5002-ComputerOriented NumericalMethods –I	2	0	2	2Hrs	50	20	70
	5003-Fourier Series	2	0	2	2Hrs	50	20	70

	Total	20	0	20				
Program Structure		Semester 6						
Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH -601	RingTheory	3	0	3	2Hrs	50	20	70
MTH -602	LinearAlgebra–II	3	0	3	2Hrs	50	20	70
MTH -603	RealAnalysis–III	3	0	3	2Hrs	50	20	70
MTH -604	RealAnalysis–IV	3	0	3	2Hrs	50	20	70
MTH -605	DiscreteMathematics	3	0	3	2Hrs	50	20	70
MTH -606	NumberTheory–II	3	0	3	2Hrs	50	20	70
E.G.	6001-OperationsResearch– II	2	0	2	2Hrs	50	20	70
	6002-ComputerOriented NumericalMethods –II	2	0	2	2Hrs	50	20	70

	6003-FourierTransformanditsApplications	2	0	2	2Hrs	50	20	70
	Total	**20**	**0**	**20**				

B.Sc.Mathematics 1st Semester

Course: MTH-101: **Mathematics-I**

Course Code	**MTH-101**
Course Title	Mathematics-1
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Trigonometry .
Course Objective	To make students acquainted with concepts of Trigonometry
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the fundamental aspects of the Trigonometry . CO2 : Assimilate the De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments. CO3 : Calculate the Indeterminate forms by using Euler's expressions, Hyperbolic functions.. CO4 : Understand the Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.

	CO5 : Sketch curves in Trigonometric and hyperbolic functions. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit –I De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments. Unit-II Euler's expressions, Evaluation of Indeterminate forms by using Euler's expressions, Hyperbolic functions for real arguments and their inverses. Unit-III Exponential, Circular and Hyperbolic functions of complex variables and their identities, Euler's Theorem, Relations between circular and Hyperbolic functions. Unit-IV Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.
Reference Books	1. S. L. Loney: Plane Trigonometry, Part I and II, McMillan and Co. London. 2. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd. Allahabad. 3. E. Kreyszig: Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 4. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc.Mathematics 1st Semester

Course: MTH-102: **Mathematics-II**

Course Code	**MTH-102**
Course Title	Mathematics-2
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts calculus of and learn its applications.
Course Objective	To make students acquainted with concepts of calculus.
Course Outcomes	This course will enable the students to CO1 : Explain the insight of the historical and fundamental aspects the Calculus. CO2 : Assimilate the Successive differentiation, Leibnitz theorem and its applications CO3 : Understand the consequences of various mean value theorems for differentiable functions , Asymptotes, Concavity, Convexity and reduction function. CO4 : Calculate the Curvature and radius of curvature. CO5 : Apply concept of Increasing and Decreasing functions, Asymptotes, Concavity and Convexity CO6 : Apply calculus in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								

	CO6
Pre-requisite	Basics of Mathematics
Course Content	Unit –I Successive differentiation, Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions), Leibnitz theorem and its applications Unit-II Rolle's Theorems and its geometrical interpretation, Lagrange's Theorem and its geometrical interpretation, Cauchy theorem, Maclaurin and Taylor series expansions Unit-III Curvature and radius of curvature (except Polar form), Increasing and Decreasing functions, Asymptotes, Concavity and Convexity Unit-IV Reduction formulae for integration of $sin^n x, cos^n x, tan^n x, cot^n x, sec^n x, cosec^n x, sin^p x cos^q x, x^m cosnx, x^m sinnx.$
Reference Books	1. Shantinarayan: Differential Calculus, Revised EditionDecember-2004 , S. Chand and Co. New Delhi. 2. Shantinarayan: Integral Calculus, S. Chand and Co. New Delhi. 3. Gorakhprasad: Differential Calculus, Pothishala Pvt. Ltd. Allahabad. 4. M. R. Spigel: Theory and Problems of Advanced Calculus, Schaum's Publishing Co., New York. 5. N. P. Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-201: **Mathematics-III**

Course Code	**MTH-201**
Course Title	Mathematics-III
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the theory of matrices with its applications.
Course Objective	To make students acquainted with concepts of Theory of matrices.
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of fundamental aspects the theory of matrices. CO2 : Understand the genesis of theory of matrices.. CO3 : Learn elementary raw operations, rank theory and matrix properties. CO4 : Find eigen values and corresponding eigenvectors for a square matrix. CO5 : Calculate solution of linear system of equation. CO6 : Apply matrix theory in social sciences, physical sciences, life sciences and a host of other disciplines.
Mapping between COs with PSOs	
Pre-requisite	Basics of Matrices
Course Content	Unit-I

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Different types of matrices, Operation on matrieces, Properties of operation of matrices, Elementary row operations. Unit-II Row-reduced echelon forms. Inverse of matrix by Row-Reduced Echelon form, Row rank of a matrix, Quadratic form. Unit-III Trace of matrix and its properties, Solution of homogeneous system of linear equations using row –reduced echelon forms. Unit-IV Characteristic equation of a matrix, Method to find Characteristic equation using determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix, Cayley-Hamilton theorem and its application to find an inverse of a matrix, Method of diagonalization.
Reference Books	1. Krishnamurthy, Mainra and Arora: An Introduction to linear Algebra, Affiliated West Press Pvt. Ltd., New Delhi. 2. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India (P) Ltd., 2009. 3. B.S.Vasta and SuchiVasta: Theory of Matrices; 4rd Edition -2014, New Age International (P) Ltd. Publishers, New Delhi. 4. Shantinarayan: Text book of Matrices, S. Chand and Co., New Delhi. 5. H. K. Dass, H. C. Saxena, M. D. Raisinghania: Simplified course in Matrices, S. Chand and Co., NewDelhi. 6. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-202: **Mathematics-IV**

Course Code	**MTH-202**
Course Title	Mathematics-IV
Credit	3
Teaching per Week	3 Hrs

<table>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2020</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.</td></tr>
<tr><td>Course Objective</td><td>The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Understand the genesis of Integral Calculus and ordinary differential equations.
CO2: Sketch curves in Cartesian coordinate systems.
CO3 :To solve first order first degree and first order higher degree differential equation.
CO4 : Grasp the concept of a general solution of a higher order linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.
CO5: To solve initial and boundary value problem.
CO6 : Apply Integral Calculus and Differential Equations in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Derivative</td></tr>
<tr><td>Course Content</td><td>Unit-I
Curve Tracing : Equation of the form $y = f(x)$,Equation of the form $y^2 = f(x)$,Parametric equations, Tracing of Polar curves.

Unit-II
Application of Integral calculus: Length of a curve, Intrinsic equation (except polar</td></tr>
</table>

	coordinates). Unit:III Bernoulli's equation, Exact differential equation, Differential equations of first order and higher degree : Solvable for x, y, p and Lagrange's equation, Clairaut's equation. Unit-IV Linear Differential Equations with constant coefficients: Complimentary functions, Particular Integral, General Solution, Method for finding Particular Integral specially for e^{ax}, sinax, cosax, polynomial in terms of x, $e^{ax}V$ and xV, where V is a function of x.
Reference Books	1. 1.Shantinarayan : Differential calculus ,4th edition -2001,Shyamlal Charitable Trust,Ramnagar New Delhi, S. Chand and Company LTD. 2. Shantinarayan: Integral Calculus, Revised Edition-2009, S.Chand and Co., New Delhi. 3. Gorakhprasad: Integral Calculus, PothishalaPvt.Ltd., Allahabad. 4. D.A.Murray: Differential Equations, Tata Mc Graw Hills. 5. Frank Ayres: Theory and problems on Differential Equations, Mc Graw Hill Book Co., New York. 6. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3rd Semester

Course: MTH-301: **Advanced Calculus-I**

Course Code	**MTH-301**
Course Title	Advanced Calculus-I
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018

Purpose of Course	The purpose of the course is to make the student capable to understand and implement the function of two variable and their calculus.
Course Objective	To make students acquainted with concepts of the function of two variable and their calculus.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the function of two variable and their calculus. CO2 : Understand the Limits and Continuity of a function of two variables, Partial Differentiation. CO3 : Find surface integral of the surfaces. CO4 : Understand basics of vector calculus. CO5 : Apply multivariable calculus to solve function of two variable problems. CO6 : Apply Integral calculus of function of two variable and vector calculus in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of calculus
Course Content	Unit I: Limits and Continuity of a function of two variables, Partial Differentiation, Total Differential, Composite function, Homogeneous functions. Unit II: Taylor's theorem for functions of two variables, Maclaurian's expansions in power series, Jacobian. Unit III: Vector point function, Differentiation of a Vector point function, Gradient, Divergence

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	and Curl and their properties, Line Integral. Unit III: Unit IV: Surface Integral, Green's, Gauss'andStoke'stheorems (Only for Cartesian coordinates).
Reference Books	1. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 2. HariKishan : Vector Algebra and Calculus, Atlantic Pub. & Distributors(P) Ltd., New Delhi. 3. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 4. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi. 5. N. P. Bhamore& et el : Mathematics Paper III–IV, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: MTH-302: **Numerical Analysis-I**

Course Code	**MTH-302**
Course Title	Numerical Analysis-I
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of basics of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis.

	CO2 : Understand the errors and their numerical computation CO3 : Obtain numerical solutions of algebraic and transcendental equations. CO4 : Learn about various interpolating and extrapolating methods. CO5 : predict future trend by interpolating and extrapolating methods. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Error estimation: Errors and their computations, A general error formula. Unit II: Numerical Solutions of Algebraic and Transcendental Equations: Bisection Method, Method of False position, Iteration Method, Newton-Raphson's Method. Unit III: Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols, Differences of Polynomials. Unit IV: Newton's Forward and Backward Formulae, Gauss' Interpolation formulae.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 5th Edition. 2. M. K. Jain, Iyenger, Jain : Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, Mc Graw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods and Analysis, Mc Graw Hill Book Co., London.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	6. P. C. Biswal:NumericalAnalysis,Prentice-HallofIndia, 2008. 7. H. C. Saxena: Finite Differences and Numerical Analysis. S. Chandand Co., 2005.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: MTH-303: **Differential-Equations**

Course Code	**MTH-303**
Course Title	Differential-Equations
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the higher order differential equation and basics of partial differential equation.
Course Objective	To make students acquainted with concepts of higher order differential equation and basics of partial differential equation.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Linear Differential Equations with variable coefficients. CO2 : Understand Second order Differential Equations CO3 : Learn about Formation of Partial Differential Equation.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								

	CO5 CO6
Pre-requisite	Basics of ordinary differential equation and partial derivative
Course Content	Unit I: Linear Differential Equations with variable coefficients, Homogeneous Differential Equations, Legendre's Differential Equation. Unit II: Second order Differential Equations: Solution in terms of known Integral, Solution by method of removal of first order derivatives, Method of Changing Independent Variable. Unit III: Formation of Partial Differential Equation, Solution of Partial Differential Equations, Equations solvable by direct integral. Unit IV: Partial Differential Equations of first order, Nonlinear Partial Differential Equations of first order, Some special methods.
Reference Books	1. D. A. Murray: An Introductory Course in Differential Equations, Orient Longmans, Bombay. 2. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company. 3. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi. 4. Gorakhprasad : Differential Equations, Pothishala Pvt. Ltd., Allahabad. 5. M. D. Rai Singhania : Differential Equations, S. Chand & Co., New Delhi. 6. Nita H. Shah : Ordinary and Partial Differential Equations : Theory and Applications, PHI Learning Pvt. Ltd, New Delhi. 7. N. P. Bhamore& et el. : Mathematics Paper III–IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3rd Semester

Course: E.G.-3001: Mathematical Methods

<table>
<tr><td>Course Code</td><td>E.G.-3001</td></tr>
<tr><td>Course Title</td><td>Mathematical Methods</td></tr>
<tr><td>Credit</td><td>2</td></tr>
<tr><td>Teaching per Week</td><td>2 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2018</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the difference method</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Mathematical difference Method.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the difference calculus.
CO2 : Understand Finite difference and Method of unknown coefficients
CO3 : Learn about Difference equation.
CO4 : Solve problem of Difference equation.
CO5 : Obtain solution of Homogeneous difference equations with constant coefficients.
CO6 : Apply difference calculus in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Notations of finite difference calculus, Operators E, Δ , Relations between different</td></tr>
</table>

	operators and their prosperities, Relation between difference and differential operators, Method of constructing difference tables, Finding the missing terms. Unit II: Factorial notation, Expression of polynomials in factorial notation by using finite differences, Method of unknown coefficients. Unit III: Difference equations: Order and degree of a difference equation, Solution of difference equations, Homogeneous difference equations with constant coefficients.
Reference Books	1. S.S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition. 2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods & Analysis, McGraw Hill Book Co., London.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: E.G.-3002: Group of Symmetries-I

Course Code	**E.G.-3002**
Course Title	**Group of Symmetries-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.

Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Group theory. CO2 : Understand Sub group and their properties CO3 : Learn about Symmetry planes and reflection symmetry. CO4 : Solve problem of Product of symmetry operations. CO5 : Analyze consequences of Rotation axes and rotation symmetry CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Definition of a group and its elementary properties, Order of a group, Order of an element of a group, Group multiplication tables, Examples of groups including finite groups and infinite groups, Abelian groups, Cyclic groups. Unit II: Subgroup, Condition that a subset is a subgroup, Examples of subgroups, Basic concept of symmetry, Symmetry elements and symmetry operations in a space, Identity symmetry operation. Unit III: Symmetry planes and reflection symmetry, Inversion centre and inversion symmetry, Rotation axes and rotation symmetry, Improper axes and improper rotation symmetry, Product of symmetry operations.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-401: **Advanced Calculus-II**

Course Code	**MTH-401**
Course Title	Advanced Calculus-II
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Special function, double Triple integral and Laplace transform
Course Objective	To make students acquainted with concepts of the Special function, double Triple integral and Laplace transform.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the beta gamma function and Maxima- Minimafor Function softwovariables. CO2 : Understand Double and triple integrals CO3 : Learn about Laplace transform . CO4 : Realize importance of Laplace transform. CO5 : Determine various Inverse Laplace transform. CO6 : Apply the Special function, double Triple integral and Laplace transform in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8

	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								
Pre-requisite	Basics of Mathematics								
Course Content	Unit I: Maxima- Minimaforfunctionsoftwovariables:Necessaryandsufficientconditionsfor extreme points. Unit II: DoubleandTripleIntegrals:Changeoforder of Doubleintegrals, Area. Unit III: Beta-Gamma functions: Relation between Beta and Gamma functions, Properties, Applications of Beta-Gamma function. Unit IIV: Laplace Transforms: Laplace Transform of elementary functions, Properties of Laplace Transform, Differentiation and Integration of Laplace Transform, Laplace Transform of derivatives and integrals.Inverse of Laplace Transform: Method of Partial fractions, Properties of inverse Laplace Transform.								
Reference Books	1. David V. Widder : Advanced Calculus, PHI Learning Pvt. Ltd, New Delhi 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 4. N. P. Bhamore& et al : Mathematics Paper III-IV, Popular Prakashan, Surat.								
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment								
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination								

B.Sc. Mathematics 4th Semester

Course: MTH-402: **Numerical Analysis-II**

Course Code	**MTH-402**
Course Title	Numerical Analysis-II
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 : Understand the Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula CO3 : Obtain numerical Differentiation. CO4 : Learn about Numerical Integration. CO5 :Determine Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Course Content	Unit I: Finite difference with unequal interval, Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula. Unit II: Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae. Unit III: Numerical Integration: General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule. Unit IV: Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition. 2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner: Numerical Methods and Analysis, McGraw Hill Book Co., London
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-403: Introduction to Abstract Algebra

Course Code	**MTH-403**
Course Title	Introduction to Abstract Algebra
Credit	3

<table>
<tr><td>Teaching per Week</td><td>3 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2018</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the concepts of Basic real analysis and basic of number theory .</td></tr>
<tr><td>Course outcomes</td><td>To make students acquainted with concepts of Basic real analysis and basic of number theory.</td></tr>
<tr><td>Course Objective</td><td>The course will enable the students to:
CO1 : Explain the insight of the Divisors GCD and LCM.
CO2 : Understand the basics of group and elementary properties of group
CO3 : Recognize Subgroups, CyclicGroups, Orderofanelement.
CO4 : Learn about basics of Ring theory.
CO5 :Determine Least Common multiple, Prime numbers, Fundamental theorem of Arithmetic.
CO6 : Apply Basic of number theory in social sciences, physical sciences, life sciences and a host of other disciplines.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Divisors,Greatestcommondivisor,LeastCommonmultiple,Primenumbers, Fundamentaltheoremof Arithmetic, Congruence relation, Equivalenceclasses.

Unit II:
DefinitionofaGroup,ExamplesofGroup,elementarypropertiesofaGroup, FiniteGroups.</td></tr>
</table>

	Unit III: Subgroups, CyclicGroups, Orderofanelement. Unit IV: DefinitionofaRing,ExamplesofRing,IntegralDomain, Field,BooleanRing.
Reference Books	1. I. N. Herstein:Topics in Algebra, Wiley Eastern Ltd., New Delhi, 2006. 2. I. H. Sheth:AbstractAlgebra,NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan :UniversityAlgebra, WileyEastern Ltd. 4. P.R.Bhattacharya,S.K.JainandS.R.Nagpaul:BasicAbstractAlgebra, Cambridge UniversityPress, Indian Edition, 1997. 5. Shantinarayan:ModernAlgebra,S. Chand and Co., New Delhi. 6. SergeLang :Algebra, AdditionWesley, 1993. 7. Surjeet, KaziZameeruddin:Modern Algebra, VikasPublishingHouse.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: E.G.-4001: Mathematical Modelling

Course Code	**E.G.-4001**
Course Title	**Mathematical Modelling**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Mathematical Modelling .
Course Objective	To make students acquainted with concepts Mathematical Modelling.

Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Mathematical Modelling. CO2 : explain the concept of mathematical modelling CO3 : formulate the real world problem into Mathematical form. CO4 :analyze the mathematical model. CO5 : Predict the future by using mathematical modelling. CO6 : Apply Mathematical modelling in social sciences, physical sciences, life sciences and a host of other disciplines

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics Ordinary differential equation
Course Content	Unit I: Mathematical modelling through ordinary differential equation of first order, Linear growth models; Linear decay models, Models for growth of Science and scientists. Unit II: Non-linear growth and decay models, Model of Logistic law of population, Spread of technological innovation, Spread of infectious diseases. Unit III: Mathematical models of geometrical problems through ordinary differential equation of first order, Simple geometrical problems, Orthogonal trajectories.
Reference Books	1. J. N. Kapoor: Mathematical Modelling, New Age International Publishers, New Delhi. 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. J. K. Sharma: OR Theory & Applications, Mac Milian India Ltd., 1998. 4. G.Hadley:Linear Programming, Narosa Publishing House, New Delhi,1995. 5. G. Paria : Linear Programming, Transportation, Assignment, Game, Books & Allied Pvt. Ltd. Calcutta.

Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: E.G.-4002: Group of Symmetries-II

Course Code	**E.G.-4002**
Course Title	**Group of Symmetries-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2018
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of groups of symmetries. CO2 : Understand formation of groups of symmetries of the Chemical Molecules CO3 : Learn about Concept of isomorphism of groups. CO4 : Recognize Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3. CO5 :Determine Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries CO6 : Apply Group of Symmetries in social sciences, physical sciences, life

	sciences and a host of other disciplines
Mapping between COs with PSOs	<table><tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr><tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>
Pre-requisite	Basics of Group of Symmetries
Course Content	Unit I: Formation of groups of symmetries (in space) of the following Plane figures (regarded as rigid objects): An isosceles triangle (cyclic group C2 of order 2) An equilateral triangle (the group S3 of order 6) A rectangle (the group V4) A square (the group D4) Unit II: Formation of groups of symmetries of the following Chemical Molecules (Configuration of atoms). H2O (the group V4) H2O2 Trans- N2 – F2 (the group V4) NH3, PCl3, CHCl3(the group S3) Unit III: Concept of isomorphism of groups, Isomorphism of multiplicative group with the group C2 of the symmetries of an isosceles triangle, Isomorphism of multiplicative group with the group V4 of the symmetries of a rectangle, Isomorphism of group V4 of the symmetries of a rectangle with the group of symmetries of H2O, Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi.

	2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-501: Group Theory

Course Code	**MTH-501**
Course Title	**Group Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group theory.
Course Objective	To make students acquainted with concepts of group theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of group theory. CO2 : Understand Cosets, Lagrange's theorem, Euler's theorem, Fermat's theorem, counting principle CO3 : Learn about Concept of Normal subgroup & Quotient groups, Homomorphism with their properties. CO4 : Recognize Automorphisms, Cayley's theorem and its applications CO5 :Determine different permutation and Permutation Groups, even permutation, odd permutation.

	CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Group theory
Course Content	Unit 1: Cosets, Congruence Relation in Group Lagrange's theorem, Euler's theorem, Fermat's theorem, Counting principle. Unit 2: Normal subgroups &Quotientgroups, Homomorphism, Isomorphism, Isomorphic groups, Fundamental theorem ofhomomorphism. Unit 3: Automorphisms, Cayley's theorem and its applications. Unit 4: Permutation Groups, Orbit& Cycles, Even permutation, Odd permutation, Alternating Group.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-502: Linear Algebra - I

Course Code	**MTH-502**
Course Title	**Linear Algebra - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the LinearAlgebra.
Course Objective	To make students acquainted with concepts of LinearAlgebra.
Course Outcomes	The course will enable the students to:
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of algebraic system
Course Content	Unit 1: Definition and examples of Vector space, Subspace, Necessary and sufficient condition for a subspace, Illustrations. Unit 2: Span of a set, union and intersection of subspaces, sum and direct sum of subspaces. Unit 3: Linearly dependent and independent vectors, checking of Linear dependence or independence.

	Unit 4: Dimension and Basis of a vector space, extension of a linearly independent set to a basis, dimension of sum.
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-503: Real Analysis - I

Course Code	**MTH-503**
Course Title	**Real Analysis - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Countable & Uncountable sets, Greatest lower bound and least upper bound

<table>
<tr><td></td><td>CO3 : Recognize Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences.
CO4 : Learn about operations on convergent sequences.
CO5 :Analyze Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence.
CO6 : Apply Basic of real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Countable & uncountable sets, greatest lower bound and least upper bound.

Unit 2:
Sequences of real numbers, sub-sequences, limit of a sequence, convergent sequences, divergent sequences.

Unit 3:
Bounded sequences, monotone sequences, operations on convergent sequences.

Unit 4:
Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence.</td></tr>
<tr><td>Reference Books</td><td>1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co.
2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi.
3. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi.
4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
</table>

Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-504: Real Analysis - II

Course Code	**MTH-504**
Course Title	**Real Analysis - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Limit and Continuity of a function on the real line, Definition & examples of Metric spaces CO3 : Recognize Open ball in R1, open ball in metric space, functions continuous on metric spaces. CO4 : Learn about Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics.. CO5 :Analyze Open sets and their properties. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Revision of Limit and Continuity of a function on the real line, Definition & examples of Metric spaces. Unit 2: Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics. Unit 3: Open ball in R1, open ball in metric space, functions continuous on metric spaces. Unit 4: Open sets, more about open sets.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. D. SomSundaram& B. Chaudhari : A first course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997. 5. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-505: Graph Theory

Course Code	**MTH-505**
Course Title	**Graph Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Graph theory
Course Objective	To make students acquainted with concepts of Graph Theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the graph theory. CO2 : Understand the graph theory and relevant term CO3 : Recognize Subgraphs, Isomorphism between two graphs. CO4 : Learn about Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs and Components of graphs . CO5 :Analyze Euler graph and their properties. CO6 : Apply graph .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphs, various type of graphs, incidence and degree, isolated

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	and pendent vertices, Subgraphs, Isomorphism between two graphs. Unit 2: Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs, Components of graphs. Unit 3: Euler graphs, Arbitrary traceable graph, Hamiltonian Graphs, Applications of graphs: Konigsberg Bridge Problem, Seating Arrangement Problem, Utility Problem. Unit 4: Trees, Properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and Diameter of a Tree, Rooted & Binary trees.
Reference Books	1. NarsinghDeo : Graph Theory with applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd., 2000. 2. R. J. Wilson : Introduction to Graph Theory, Academic Press, New York, 1972. 3. E. Harray : Graph Theory, Addison Wesley Pub. Co., 1969. 4. C. Berge : The Theory of Graphs and its Applications, John Wiley & Sons, 1962.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-506: Number Theory - I

Course Code	**MTH-506**
Course Title	**Number Theory - I**

<table>
<tr><td>Credit</td><td>3</td></tr>
<tr><td>Teaching per Week</td><td>3 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2019</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand the Number theory</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Number theory.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the number theory.
CO2 : Understand the Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm
CO3 : Compute the solutions of linear Diophantine equations in two variables
CO4 :Learn about Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences
CO5 :Analyze Basic properties of Congruence, divisibility tests.
CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm, relation between greatest common divisor and least common multiple of two integers.

Unit 2:
Computation of the solutions of linear Diophantine equations in two variables, Primes</td></tr>
</table>

	and composite numbers, the fundamental theorem of arithmetic, Pythagorean theorem for the irrationality of √2 . Unit 3: Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences. Unit 4: Basic properties of Congruence, divisibility tests of 9 and 11.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5001: Operations Research-I(ElectiveGeneric)

Course Code	**E.G.-5001**
Course Title	**Operations Research-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operations research.

Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research. CO2 : Understand Linear programming problem and their Graphical solution. CO3 : Compute the solutions LPP by dual simplex method CO4 :Learn about Definition of the dual problem and their properties CO5 : Find the solution of LPP by Big-M method. CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphical Solution of Linear programming problem (LPP). Definition of the dual problem, General rules for converting any primal problem into it's dual, The symmetric dual problems. Unit 2: Basic concept of basic, non-basic, degenerate, non-degenerate and basic feasible solutions of LPP, slack & surplus variables, LPP in the standard matrix form, Slack & surplus variables, Solution of LPP using Simplex method. Unit 3: Solution of LPP using Two Phase Simplex method and Big-M method.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5002: Computer Oriented Numerical Methods – I(ElectiveGeneric)

Course Code	**E.G.-5002**
Course Title	**Computer Oriented Numerical Methods – I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 : Understand Flow charts and symbols, More flow charting examples

<table>
<tr><td></td><td>and FORTRAN language

CO3 : Compute the operations in expressions

CO4 :Learn about Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries.

CO5 : Familiarize with Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program.

CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:

Flow charts and symbols, More flow charting examples.

FORTRAN language, character used in FORTRAN, FORTRAN constants, FORTRAN variable names, Type declaration for integer and real, Arithmetic expression (real and integer expressions), Hierarchy of operations in expressions, Examples of Arithmetic expression.

Unit 2:

Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries.

Unit 3:

Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program, FORTRAN programming examples.</td></tr>
<tr><td>Reference Books</td><td>1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI.
2. V. Rajaraman : Computer Oriented Numerical Methods, PHI.
3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd.</td></tr>
</table>

	4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5003: Fourier Series (ElectiveGeneric)

Course Code	**E.G.-5003**
Course Title	**Fourier Series**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Series.
Course Objective	To make students acquainted with concepts of Fourier Series.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Series. CO2 : Understand the Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion CO3 : Compute the Fourier series of functions CO4 :Learn about Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. CO5 : Familiarize with Half range series, Typical waveforms, Parseval's formula,

	Root mean square value, Complex form of Fourier series. CO6 : Apply Fourier series in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion. Unit 2: Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. Unit 3: Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series.
Reference Books	1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi. 2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi. 3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE. 5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 6th Semester

Course: MTH-601: Ring Theory

Course Code	**MTH-601**
Course Title	**Ring Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Ring theory.
Course Objective	To make students acquainted with concepts of ring theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of Ring theory. CO2 : Understand Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal CO3 : Learn about different kinds of ring and their properties.. CO4 : Recognize Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. CO5 : Link theParticular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial. CO6 : Apply Ring theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of group theory

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Course Content	Unit 1: Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal. Unit 2: Euclidean rings, divisibility in commutative ring, gcd of two elements in a ring, units and associates in rings. Unit 3: Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. Unit 4: Particular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-602: Linear Algebra - II

Course Code	**MTH-602**
Course Title	**Linear Algebra - II**

<table>
<tr><td>Credit</td><td>3</td></tr>
<tr><td>Teaching per Week</td><td>3 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2019</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the LinearAlgebra.</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of LinearAlgebra.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:

CO1 : Explain the insight of the Linear algebra.

CO2 : Understand Linear Transformation and their properties

CO3 : Learn about rank nullity and their properties

CO4 : Recognize Matrix associated with linear transformations.

CO5 :Analyze Inner product spaces, Norm of a vector and properties.

CO6 : Apply linear algebra in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td><table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Pre-requisite</td><td>Basics of linear algebra</td></tr>
<tr><td>Course Content</td><td>Unit 1:

Definition and examples of Linear transformation, Range and kernel of a linear transformation.

Unit 2:

Rank-Nullity Theorem, Inverse of a linear transformation, Consequences of Rank-Nullity Theorem, Composition of linear transformations.</td></tr>
</table>

	Unit 3: Matrix associated with linear transformations, linear transformation associated with a matrix, Application of Rank-Nullity Theorem for matrix. Unit 4: Inner product spaces, Norm of a vector, Cauchy-Schwarz's inequality, Triangular inequality, Orthogonalvectors, Vector Projection, Gram-Schmidt Orthogonalization Process, OrthonormalSet.
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-603: Real Analysis - III

Course Code	**MTH-603**
Course Title	**Real Analysis - III**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.

Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Convergence and divergence of series of real numbers CO3 : Recognize Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. CO4 : Learn about different type of series . CO5 :Analyze Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Convergence and divergence of series of real numbers, Series with non-negative terms, Alternating series, Conditional and absolute convergence. Unit 2: Tests for absolute convergence, Series whose terms form a non-increasing sequence. Unit 3: Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Unit 4: Non Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus, Mean-value Theorems of Integral Calculus.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. Louis Leithold : Calculus with analytic Geometry, Harper and Collins Pub. Co. 5. J. B. Thomas and Finney : Calculus with analytic Geometry. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-604: Real Analysis - IV

Course Code	**MTH-604**
Course Title	**Real Analysis - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis.

	CO2 : Understand Limit points, closure of a set, closed sets, homeomorphism of metric spaces CO3 : Recognize Connected sets, Bounded sets, Totally bounded sets. CO4 : Learn about Complete metric spaces, Contraction mapping, Picard's fixed point theorem. CO5 :Analyze Open covering, Heine-Borel property. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of real analysis
Course Content	Unit 1: Limit points, closure of a set, closed sets, homeomorphism of metric spaces, dense set. Unit 2: Connected sets, Bounded sets, Totally bounded sets. Unit 3: Complete metric spaces, Contraction mapping, Picard's fixed point theorem. Unit 4: Compact metric spaces, Open covering, Heine-Borel property, Finite Intersection property.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	4. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 5. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company. 6. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: 605: Discrete Mathematics

Course Code	**MTH-605**
Course Title	**Discrete Mathematics**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Discrete Mathematics
Course Objective	To make students acquainted with concepts of Discrete Mathematics.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Discrete Mathematics. CO2 : Understand the relation , lattice and relevant term CO3 : Recognize Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. CO4 : Learn about Boolean Algebra as an algebraic system, Boolean expressions. CO5 :Determine Minimization of Boolean functions by Karnaugh Map method.

	CO6 : Apply Discrete Mathematics .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Binary relations, Properties of binary relations, Equivalence relation, Partial ordered relation, Partially ordered sets, Upper bounds, Lower bounds, GLB & LUB of sets, Totally ordered sets, Well ordered sets, Hasse Diagram, Lattices and its properties. Unit 2: Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. Unit 3: Boolean Algebra as an algebraic system, Boolean expressions (forms), Different representation of Boolean forms, Sum of products canonical form and product of sums canonical forms of Boolean expressions. Unit 4: Minimization of Boolean functions by Karnaugh Map method and Quine- McCluskey algorithm, AND, OR & NOT gates, Reduction of switching circuit diagram.
Reference Books	1. J. P. Tremblay & R. Manohar : Discrete mathematical Structures with Applications to Computer Science., McGraw Hill Book Co., 1999. 2. B. Kolman, R. C. Busby & S. Ross : Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd., 3rd ed. 2001. 3. Elements of Discrete Mathematics, C. L. Liu, D. P. Mohapatra, Tata McGraw Hill, 2008. 4. Discrete Mathematics with Applications, Thomas Koshy, Academic Press, 2004.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-606: Number Theory - II

Course Code	**MTH-606**
Course Title	**Number Theory - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Understand Fermat's little theorem, Pseudo-primes, Wilson's theorem CO3 : Compute the solutions of linear congruence , the Chinese Remainder Theorem CO4 :Learn about The number of positive divisors, multiplicative nature of functions, The Möbius Inversion formula CO5 :Analyze Euler's Phi-function and related theorem. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of number theory
Course Content	Unit 1: Computation of the solutions of linear congruence , the Chinese Remainder Theorem. Unit 2: Fermat's little theorem, Pseudo-primes, Wilson's theorem. Unit 3: The number of positive divisors and sum of all positive divisors of an integer, basic properties and multiplicative nature of these functions, The Möbius Inversion formula (without proof), the greatest integer function. Unit 4: Introduction of Euler's Phi-function , multiplicative nature of (statement only), Euler's Theorem.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G. 6001: Operations Research-II (ElectiveGeneric)

Course Code	**E.G.- 6001**

<table>
<tr><td>Course Title</td><td>Operations Research-II</td></tr>
<tr><td>Credit</td><td>2</td></tr>
<tr><td>Teaching per Week</td><td>2 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2019</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Operation research.</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Operations research.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Operations research.
CO2 : Understand the transportation problem and their solutions.
CO3 : Compute the solutions of Assignment problem
CO4 :Learn about Competitive games theory
CO5 : Find the solution Game theory problem by graphical method
CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Transportation problem, methods for finding initial basic feasible solution,
solution of Transportation problem by MODImethod, Unbalanced Transportation problem.

Unit 2: Assignment problems, The Hungarian method, balanced & unbalance assignment problems.</td></tr>
</table>

	Unit 3: Competitive games, two-person zero-sum game, maximin and minimax principle, saddle points and the value of the game (based on pure strategies), mixed strategies, solution of games with saddle point, Game without saddle points, Dominance rule, solution of m×2 and 2×n games using graphical method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.-6002: Computer Oriented Numerical Methods – II (ElectiveGeneric)

Course Code	**E.G.-6002**
Course Title	**Computer Oriented Numerical Methods – II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.

<table>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Computer Oriented Numerical Methods.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Computer Oriented Numerical Methods.
CO2 : Understand Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement
CO3 : Apply the Statement labels, GO TO statement and DO statement
CO4 :Learn about Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted expression, Dimension statement, DO type notation for input / output statement.
CO5 : Familiarize with FORMAT specification and FORMAT specification for a numerical data.
CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td><table><tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr><tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Pre-requisite</td><td>Basics of Computer Oriented Numerical Methods</td></tr>
<tr><td>Course Content</td><td>Unit1:
Controlstatements,Relationaloperators,LogicalIFstatement,ArithmeticIFstatement,Block IFstatement. Statement labels, GO TO statement, Example of use of Logical IF statement.

Unit2:
Nested logical IF statement, Computed GO TO statement, DO statement, Examples of DO statement. Rules to be followed in utilizing DO loops, Subscripted variables, Sub scripted Expression. Dimension statement, DO type notation for input/output statement. FORMAT specification.</td></tr>
</table>

	Unit3: FORMATspecificationforanumericaldata, Iterative methods. Numerical integrations and differentiations. Numerical solution of ordinary differential equations.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.-6003: Fourier Transform and its Applications (ElectiveGeneric)

Course Code	**E.G.-6003**
Course Title	**Fourier Transform and its Applications**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Transform and its Applications.
Course Objective	To make students acquainted with concepts of Fourier Transform and its Applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Transform and its Applications. CO2 : Understand the Integral transforms, Fourier Transforms, Properties of

<table>
<tr><td></td><td>Fourier Transform

CO3 : Compute the Fourier Transform

CO4 :Learn about Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform

CO5 : Familiarize with Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function

CO6 : Apply Fourier Transform in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Fourier series</td></tr>
<tr><td>Course Content</td><td>Unit 1:

Integral transforms, Fourier Transforms, Properties of Fourier Transform and its application.

Unit 2:

Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform.

Unit 3:

Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function, Fourier transform and its applications.</td></tr>
<tr><td>Reference Books</td><td>1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi.
2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi.
3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi.
4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE.
5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut</td></tr>
</table>

Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

Bachelor of Science (Mathematics)
CO-PO-2021-22

Name of Program	**Bachelor of Science (Mathematics)**
Abbreviation	**B.Sc.- Mathematics**
Duration	**3 Years**
Eligibility Criteria	Passed 12th Science with mathematics or equivalent Degree.
Objective of Program	The core objective of the B.Sc. in Mathematics is to prepare the students for productive career by providing a solid education in the basic subjects of mathematical knowledge and its applications with outstanding environment of teaching and research in the core and emerging areas of the discipline.
Program Outcome	**PO1 : Fundamental Knowledge Enrichment** Program trains students with the core Mathematics knowledge domains. It also makes students capable of using core concepts in the conceptualization of domain specific application. **PO2 : Critical Thinking Development** The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem. **PO3 : Develop arguments in a logical manner** The program trains students to formulate and develop arguments in a logical manner and make them ready to prepare real world problem solution mathematically. **PO4 : Develop decision making ability** The program develop the skill in students to take decisions at intellectual, organizational and personal from different perspectives of life using analysis **PO5 : Computational Skill Development** The program develop basic computational skill in students for planning and managing process of complex real world. **PO6 : Provides an effective Mathematical communication skill** The program develop an effective Mathematical communication skill in the students. **PO7 : Team Work and Leadership Development** Trains students to work in a team and also to take leadership.
Program Specific Outcomes	PSO1 : Develop and strengthen the fundamental core concepts that are required to solve complex problems PSO2 : Develop the skills that needs independent logical and analytical thinking, teamwork and leadership PSO3 : Nurture the students to investigate and development of a workable solution for a real world problem

Chairman
DR. M. R. Tale
B.O.S Mathematics

	PSO4 : Develop students for self-learning and practicing challenging problem solution PSO5 : Train students to apply mathematical skills for new investigation. PSO6 : Train students to expand their knowledge of fields related to their current areas of professional specialization. PSO7 : Train students to take-up the real world challenges to develop workable solution to a domain specific problem. PSO8 : Inculcate the passion for continuous learning and doing research for making a successful professional career.

Mapping between POs and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
PO1								
PO2								
PO3								
PO4								
PO5								
PO6								
PO7								

Medium of Instruction	English
Program Structure	Semester 1

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-101	Mathematics-I	3	0	3	2Hrs	50	20	70
MTH-102	Mathematics-II	3	0	3	2Hrs	50	20	70
	Total	6	0	6				

Program Structure	Semester 2

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-201	Mathematics-III	3	0	3	2Hrs	50	20	70
MTH-202	Mathematics-IV	3	0	3	2Hrs	50	20	70
	Total	6	0	6				

Program Structure	Semester 3

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		

MTH-301	Mathematics-V	3	0	3	2Hrs	50	20	70
MTH-302	Mathematics-VI	3	0	3	2Hrs	50	20	70
MTH-303	Mathematics-VII	3	0	3	2Hrs	50	20	70
E.G.	3001-MathematicalMethods	2	0	2	2Hrs	50	20	70
	3002-GroupofSymmetries–I	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 4

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-401	Mathematics-VIII	3	0	3	2Hrs	50	20	70
MTH-402	Mathematics-IX	3	0	3	2Hrs	50	20	70
MTH-403	Mathematics-X	3	0	3	2Hrs	50	20	70
E.G.	4001-MathematicalModeling	2	0	2	2Hrs	50	20	70
	4002-GroupofSymmetries–II	2	0	2	2Hrs	50	20	70
	Total	11	0	11				

Program Structure	Semester 5

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-501	GroupTheory	3	0	3	2Hrs	50	20	70
MTH-502	LinearAlgebra-I	3	0	3	2Hrs	50	20	70
MTH	RealAnalysis-I	3	0	3	2Hrs	50	20	

-503								70
MTH -504	RealAnalysis-II	3	0	3	2Hrs	50	20	70
MTH -505	GraphTheory	3	0	3	2Hrs	50	20	70
MTH -506	NumberTheory-I	3	0	3	2Hrs	50	20	70
E.G.	5001-OperationsResearch– I	2	0	2	2Hrs	50	20	70
	5002-ComputerOriented NumericalMethods –I	2	0	2	2Hrs	50	20	70
	5003-Fourier Series	2	0	2	2Hrs	50	20	70
	Total	20	0	20				

Program Structure: Semester 6

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH -601	RingTheory	3	0	3	2Hrs	50	20	70
MTH -602	LinearAlgebra–II	3	0	3	2Hrs	50	20	70
MTH -603	RealAnalysis–III	3	0	3	2Hrs	50	20	70
MTH -604	RealAnalysis–IV	3	0	3	2Hrs	50	20	70
MTH -605	DiscreteMathematics	3	0	3	2Hrs	50	20	70
MTH -606	NumberTheory–II	3	0	3	2Hrs	50	20	70
E.G.	6001-OperationsResearch– II	2	0	2	2Hrs	50	20	70
	6002-ComputerOriented NumericalMethods –II	2	0	2	2Hrs	50	20	70

	6003-FourierTransformanditsApplications	2	0	2	2Hrs	50	20	70
	Total	**20**	**0**	**20**				

B.Sc.Mathematics 1st Semester

Course: MTH-101: **Mathematics-I**

Course Code	**MTH-101**
Course Title	Mathematics-I
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Trigonometry .
Course Objective	To make students acquainted with concepts of Trigonometry
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the fundamental aspects of the Trigonometry . CO2 : Assimilate the De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments. CO3 : Calculate the Indeterminate forms by using Euler's expressions, Hyperbolic functions.. CO4 : Understand the Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts. CO5 : Sketch curves in Trigonometric and hyperbolic functions. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit –I De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments.

	Unit-II Euler's expressions, Evaluation of Indeterminate forms by using Euler's expressions, Hyperbolic functions for real arguments and their inverses. Unit-III Exponential, Circular and Hyperbolic functions of complex variables and their identities, Euler's Theorem, Relations between circular and Hyperbolic functions. Unit-IV Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.
Reference Books	1. S. L. Loney: Plane Trigonometry, Part I and II, McMillan and Co. London. 2. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd. Allahabad. 3. E. Kreyszig: Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 4. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc.Mathematics 1st Semester

Course: MTH-102: **Mathematics-II**

Course Code	**MTH-102**
Course Title	Mathematics-2
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the conceptscalculusofand learn its applications.
Course Objective	To make students acquainted with concepts of calculus.
Course Outcomes	This course will enable the students to CO1 : Explain the insight of the historical and fundamental aspects the Calculus. CO2 : Assimilate the Successive differentiation, Leibnitz theorem and its applications CO3 : Understand the consequences of various mean value theorems for differentiable functions , Asymptotes, Concavity, Convexity and reduction function. CO4 : Calculate the Curvature and radius of curvature. CO5 : Apply concept of Increasing and Decreasing functions, Asymptotes, Concavity

	and Convexity CO6 : Apply calculus in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	<table><tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr><tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>
Pre-requisite	Basics of Mathematics
Course Content	Unit –I Successive differentiation, Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions), Leibnitz theorem and its applications Unit-II Rolle's Theorems and its geometrical interpretation, Lagrange's Theorem and its geometrical interpretation, Cauchy theorem, Maclaurin and Taylor series expansions Unit-III Curvature and radius of curvature (except Polar form), Increasing and Decreasing functions, Asymptotes, Concavity and Convexity Unit-IV Reduction formulae for integration of $sin^n x, cos^n x, tan^n x, cot^n x, sec^n x, cosec^n x, sin^p x cos^q x, x^m cosnx, x^m sinnx.$
Reference Books	1. Shantinarayan: Differential Calculus, Revised EditionDecember-2004 , S. Chand and Co. New Delhi. 2. Shantinarayan: Integral Calculus, S. Chand and Co. New Delhi. 3. Gorakhprasad: Differential Calculus, Pothishala Pvt. Ltd. Allahabad. 4. M. R. Spigel: Theory and Problems of Advanced Calculus, Schaum's Publishing Co., New York. 5. N. P. Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-201: **Mathematics-III**

Course Code	**MTH-201**
Course Title	Mathematics-III
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the theory of matrices with its applications.
Course Objective	To make students acquainted with concepts of Theory of matrices.
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of fundamental aspects the theory of matrices. CO2 : Understand the genesis of theory of matrices.. CO3 : Learn elementary raw operations, rank theory and matrix properties. CO4 : Find eigen values and corresponding eigenvectors for a square matrix. CO5 : Calculate solution of linear system of equation. CO6 : Apply matrix theory in social sciences, physical sciences, life sciences and a host of other disciplines.
Mapping between COs with PSOs	
Pre-requisite	Basics of Matrices
Course Content	Unit-I Different types of matrices, Operation on matrieces, Properties of operation of matrices, Elementary row operations. Unit-II Row-reduced echelon forms. Inverse of matrix by Row-Reduced Echelon form, Row rank of a matrix, Quadratic form. Unit-III Trace of matrix and its properties, Solution of homogeneous system of linear equations using row –reduced echelon forms. Unit-IV Characteristic equation of a matrix, Method to find Characteristic equation using determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix, Cayley-Hamilton theorem and its application to find an inverse of a matrix, Method of diagonalization.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Reference Books	1. Krishnamurthy, Mainra and Arora: An Introduction to linear Algebra, Affiliated West Press Pvt. Ltd., New Delhi. 2. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India (P) Ltd., 2009. 3. B.S.Vasta and SuchiVasta: Theory of Matrices; 4rd Edition -2014, New Age International (P) Ltd. Publishers, New Delhi. 4. Shantinarayan: Text book of Matrices, S. Chand and Co., New Delhi. 5. H. K. Dass, H. C. Saxena, M. D. Raisinghania: Simplified course in Matrices, S. Chand and Co., NewDelhi. 6. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-202: **Mathematics-IV**

Course Code	**MTH-202**
Course Title	Mathematics-IV
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Objective	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Outcomes	The course will enable the students to: CO1 : Understand the genesis of Integral Calculus and ordinary differential equations. CO2: Sketch curves in Cartesian coordinate systems. CO3 :To solve first order first degree and first order higher degree differential equation. CO4 : Grasp the concept of a general solution of a higher order linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations. CO5: To solve initial and boundary value problem. CO6 : Apply Integral Calculus and Differential Equations in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								
Pre-requisite	Basics of Derivative								
Course Content	Unit-I Curve Tracing : Equation of the form $y = f(x)$,Equation of the form $y^2 = f(x)$,Parametric equations, Tracing of Polar curves. Unit-II Application of Integral calculus: Length of a curve, Intrinsic equation (except polar coordinates). Unit:III Bernoulli's equation, Exact differential equation, Differential equations of first order and higher degree : Solvable for x, y, p and Lagrange's equation, Clairaut's equation. Unit-IV Linear Differential Equations with constant coefficients: Complimentary functions, Particular Integral, General Solution, Method for finding Particular Integral specially for e^{ax}, sinax, cosax, polynomial in terms of x, $e^{ax}V$ and xV, where V is a function of x.								
Reference Books	1. 1.Shantinarayan : Differential calculus ,4th edition -2001,Shyamlal Charitable Trust,Ramnagar New Delhi, S. Chand and Company LTD. 2. Shantinarayan: Integral Calculus, Revised Edition-2009, S.Chand and Co., New Delhi. 3. Gorakhprasad: Integral Calculus, PothishalaPvt.Ltd., Allahabad. 4. D.A.Murray: Differential Equations, Tata Mc Graw Hills. 5. Frank Ayres: Theory and problems on Differential Equations, Mc Graw Hill Book Co., New York. 6. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.								
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment								
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination								

B.Sc. Mathematics 3rd Semester

Course: MTH-301: **Mathematics-V**

Course Code	**MTH-301**
Course Title	Mathematics-V
Credit	3

Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the function of two variable and their calculus.
Course Objective	To make students acquainted with concepts of the function of two variable and their calculus.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the function of two variable and their calculus. CO2 :Find the Limits and Continuity of a function of two variables, Partial Differentiation. CO3 :Calculate Jacobian as well as Maxima and Minima for function of two variable. CO4 :Find vectorGradient, Divergence and Curl. CO5 : Apply multivariable calculus to solve function of two variable problems. CO6 : Apply function of two variable and vector calculus in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of calculus
Course Content	Unit I: Limits and Continuity of a function of two variables, Partial Differentiation, Total Differential, Composite function, Homogeneous functions. Unit II: Euler's theorem for Homogeneous functions, Taylor's theorem for functions of two variables, Maclaurian's expansions in power series, Jacobian. Unit III: Maxima-Minima for functions of two variables: Necessary and sufficient conditions for extreme points. Unit IV: Vector point function, Differentiation of a Vector point function, Gradient, Divergence and Curl and their properties, Line Integral.
Reference Books	1. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 2. Hari Kishan : Vector Algebra and Calculus, Atlantic Pub. & Distributors(P) Ltd., New Delhi. 3. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 4. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi. 5. N. P. Bhamore& et el : Mathematics Paper III–IV, Popular Prakashan,

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3rd Semester

Course: MTH-302: **Mathematics-VI**

Course Code	**MTH-302**
Course Title	Mathematics-VI
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of basics of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 :Recognize the errors and their numerical computation CO3 : Obtain numerical solutions of algebraic and transcendental equations. CO4 : Learn about various interpolating and extrapolating methods. CO5 : predict future trend by interpolating and extrapolating methods. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Error estimation: Errors and their computations, A general error formula. Unit II: Numerical Solutions of Algebraic and Transcendental Equations: Bisection Method, Method of False position, Iteration Method, Newton-Raphson's Method. Unit III:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols, Differences of Polynomials. Unit IV: Newton's Forward and Backward Formulae, Gauss' Interpolation formulae.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 5th Edition. 2. M. K. Jain, Iyenger, Jain : Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, Mc Graw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods and Analysis, Mc Graw Hill Book Co., London. 6. P. C. Biswal:NumericalAnalysis,Prentice-HallofIndia, 2008. 7. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chandand Co., 2005.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: MTH-303: **Mathematics-VII**

Course Code	**MTH-303**
Course Title	Mathematics- VII
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the higher order differential equation and basics of partial differential equation.
Course Objective	To make students acquainted with concepts of higher order differential equation and basics of partial differential equation.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Linear Differential Equations with variable coefficients. CO2 :Find solution ofSecond order Differential Equations CO3 : Learn about Formation of Partial Differential Equation. CO4 : Solve Partial Differential Equations by direct integral methods. CO5 : Obtain solution Nonlinear Partial Differential Equations of first order. CO6 : Apply differential equation in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								
Pre-requisite	Basics of ordinary differential equation and partial derivative								
Course Content	Unit I: Linear Differential Equations with variable coefficients, Homogeneous Differential Equations, Legendre's Differential Equation. Unit II: Second order Differential Equations: Solution in terms of known Integral, Solution by method of removal of first order derivatives, Method of Changing Independent Variable. Unit III: Formation of Partial Differential Equation, Solution of Partial Differential Equations, Equations solvable by direct integral. Unit IV: Partial Differential Equations of first order, Nonlinear Partial Differential Equations of first order, Some special methods.								
Reference Books	1. D. A. Murray: An Introductory Course in Differential Equations, Orient Longmans, Bombay. 2. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company. 3. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi. 4. Gorakhprasad : Differential Equations, Pothishala Pvt. Ltd., Allahabad. 5. M. D. Rai Singhania : Differential Equations, S. Chand & Co., New Delhi. 6. Nita H. Shah : Ordinary and Partial Differential Equations : Theory and Applications, PHI Learning Pvt. Ltd, New Delhi. 7. N. P. Bhamore& et el. : Mathematics Paper III–IV, Popular Prakashan, Surat.								
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment								
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination								

B.Sc. Mathematics 3nd Semester

Course: E.G.-3001: Mathematical Methods

<table>
<tr><td>Course Code</td><td>E.G.-3001</td></tr>
<tr><td>Course Title</td><td>Mathematical Methods</td></tr>
<tr><td>Credit</td><td>2</td></tr>
<tr><td>Teaching per Week</td><td>2 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2021</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the difference method</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Mathematical difference Method.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the difference calculus.
CO2 :Find Finite difference and Method of unknown coefficients
CO3 : Learn about Difference equation.
CO4 : Solve problem of Difference equation.
CO5 : Obtain solution of Homogeneous difference equations with constant coefficients.
CO6 : Apply difference calculus in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Notations of finite difference calculus, Operators E, Δ , Relations between different operators and their prosperities, Relation between difference and differential operators, Method of constructing difference tables, Finding the missing terms.

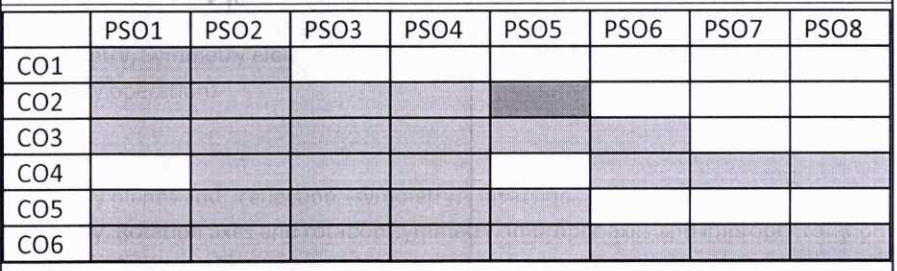
Unit II:</td></tr>
</table>

	Factorial notation, Expression of polynomials in factorial notation by using finite differences, Method of unknown coefficients. Unit III: Difference equations: Order and degree of a difference equation, Solution of difference equations, Homogeneous difference equations with constant coefficients.
Reference Books	1. S.S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition. 2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods & Analysis, McGraw Hill Book Co., London.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: E.G.-3002: Group of Symmetries-I

Course Code	**E.G.-3002**
Course Title	**Group of Symmetries-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Group theory. CO2 :Identify Sub group and their properties CO3 : Learn about Symmetry planes and reflection symmetry. CO4 : Solve problem of Product of symmetry operations.

	CO5 : Analyze consequences of Rotation axes and rotation symmetry CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Definition of a group and its elementary properties, Order of a group, Order of an element of a group, Group multiplication tables, Examples of groups including finite groups and infinite groups, Abelian groups, Cyclic groups. Unit II: Subgroup, Condition that a subset is a subgroup, Examples of subgroups, Basic concept of symmetry, Symmetry elements and symmetry operations in a space, Identity symmetry operation. Unit III: Symmetry planes and reflection symmetry, Inversion centre and inversion symmetry, Rotation axes and rotation symmetry, Improper axes and improper rotation symmetry, Product of symmetry operations.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi. 2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 4th Semester

Course: MTH-401: Mathematics-VIII

<table>
<tr><td>Course Code</td><td>MTH-401</td></tr>
<tr><td>Course Title</td><td>Mathematics-VIII</td></tr>
<tr><td>Credit</td><td>3</td></tr>
<tr><td>Teaching per Week</td><td>3 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2021</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Special function, double Triple integral and Laplace transform</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of the Special function, double Triple integral and Laplace transform.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the beta gamma functio.
CO2 : Find Double and triple integrals
CO3 : Learn about Laplace transform .
CO4 : Realize importance of Laplace transform.
CO5 : Determine various Inverse Laplace transform.
CO6 : Apply the Special function, double Triple integral and Laplace transform in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Beta-Gamma functions: Relation between Beta and Gamma functions, Properties, Applications of Beta-Gamma function.

Unit II:
DoubleandTripleIntegrals:Changeoforder of Doubleintegrals, Area.

Unit III:
Laplace Transform of elementary functions, Properties of Laplace Transform, Differentiation and Integration of Laplace Transform, Laplace Transform of derivatives</td></tr>
</table>

	and integrals Unit IIV: Inverse of Laplace Transform: Method of Partial fractions, Properties of inverse Laplace Transform.
Reference Books	1. David V. Widder : Advanced Calculus, PHI Learning Pvt. Ltd, New Delhi 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 4. N. P. Bhamore& et al : Mathematics Paper III-IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-402:Mathematics-IX

Course Code	**MTH-402**
Course Title	Mathematics-IX
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 : Understand the Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula CO3 : Obtain numerical Differentiation. CO4 : Learn about Numerical Integration. CO5 :Determine Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	CO4								
	CO5								
	CO6								
Pre-requisite	Basics of Mathematics								
Course Content	Unit I: Finite difference with unequal interval, Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula. Unit II: Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae. Unit III: Numerical Integration: General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule. Unit IV: Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.								
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition. 2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner: Numerical Methods and Analysis, McGraw Hill Book Co., London								
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment								
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination								

B.Sc. Mathematics 4th Semester

Course: MTH-403: **Mathematics-X**

Course Code	**MTH-403**
Course Title	Mathematics – X
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)

<table>
<tr><td>Effective From</td><td>June 2021</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the concepts of Basic real analysis and basic of number theory.</td></tr>
<tr><td>Course outcomes</td><td>To make students acquainted with concepts of Basic real analysis and basic of number theory.</td></tr>
<tr><td>Course Objective</td><td>The course will enable the students to:
CO1 : Explain the insight of the Divisors GCD and LCM, prime number, Congruence relation.
CO2 :Separate Countable & uncountable set
CO3 :FindGreatest lower bound and least upper bound.
CO4 :Learn about basics of Sequences of real numbers, Sub-sequences.
CO5: IdentifyConvergent sequences, Divergent sequences
CO6: Apply Basic of number theory in social sciences, physical sciences, life sciences and a host of other disciplines.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Sets and elements, Operations on sets, Functions, Real-valued functions.

Unit II:
Countable & Uncountable sets, Greatest lower bound and least upper bound.

Unit III:
Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences.

Unit IV:
Divisors, Greatest common divisor, Least Common multiple, Prime numbers, Fundamental theorem of Arithmetic, Congruence relation, Equivalence classes.</td></tr>
<tr><td>Reference Books</td><td>1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co.
2. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 2006.
3. I. H. Sheth : Abstract Algebra, Nirav Prakashan, Ahmedabad.
4. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi.
5. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi.
6. Shantinarayan : Modern Algebra, S. Chand and Co., New Delhi.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

B.Sc. Mathematics 4th Semester

Course: E.G.-4001: Mathematical Modelling

Course Code	**E.G.-4001**
Course Title	**Mathematical Modelling**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Mathematical Modelling .
Course Objective	To make students acquainted with concepts Mathematical Modelling.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Mathematical Modelling. CO2 : explain the concept of mathematical modelling CO3 : formulate the real world problem into Mathematical form. CO4 :analyze the mathematical model. CO5 : Predict the future by using mathematical modelling. CO6 : Apply Mathematical modelling in social sciences, physical sciences, life sciences and a host of other disciplines

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics Ordinary differential equation
Course Content	Unit I: Mathematical modelling through ordinary differential equation of first order, Linear growth models; Linear decay models, Models for growth of Science and scientists. Unit II: Non-linear growth and decay models, Model of Logistic law of population, Spread of technological innovation, Spread of infectious diseases. Unit III: Mathematical models of geometrical problems through ordinary differential equation

	of first order, Simple geometrical problems, Orthogonal trajectories.
Reference Books	1. J. N. Kapoor: Mathematical Modelling, New Age International Publishers, New Delhi. 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. J. K. Sharma: OR Theory & Applications, Mac Milian India Ltd., 1998. 4. G.Hadley:Linear Programming, Narosa Publishing House, New Delhi,1995. 5. G. Paria : Linear Programming, Transportation, Assignment, Game, Books & Allied Pvt. Ltd. Calcutta.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: E.G.-4002: Group of Symmetries-II

Course Code	**E.G.-4002**
Course Title	**Group of Symmetries-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of groups of symmetries. CO2 : Understand formation of groups of symmetries of the Chemical Molecules CO3 : Learn about Concept of isomorphism of groups. CO4 : Recognize Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3. CO5 :Determine Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	CO4 CO5 CO6
Pre-requisite	Basics of Group of Symmetries
Course Content	Unit I: Formation of groups of symmetries (in space) of the following Plane figures (regarded as rigid objects): An isosceles triangle (cyclic group C2 of order 2) An equilateral triangle (the group S3 of order 6) A rectangle (the group V4) A square (the group D4) Unit II: Formation of groups of symmetries of the following Chemical Molecules (Configuration of atoms). H2O (the group V4) H2O2 Trans- N2 – F2 (the group V4) NH3, PCl3, CHCl3(the group S3) Unit III: Concept of isomorphism of groups, Isomorphism of multiplicative group with the group C2 of the symmetries of an isosceles triangle, Isomorphism of multiplicative group with the group V4 of the symmetries of a rectangle, Isomorphism of group V4 of the symmetries of a rectangle with the group of symmetries of H2O, Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi. 2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-501: Group Theory

Course Code	**MTH-501**
Course Title	**Group Theory**

Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group theory.
Course Objective	To make students acquainted with concepts of group theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of group theory. CO2 : Understand Cosets, Lagrange's theorem, Euler's theorem, Fermat's theorem, counting principle CO3 : Learn about Concept of Normal subgroup & Quotient groups, Homomorphism with their properties. CO4 : Recognize Automorphisms, Cayley's theorem and its applications CO5 :Determine different permutation and Permutation Groups, even permutation, odd permutation. CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Group theory
Course Content	Unit 1: Cosets, Congruence Relation in Group Lagrange's theorem, Euler's theorem, Fermat's theorem, Counting principle. Unit 2: Normal subgroups &Quotientgroups, Homomorphism, Isomorphism, Isomorphic groups, Fundamental theorem ofhomomorphism. Unit 3: Automorphisms, Cayley's theorem and its applications. Unit 4: Permutation Groups, Orbit& Cycles, Even permutation, Odd permutation, Alternating Group.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-502: Linear Algebra - I

Course Code	**MTH-502**
Course Title	**Linear Algebra – I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theLinearAlgebra.
Course Objective	To make students acquainted with concepts of LinearAlgebra.
Course Outcomes	The course will enable the students to:
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of algebraic system
Course Content	Unit 1: Definition and examples of Vector space, Subspace, Necessary and sufficient condition for a subspace, Illustrations. Unit 2: Span of a set, union and intersection of subspaces, sum and direct sum of subspaces. Unit 3: Linearly dependent and independent vectors, checking of Linear dependence or independence. Unit 4: Dimension and Basis of a vector space, extension of a linearly independent set to a basis, dimension of sum.

Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-503: Real Analysis - I

Course Code	**MTH-503**
Course Title	**Real Analysis – I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Countable & Uncountable sets, Greatest lower bound and least upper bound CO3 : Recognize Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences. CO4 : Learn about operations on convergent sequences. CO5 :Analyze Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence. CO6 : Apply Basic of real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Course Content	Unit 1: Countable & uncountable sets, greatest lower bound and least upper bound. Unit 2: Sequences of real numbers, sub-sequences, limit of a sequence, convergent sequences, divergent sequences. Unit 3: Bounded sequences, monotone sequences, operations on convergent sequences. Unit 4: Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence.
Reference Books	1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-504: Real Analysis - II

Course Code	**MTH-504**
Course Title	**Real Analysis – II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Limit and Continuity of a function on the real line, Definition & examples of Metric spaces CO3 : Recognize Open ball in R1, open ball in metric space, functions continuous on metric spaces. CO4 : Learn about Limit, Convergence and Cauchy sequence in metric space,

<table>
<tr><td></td><td>Equivalent metrics..
CO5 :Analyze Open sets and their properties.
CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Real analysis</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Revision of Limit and Continuity of a function on the real line, Definition & examples of Metric spaces.

Unit 2:
Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics.

Unit 3:
Open ball in R1, open ball in metric space, functions continuous on metric spaces.

Unit 4: Open sets, more about open sets.</td></tr>
<tr><td>Reference Books</td><td>1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi.
2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983.
4. D. SomSundaram& B. Chaudhari : A first course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968.
7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

B.Sc. Mathematics 5th Semester

Course: MTH-505: Graph Theory

Course Code	**MTH-505**
Course Title	**Graph Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Graph theory
Course Objective	To make students acquainted with concepts of Graph Theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the graph theory. CO2 : Understand the graph theory and relevant term CO3 : Recognize Subgraphs, Isomorphism between two graphs. CO4 : Learn about Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs and Components of graphs . CO5 :Analyze Euler graph and their properties. CO6 : Apply graph .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphs, various type of graphs, incidence and degree, isolated and pendent vertices, Subgraphs, Isomorphism between two graphs. Unit 2: Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs, Components of graphs. Unit 3: Euler graphs, Arbitrary traceable graph, Hamiltonian Graphs, Applications of graphs: Konigsberg Bridge Problem, Seating Arrangement Problem, Utility Problem. Unit 4: Trees, Properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and Diameter of a Tree, Rooted & Binary trees.

Reference Books	1. NarsinghDeo : Graph Theory with applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd., 2000. 2. R. J. Wilson : Introduction to Graph Theory, Academic Press, New York, 1972. 3. E. Harray : Graph Theory, Addison Wesley Pub. Co., 1969. 4. C. Berge : The Theory of Graphs and its Applications, John Wiley & Sons, 1962.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-506: Number Theory - I

Course Code	**MTH-506**
Course Title	**Number Theory - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Understand the Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm CO3 : Compute the solutions of linear Diophantine equations in two variables CO4 :Learn about Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences CO5 :Analyze Basic properties of Congruence, divisibility tests. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1:

	Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm, relation between greatest common divisor and least common multiple of two integers. Unit 2: Computation of the solutions of linear Diophantine equations in two variables, Primes and composite numbers, the fundamental theorem of arithmetic, Pythagorean theorem for the irrationality of √2 . Unit 3: Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences. Unit 4: Basic properties of Congruence, divisibility tests of 9 and 11.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5001: Operations Research-I(ElectiveGeneric)

Course Code	**E.G.-5001**
Course Title	**Operations Research-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operations research.
Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research.

	CO2 : Understand Linear programming problem and their Graphical solution. CO3 : Compute the solutions LPP by dual simplex method CO4 :Learn about Definition of the dual problem and their properties CO5 : Find the solution of LPP by Big-M method. CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphical Solution of Linear programming problem (LPP). Definition of the dual problem, General rules for converting any primal problem into it's dual, The symmetric dual problems. Unit 2: Basic concept of basic, non-basic, degenerate, non-degenerate and basic feasible solutions of LPP, slack & surplus variables, LPP in the standard matrix form, Slack & surplus variables, Solution of LPP using Simplex method. Unit 3: Solution of LPP using Two Phase Simplex method and Big-M method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 5th Semester

Course: E.G.-5002: Computer Oriented Numerical Methods – I(ElectiveGeneric)

Course Code	**E.G.-5002**
Course Title	**Computer Oriented Numerical Methods – I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 : Understand Flow charts and symbols, More flow charting examples and FORTRAN language CO3 : Compute the operations in expressions CO4 :Learn about Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries. CO5 : Familiarize with Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program. CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Flow charts and symbols, More flow charting examples. FORTRAN language, character used in FORTRAN, FORTRAN constants, FORTRAN variable names, Type declaration for integer and real, Arithmetic expression (real and integer expressions), Hierarchy of operations in expressions, Examples of Arithmetic expression. Unit 2: Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Unit 3: Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program, FORTRAN programming examples.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5003: Fourier Series (ElectiveGeneric)

Course Code	**E.G.-5003**
Course Title	**Fourier Series**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Series.
Course Objective	To make students acquainted with concepts of Fourier Series.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Series. CO2 : Understand the Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion CO3 : Compute the Fourier series of functions CO4 :Learn about Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. CO5 : Familiarize with Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series. CO6 : Apply Fourier series in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

	CO3								
	CO4								
	CO5								
	CO6								
Pre-requisite	Basics of Mathematics								
Course Content	Unit 1: Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion. Unit 2: Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions. Unit 3: Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series.								
Reference Books	1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi. 2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi. 3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE. 5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut								
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment								
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination								

B.Sc. Mathematics 6th Semester

Course: MTH-601: Ring Theory

Course Code	**MTH-601**
Course Title	**Ring Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Ring theory.

Course Objective	To make students acquainted with concepts of ring theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of Ring theory. CO2 : Understand Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal CO3 : Learn about different kinds of ring and their properties.. CO4 : Recognize Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. CO5 : Link theParticular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial. CO6 : Apply Ring theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of group theory
Course Content	Unit 1: Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal. Unit 2: Euclidean rings, divisibility in commutative ring, gcd of two elements in a ring, units and associates in rings. Unit 3: Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. Unit 4: Particular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 6th Semester

Course: MTH-602: Linear Algebra - II

<table>
<tr><td>Course Code</td><td>MTH-602</td></tr>
<tr><td>Course Title</td><td>Linear Algebra - II</td></tr>
<tr><td>Credit</td><td>3</td></tr>
<tr><td>Teaching per Week</td><td>3 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2019</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement theLinearAlgebra.</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of LinearAlgebra.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Linear algebra.
CO2 : Understand Linear Transformation and their properties
CO3 : Learn about rank nullity and their properties
CO4 : Recognize Matrix associated with linear transformations.
CO5 :Analyze Inner product spaces, Norm of a vector and properties.
CO6 : Apply linear algebra in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of linear algebra</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Definition and examples of Linear transformation, Range and kernel of a linear transformation.

Unit 2:
Rank-Nullity Theorem, Inverse of a linear transformation, Consequences of Rank-Nullity Theorem, Composition of linear transformations.

Unit 3:
Matrix associated with linear transformations, linear transformation associated with a matrix, Application of Rank-Nullity Theorem for matrix.

Unit 4:</td></tr>
</table>

	Inner product spaces, Norm of a vector, Cauchy-Schwarz's inequality, Triangular inequality, Orthogonalvectors, Vector Projection, Gram-Schmidt Orthogonalization Process, OrthonormalSet.
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-603: Real Analysis - III

Course Code	**MTH-603**
Course Title	**Real Analysis - III**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Convergence and divergence of series of real numbers CO3 : Recognize Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. CO4 : Learn about different type of series . CO5 :Analyze Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								

	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Convergence and divergence of series of real numbers, Series with non-negative terms, Alternating series, Conditional and absolute convergence. Unit 2: Tests for absolute convergence, Series whose terms form a non-increasing sequence. Unit 3: Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. Unit 4: Non Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus, Mean-value Theorems of Integral Calculus.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. Louis Leithold : Calculus with analytic Geometry, Harper and Collins Pub. Co. 5. J. B. Thomas and Finney : Calculus with analytic Geometry. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-604: Real Analysis - IV

Course Code	**MTH-604**
Course Title	**Real Analysis - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019

Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand Limit points, closure of a set, closed sets, homeomorphism of metric spaces CO3 : Recognize Connected sets, Bounded sets, Totally bounded sets. CO4 : Learn about Complete metric spaces, Contraction mapping, Picard's fixed point theorem. CO5 :Analyze Open covering, Heine-Borel property. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of real analysis
Course Content	Unit 1: Limit points, closure of a set, closed sets, homeomorphism of metric spaces, dense set. Unit 2: Connected sets, Bounded sets, Totally bounded sets. Unit 3: Complete metric spaces, Contraction mapping, Picard's fixed point theorem. Unit 4: Compact metric spaces, Open covering, Heine-Borel property, Finite Intersection property.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 5. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company. 6. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: 605: Discrete Mathematics

Course Code	**MTH-605**
Course Title	**Discrete Mathematics**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Discrete Mathematics
Course Objective	To make students acquainted with concepts of Discrete Mathematics.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Discrete Mathematics. CO2 : Understand the relation , lattice and relevant term CO3 : Recognize Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. CO4 : Learn about Boolean Algebra as an algebraic system, Boolean expressions. CO5 :Determine Minimization of Boolean functions by Karnaugh Map method. CO6 : Apply Discrete Mathematics .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Binary relations, Properties of binary relations, Equivalence relation, Partial ordered relation, Partially ordered sets, Upper bounds, Lower bounds, GLB & LUB of sets, Totally ordered sets, Well ordered sets, Hasse Diagram, Lattices and its properties. Unit 2: Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. Unit 3: Boolean Algebra as an algebraic system, Boolean expressions (forms), Different

	representation of Boolean forms, Sum of products canonical form and product of sums canonical forms of Boolean expressions. Unit 4: Minimization of Boolean functions by Karnaugh Map method and Quine- McCluskey algorithm, AND, OR & NOT gates, Reduction of switching circuit diagram.
Reference Books	1. J. P. Tremblay & R. Manohar : Discrete mathematical Structures with Applications to Computer Science., McGraw Hill Book Co., 1999. 2. B. Kolman, R. C. Busby & S. Ross : Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd., 3rd ed. 2001. 3. Elements of Discrete Mathematics, C. L. Liu, D. P. Mohapatra, Tata McGraw Hill, 2008. 4. Discrete Mathematics with Applications, Thomas Koshy, Academic Press, 2004.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-606: Number Theory - II

Course Code	**MTH-606**
Course Title	**Number Theory - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Understand Fermat's little theorem, Pseudo-primes, Wilson's theorem CO3 : Compute the solutions of linear congruence , the Chinese Remainder Theorem CO4 :Learn about The number of positive divisors, multiplicative nature of functions, The Möbius Inversion formula CO5 :Analyze Euler's Phi-function and related theorem. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8

PSOs	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								

Pre-requisite	Basics of number theory
Course Content	Unit 1: Computation of the solutions of linear congruence , the Chinese Remainder Theorem. Unit 2: Fermat's little theorem, Pseudo-primes, Wilson's theorem. Unit 3: The number of positive divisors and sum of all positive divisors of an integer, basic properties and multiplicative nature of these functions, The Möbius Inversion formula (without proof), the greatest integer function. Unit 4: Introduction of Euler's Phi-function , multiplicative nature of (statement only), Euler's Theorem.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G. 6001: Operations Research-II (ElectiveGeneric)

Course Code	**E.G.- 6001**
Course Title	**Operations Research-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)

Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operation research.
Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research. CO2 : Understand the transportation problem and their solutions. CO3 : Compute the solutions of Assignment problem CO4 :Learn about Competitive games theory CO5 : Find the solution Game theory problem by graphical method CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Transportation problem, methods for finding initial basic feasible solution, solution of Transportation problem by MODImethod, Unbalanced Transportation problem. Unit 2: Assignment problems, The Hungarian method, balanced & unbalance assignment problems. Unit 3: Competitive games, two-person zero-sum game, maximin and minimax principle, saddle points and the value of the game (based on pure strategies), mixed strategies, solution of games with saddle point, Game without saddle points, Dominance rule, solution of m×2 and 2×n games using graphical method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.-6002: Computer Oriented Numerical Methods – II (ElectiveGeneric)

<table>
<tr><td>Course Code</td><td>E.G.-6002</td></tr>
<tr><td>Course Title</td><td>Computer Oriented Numerical Methods – II</td></tr>
<tr><td>Credit</td><td>2</td></tr>
<tr><td>Teaching per Week</td><td>2 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2019</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Computer Oriented Numerical Methods.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Computer Oriented Numerical Methods.
CO2 :Recognize Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement
CO3 : Apply the Statement labels, GO TO statement and DO statement
CO4 :Learn about Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted expression, Dimension statement, DO type notation for input / output statement.
CO5 : Familiarize with FORMAT specification and FORMAT specification for a numerical data.
CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Computer Oriented Numerical Methods</td></tr>
<tr><td>Course Content</td><td>Unit1:
Controlstatements,Relationaloperators,LogicalIFstatement,ArithmeticIFstatement,Block IFstatement. Statement labels, GO TO statement, Example of use of Logical IF statement.</td></tr>
</table>

	Unit2: Nested logical IF statement, Computed GO TO statement, DO statement, Examples of DO statement. Rules to be followed in utilizing DO loops, Subscripted variables, Sub scripted Expression. Dimension statement, DO type notation for input/output statement. FORMAT specification. Unit3: FORMATspecificationforanumericaldata, Iterative methods. Numerical integrations and differentiations. Numerical solution of ordinary differential equations.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.-6003: Fourier Transform and its Applications (ElectiveGeneric)

Course Code	**E.G.-6003**
Course Title	**Fourier Transform and its Applications**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Transform and its Applications.
Course Objective	To make students acquainted with concepts of Fourier Transform and its Applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Transform and its Applications. CO2 : Understand the Integral transforms, Fourier Transforms, Properties of Fourier Transform CO3 : Compute the Fourier Transform CO4 :Learn about Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform CO5 : Familiarize with Relation between Fourier and Laplace Transforms, Fourier

<table>
<tr><td></td><td>transforms of the derivatives of a function
CO6 : Apply Fourier Transform in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Fourier series</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Integral transforms, Fourier Transforms, Properties of Fourier Transform and its application.

Unit 2:
Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform.

Unit 3:
Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function, Fourier transform and its applications.</td></tr>
<tr><td>Reference Books</td><td>1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi.
2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi.
3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi.
4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE.
5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

Bachelor of Science (Mathematics)
CO-PO-2022-23

Name of Program	**Bachelor of Science (Mathematics)**
Abbreviation	**B.Sc.- Mathematics**
Duration	**3 Years**
Eligibility Criteria	Passed 12th Science with mathematics or equivalent Degree.
Objective of Program	The core objective of the B.Sc. in Mathematics is to prepare the students for productive career by providing a solid education in the basic subjects of mathematical knowledge and its applications with outstanding environment of teaching and research in the core and emerging areas of the discipline.
Program Outcome	**PO1 : Fundamental Knowledge Enrichment** Program trains students with the core Mathematics knowledge domains. It also makes students capable of using core concepts in the conceptualization of domain specific application. **PO2 : Critical Thinking Development** The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem. **PO3 : Develop arguments in a logical manner** The program trains students to formulate and develop arguments in a logical manner and make them ready to prepare real world problem solution mathematically. **PO4 : Develop decision making ability** The program develop the skill in students to take decisions at intellectual, organizational and personal from different perspectives of life using analysis **PO5 : Computational Skill Development** The program develop basic computational skill in students for planning and managing process of complex real world. **PO6 : Provides an effective Mathematical communication skill** The program develop an effective Mathematical communication skill in the students. **PO7 : Team Work and Leadership Development** Trains students to work in a team and also to take leadership.
Program Specific Outcomes	PSO1 : Develop and strengthen the fundamental core concepts that are required to solve complex problems PSO2 : Develop the skills that needs independent logical and analytical thinking, teamwork and leadership PSO3 : Nurture the students to investigate and development of a workable solution for a real world problem PSO4 : Develop students for self-learning and practicing challenging problem solution

DR MRDaila
Chairman
B.OS Mathematics
30/3/2023

	PSO5 : Train students to apply mathematical skills for new investigation. PSO6 : Train students to expand their knowledge of fields related to their current areas of professional specialization. PSO7 : Train students to take-up the real world challenges to develop workable solution to a domain specific problem. PSO8 : Inculcate the passion for continuous learning and doing research for making a successful professional career.

Mapping between POs and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
PO1								
PO2								
PO3								
PO4								
PO5								
PO6								
PO7								

Medium of Instruction	English
Program Structure	Semester 1

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-101	Mathematics-I	3	0	3	2Hrs	50	20	70
MTH-102	Mathematics-II	3	0	3	2Hrs	50	20	70
	Total	6	0	6				

Program Structure	Semester 2

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-201	Mathematics-III	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-202	Mathematics-IV	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
	Total	6	0	6				

Program Structure	Semester 3

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-301	Mathematics-V	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-	Mathematics-VI	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**

302								
MTH-303	Mathematics-VII	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
E.G.	3001-MathematicalMethods	**2**	**0**	**2**	**2Hrs**	**50**	**20**	**70**
	3002-GroupofSymmetries–I	**2**	**0**	**2**	**2Hrs**	**50**	**20**	**70**
	Total	11	0	11				

Program Structure: Semester 4

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-401	Mathematics-VIII	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-402	Mathematics-IX	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-403	Mathematics-X	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
E.G.	4001-MathematicalModeling	**2**	**0**	**2**	**2Hrs**	**50**	**20**	**70**
	4002-GroupofSymmetries–II	**2**	**0**	**2**	**2Hrs**	**50**	**20**	**70**
	Total	**11**	**0**	**11**				

Program Structure: Semester 5

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH-501	GroupTheory	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-502	LinearAlgebra-I	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-503	RealAnalysis-I	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH-504	RealAnalysis-II	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**
MTH	GraphTheory	**3**	**0**	**3**	**2Hrs**	**50**	**20**	**70**

-505								
MTH -506	NumberTheory-I	3	0	3	2Hrs	50	20	70
E.G.	5001-OperationsResearch– I	2	0	2	2Hrs	50	20	70
	5002-ComputerOriented NumericalMethods –I	2	0	2	2Hrs	50	20	70
	5003-Fourier Series	2	0	2	2Hrs	50	20	70
	5004-Computer Programming in FORTRAN 90 and 95-I	2	0	2	2Hrs	50	20	70
	Total	20	0	20				

Program Structure	Semester 6

Course Code	Title	Teaching per week		Course Credits	University Examination		Internal Marks	Total Marks
		Theory	Practical		Duration	Marks		
MTH -601	RingTheory	3	0	3	2Hrs	50	20	70
MTH -602	LinearAlgebra–II	3	0	3	2Hrs	50	20	70
MTH -603	RealAnalysis–III	3	0	3	2Hrs	50	20	70
MTH -604	RealAnalysis–IV	3	0	3	2Hrs	50	20	70
MTH -605	DiscreteMathematics	3	0	3	2Hrs	50	20	70
MTH -606	NumberTheory–II	3	0	3	2Hrs	50	20	70
E.G.	6001-OperationsResearch– II	2	0	2	2Hrs	50	20	70
	6002-ComputerOriented NumericalMethods –II	2	0	2	2Hrs	50	20	70
	6003-FourierTransformanditsApplications	2	0	2	2Hrs	50	20	70

	6004-Computer Programming in FORTRAN 90 and 95-II	2	0	2	2Hrs	50	20	70
	Total	**20**	**0**	**20**				

B.Sc.Mathematics 1st Semester

Course: MTH-101: **Mathematics-I**

Course Code	**MTH-101**
Course Title	Mathematics-1
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Trigonometry .
Course Objective	To make students acquainted with concepts of Trigonometry
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of the fundamental aspects of the Trigonometry . CO2 : Assimilate the De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments. CO3 : Calculate the Indeterminate forms by using Euler's expressions, Hyperbolic functions.. CO4 : Understand the Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts. CO5 : Sketch curves in Trigonometric and hyperbolic functions. CO6 : Apply Trigonometry in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit –I De' Moivre's theorem and its applications, Trigonometric functions for multiple arguments. Unit-II Euler's expressions, Evaluation of Indeterminate forms by using Euler's expressions, Hyperbolic functions for real arguments and their inverses.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Unit-III Exponential, Circular and Hyperbolic functions of complex variables and their identities, Euler's Theorem, Relations between circular and Hyperbolic functions. Unit-IV Logarithm of complex quantities, Separations of Logarithmic, Inverse circular and Inverse hyperbolic functions into real and imaginary parts.
Reference Books	1. S. L. Loney: Plane Trigonometry, Part I and II, McMillan and Co. London. 2. R. S. Verma, K. S. Shukla: Text book of Trigonometry, Pothishala Pvt. Ltd. Allahabad. 3. E. Kreyszig: Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 4. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc.Mathematics 1st Semester

Course: MTH-102: **Mathematics-II**

Course Code	**MTH-102**
Course Title	Mathematics-2
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the conceptscalculusofand learn its applications.
Course Objective	To make students acquainted with concepts of calculus.
Course Outcomes	This course will enable the students to CO1 : Explain the insight of the historical and fundamental aspects the Calculus. CO2 : Assimilate the Successive differentiation, Leibnitz theorem and its applications CO3 : Understand the consequences of various mean value theorems for differentiable functions , Asymptotes, Concavity, Convexity and reduction function. CO4 : Calculate the Curvature and radius of curvature. CO5 : Apply concept of Increasing and Decreasing functions, Asymptotes, Concavity and Convexity CO6 : Apply calculus in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	CO4							
	CO5							
	CO6							

Pre-requisite	Basics of Mathematics
Course Content	Unit –I Successive differentiation, Calculation of n^{th} derivatives of some standard functions (rational functions and powers of sine, cosine functions), Leibnitz theorem and its applications Unit-II Rolle's Theorems and its geometrical interpretation, Lagrange's Theorem and its geometrical interpretation, Cauchy theorem, Maclaurin and Taylor series expansions Unit-III Curvature and radius of curvature (except Polar form), Increasing and Decreasing functions, Asymptotes, Concavity and Convexity Unit-IV Reduction formulae for integration of $sin^n x, cos^n x, tan^n x, cot^n x, sec^n x, cosec^n x, sin^p x cos^q x, x^m cosnx, x^m sinnx.$
Reference Books	1. Shantinarayan: Differential Calculus, Revised EditionDecember-2004 , S. Chand and Co. New Delhi. 2. Shantinarayan: Integral Calculus, S. Chand and Co. New Delhi. 3. Gorakhprasad: Differential Calculus, Pothishala Pvt. Ltd. Allahabad. 4. M. R. Spigel: Theory and Problems of Advanced Calculus, Schaum's Publishing Co., New York. 5. N. P. Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-201: **Mathematics-III**

Course Code	**MTH-201**
Course Title	Mathematics-III
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020

Purpose of Course	The purpose of the course is to make the student capable to understand and implement the theory of matrices with its applications.
Course Objective	To make students acquainted with concepts of Theory of matrices.
Course Outcomes	This course will enable the students to: CO1 : Explain the insight of fundamental aspects the theory of matrices. CO2 : Understand the genesis of theory of matrices.. CO3 : Learn elementary raw operations, rank theory and matrix properties. CO4 : Find eigen values and corresponding eigenvectors for a square matrix. CO5 : Calculate solution of linear system of equation. CO6 : Apply matrix theory in social sciences, physical sciences, life sciences and a host of other disciplines.
Mapping between COs with PSOs	

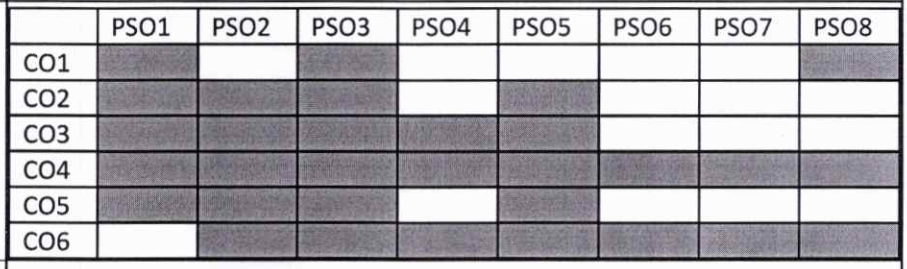
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Matrices
Course Content	Unit-I Different types of matrices, Operation on matrieces, Properties of operation of matrices, Elementary row operations. Unit-II Row-reduced echelon forms. Inverse of matrix by Row-Reduced Echelon form, Row rank of a matrix, Quadratic form. Unit-III Trace of matrix and its properties, Solution of homogeneous system of linear equations using row –reduced echelon forms. Unit-IV Characteristic equation of a matrix, Method to find Characteristic equation using determinant and minors of a matrix, Eigen values and Eigen vectors of a matrix, Cayley-Hamilton theorem and its application to find an inverse of a matrix, Method of diagonalization.
Reference Books	1. Krishnamurthy, Mainra and Arora: An Introduction to linear Algebra, Affiliated West Press Pvt. Ltd., New Delhi. 2. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India (P) Ltd., 2009. 3. B.S.Vasta and SuchiVasta: Theory of Matrices; 4rd Edition -2014, New Age International (P) Ltd. Publishers, New Delhi. 4. Shantinarayan: Text book of Matrices, S. Chand and Co., New Delhi. 5. H. K. Dass, H. C. Saxena, M. D. Raisinghania: Simplified course in Matrices, S. Chand and Co., NewDelhi. 6. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment

Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 2nd Semester

Course: MTH-202: **Mathematics-IV**

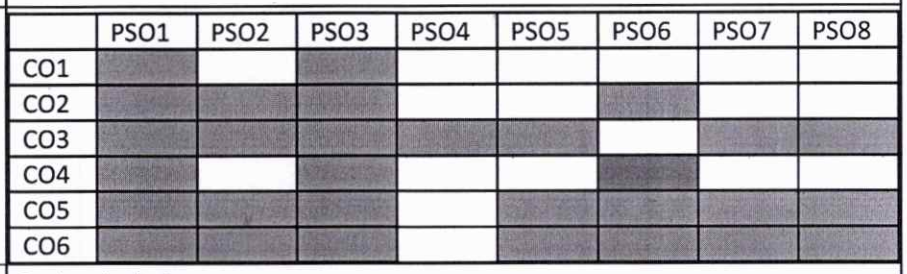
Course Code	**MTH-202**
Course Title	Mathematics-IV
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2020
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Objective	The purpose of the course is to make the student capable to understand and implement the Integral Calculus and Differential Equation.
Course Outcomes	The course will enable the students to: CO1 : Understand the genesis of Integral Calculus and ordinary differential equations. CO2: Sketch curves in Cartesian coordinate systems. CO3 :To solve first order first degree and first order higher degree differential equation. CO4 : Grasp the concept of a general solution of a higher order linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations. CO5: To solve initial and boundary value problem. CO6 : Apply Integral Calculus and Differential Equations in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Derivative
Course Content	Unit-I Curve Tracing : Equation of the form $y = f(x)$,Equation of the form $y^2 = f(x)$,Parametric equations, Tracing of Polar curves. Unit-II Application of Integral calculus: Length of a curve, Intrinsic equation (except polar coordinates).

	Unit:III Bernoulli's equation, Exact differential equation, Differential equations of first order and higher degree : Solvable for x, y, p and Lagrange's equation, Clairaut's equation. Unit-IV Linear Differential Equations with constant coefficients: Complimentary functions, Particular Integral, General Solution, Method for finding Particular Integral specially for e^{ax}, sinax, cosax, polynomial in terms of x, $e^{ax}V$ and xV, where V is a function of x.
Reference Books	1. 1.Shantinarayan : Differential calculus ,4th edition -2001,Shyamlal Charitable Trust,Ramnagar New Delhi, S. Chand and Company LTD. 2. Shantinarayan: Integral Calculus, Revised Edition-2009, S.Chand and Co., New Delhi. 3. Gorakhprasad: Integral Calculus, PothishalaPvt.Ltd., Allahabad. 4. D.A.Murray: Differential Equations, Tata Mc Graw Hills. 5. Frank Ayres: Theory and problems on Differential Equations, Mc Graw Hill Book Co., New York. 6. N.P.Bhamore and et al: College AadhunikGanitshastra, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3rd Semester

Course: MTH-301: **Mathematics-V**

Course Code	**MTH-301**
Course Title	Mathematics-V
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the function of two variable and their calculus.
Course Objective	To make students acquainted with concepts of the function of two variable and their calculus.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the function of two variable and their calculus. CO2 :Find the Limits and Continuity of a function of two variables, Partial Differentiation. CO3 :Calculate Jacobian as well as Maxima and Minima for function of two variable. CO4 :Find vectorGradient, Divergence and Curl. CO5 : Apply multivariable calculus to solve function of two variable problems. CO6 : Apply function of two variable and vector calculus in social sciences, physical sciences, life sciences and a host of other

	disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of calculus
Course Content	Unit I: Limits and Continuity of a function of two variables, Partial Differentiation, Total Differential, Composite function, Homogeneous functions. Unit II: Euler's theorem for Homogeneous functions, Taylor's theorem for functions of two variables, Maclaurian's expansions in power series, Jacobian. Unit III: Maxima-Minima for functions of two variables: Necessary and sufficient conditions for extreme points. Unit IV: Vector point function, Differentiation of a Vector point function, Gradient, Divergence and Curl and their properties, Line Integral.
Reference Books	1. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 2. Hari Kishan : Vector Algebra and Calculus, Atlantic Pub. & Distributors(P) Ltd., New Delhi. 3. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 4. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi. 5. N. P. Bhamore& et el : Mathematics Paper III–IV, Popular Prakashan, Surat
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: MTH-302: **Mathematics-VI**

Course Code	**MTH-302**
Course Title	Mathematics-VI
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)

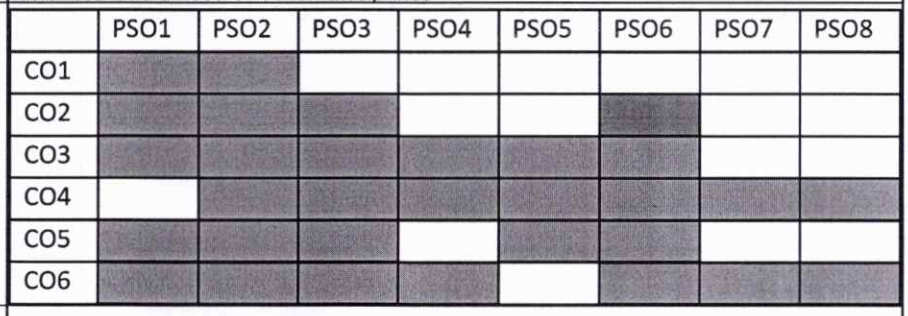
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of basics of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 :Recognize the errors and their numerical computation CO3 : Obtain numerical solutions of algebraic and transcendental equations. CO4 : Learn about various interpolating and extrapolating methods. CO5 : predict future trend by interpolating and extrapolating methods. CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Error estimation: Errors and their computations, A general error formula. Unit II: Numerical Solutions of Algebraic and Transcendental Equations: Bisection Method, Method of False position, Iteration Method, Newton-Raphson's Method. Unit III: Forward Differences, Backward Differences, Central Differences, Symbolic relation and separation of symbols, Differences of Polynomials. Unit IV: Newton's Forward and Backward Formulae, Gauss' Interpolation formulae.
Reference Books	1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 5th Edition. 2. M. K. Jain, Iyenger, Jain : Numerical Methods for Scientific and Engineering Computations, New Age International Ltd. 3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut. 4. Kaiser A. Kunz : Numerical Analysis, Mc Graw Hill Book Co., London. 5. James I. Buchanan, Peter R. Turner : Numerical Methods and Analysis, Mc Graw Hill Book Co., London. 6. P. C. Biswal:NumericalAnalysis,Prentice-HallofIndia, 2008. 7. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chandand Co., 2005.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3rd Semester

Course: MTH-303: Mathematics-VII

Course Code	**MTH-303**
Course Title	Mathematics- VII
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the higher order differential equation and basics of partial differential equation.
Course Objective	To make students acquainted with concepts of higher order differential equation and basics of partial differential equation.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Linear Differential Equations with variable coefficients. CO2 :Find solution ofSecond order Differential Equations CO3 : Learn about Formation of Partial Differential Equation. CO4 : Solve Partial Differential Equations by direct integral methods. CO5 : Obtain solution Nonlinear Partial Differential Equations of first order. CO6 : Apply differential equation in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of ordinary differential equation and partial derivative
Course Content	Unit I: Linear Differential Equations with variable coefficients, Homogeneous Differential Equations, Legendre's Differential Equation. Unit II: Second order Differential Equations: Solution in terms of known Integral, Solution by method of removal of first order derivatives, Method of Changing Independent Variable. Unit III: Formation of Partial Differential Equation, Solution of Partial Differential Equations, Equations solvable by direct integral.

	Unit IV: Partial Differential Equations of first order, Nonlinear Partial Differential Equations of first order, Some special methods.
Reference Books	1. D. A. Murray: An Introductory Course in Differential Equations, Orient Longmans, Bombay. 2. N. Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company. 3. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi. 4. Gorakhprasad : Differential Equations, Pothishala Pvt. Ltd., Allahabad. 5. M. D. Rai Singhania : Differential Equations, S. Chand & Co., New Delhi. 6. Nita H. Shah : Ordinary and Partial Differential Equations : Theory and Applications, PHI Learning Pvt. Ltd, New Delhi. 7. N. P. Bhamore& et el. : Mathematics Paper III–IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 3nd Semester

Course: E.G.-3001: Mathematical Methods

Course Code	**E.G.-3001**
Course Title	**Mathematical Methods**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the difference method
Course Objective	To make students acquainted with concepts of Mathematical difference Method.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the difference calculus. CO2 :Find Finite difference and Method of unknown coefficients CO3 : Learn about Difference equation.

<table>
<tr><td></td><td>CO4 : Solve problem of Difference equation.
CO5 : Obtain solution of Homogeneous difference equations with constant coefficients.
CO6 : Apply difference calculus in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Notations of finite difference calculus, Operators E, Δ , Relations between different operators and their prosperities, Relation between difference and differential operators, Method of constructing difference tables, Finding the missing terms.

Unit II:
Factorial notation, Expression of polynomials in factorial notation by using finite differences, Method of unknown coefficients.

Unit III:
Difference equations: Order and degree of a difference equation, Solution of difference equations, Homogeneous difference equations with constant coefficients.</td></tr>
<tr><td>Reference Books</td><td>1. S.S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition.
2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd.
3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut.
4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London.
5. James I. Buchanan, Peter R. Turner : Numerical Methods & Analysis, McGraw Hill Book Co., London.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

B.Sc. Mathematics 3rd Semester

Course: E.G.-3002: Group of Symmetries-I

Course Code	**E.G.-3002**
Course Title	**Group of Symmetries-I**

Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Group theory. CO2 :Identify Sub group and their properties CO3 : Learn about Symmetry planes and reflection symmetry. CO4 : Solve problem of Product of symmetry operations. CO5 : Analyze consequences of Rotation axes and rotation symmetry CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Definition of a group and its elementary properties, Order of a group, Order of an element of a group, Group multiplication tables, Examples of groups including finite groups and infinite groups, Abelian groups, Cyclic groups. Unit II: Subgroup, Condition that a subset is a subgroup, Examples of subgroups, Basic concept of symmetry, Symmetry elements and symmetry operations in a space, Identity symmetry operation. Unit III: Symmetry planes and reflection symmetry, Inversion centre and inversion symmetry, Rotation axes and rotation symmetry, Improper axes and improper rotation symmetry, Product of symmetry operations.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi. 2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi

Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-401: Mathematics-VIII

Course Code	**MTH-401**
Course Title	Mathematics-VIII
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Special function, double Triple integral and Laplace transform
Course Objective	To make students acquainted with concepts of the Special function, double Triple integral and Laplace transform.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the beta gamma functio. CO2 : Find Double and triple integrals CO3 : Learn about Laplace transform . CO4 : Realize importance of Laplace transform. CO5 : Determine various Inverse Laplace transform. CO6 : Apply the Special function, double Triple integral and Laplace transform in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								

	CO6
Pre-requisite	Basics of Mathematics
Course Content	Unit I: Beta-Gamma functions: Relation between Beta and Gamma functions, Properties, Applications of Beta-Gamma function. Unit II: DoubleandTripleIntegrals:Changeoforder of Doubleintegrals, Area. Unit III: Laplace Transform of elementary functions, Properties of Laplace Transform, Differentiation and Integration of Laplace Transform, Laplace Transform of derivatives and integrals Unit IIV: Inverse of Laplace Transform: Method of Partial fractions, Properties of inverse Laplace Transform.
Reference Books	1. David V. Widder : Advanced Calculus, PHI Learning Pvt. Ltd, New Delhi 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. Shantinarayan, P. K. Mittal : A course of Mathematical Analysis, S. Chand and Co., New Delhi. 4. N. P. Bhamore& et al : Mathematics Paper III-IV, Popular Prakashan, Surat.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: MTH-402:Mathematics-IX

Course Code	**MTH-402**
Course Title	Mathematics-IX
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of numerical methods and its applications.
Course Objective	To make students acquainted with concepts of numerical methods
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the numerical analysis. CO2 : Understand the Lagrange's Interpolation Formula, Divided Differences,

<table>
<tr><td></td><td>Newton's General Interpolation Formula
CO3 : Obtain numerical Differentiation.
CO4 : Learn about Numerical Integration.
CO5 :Determine Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.
CO6 : Apply numerical analysis in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit I:
Finite difference with unequal interval, Lagrange's Interpolation Formula, Divided Differences, Newton's General Interpolation Formula.
Unit II:
Numerical Differentiation: 1st and 2nd order derivatives based on Newton's forward and backward difference interpolation formulae.

Unit III:
Numerical Integration: General Integration formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule.

Unit IV:
Solution of Ordinary Differential Equations by Taylor's series method, Picard's approximation method, Euler's method.</td></tr>
<tr><td>Reference Books</td><td>1. S. S. Sastry : Introductory methods of Numerical Analysis, Prentice-Hall of India Pvt. Ltd.; 4th Edition.
2. M. K. Jain, Iyenger, Jain: Numerical Methods for Scientific and Engineering Computations, New Age International Ltd.
3. Goel, Mittal : Numerical Analysis, PragatiPrakashan, Meerut.
4. Kaiser A. Kunz : Numerical Analysis, McGraw Hill Book Co., London.
5. James I. Buchanan, Peter R. Turner: Numerical Methods and Analysis, McGraw Hill Book Co., London</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

B.Sc. Mathematics 4th Semester

Course: MTH-403: Mathematics-X

Course Code	**MTH-403**
Course Title	Mathematics – X
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Basic real analysis and basic of number theory.
Course outcomes	To make students acquainted with concepts of Basic real analysis and basic of number theory.
Course Objective	The course will enable the students to: CO1 : Explain the insight of the Divisors GCD and LCM, prime number, Congruence relation. CO2 :Separate Countable & uncountable set CO3 :FindGreatest lower bound and least upper bound. CO4 :Learn about basics of Sequences of real numbers, Sub-sequences. CO5: IdentifyConvergent sequences, Divergent sequences CO6: Apply Basic of number theory in social sciences, physical sciences, life sciences and a host of other disciplines.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit I: Sets and elements, Operations on sets, Functions, Real-valued functions. Unit II: Countable & Uncountable sets, Greatest lower bound and least upper bound. Unit III: Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences. Unit IV: Divisors, Greatest common divisor, Least Common multiple, Prime numbers, Fundamental theorem of Arithmetic, Congruence relation, Equivalence classes.
Reference Books	1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co. 2. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 2006. 3. I. H. Sheth : Abstract Algebra, Nirav Prakashan, Ahmedabad.

	4. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 5. S. C. Malik : Mathematical Analysis, Wiley-Eastern Ltd, New Delhi. 6. Shantinarayan : Modern Algebra, S. Chand and Co., New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: E.G.-4001: Mathematical Modelling

Course Code	**E.G.-4001**
Course Title	**Mathematical Modelling**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the concepts of Mathematical Modelling .
Course Objective	To make students acquainted with concepts Mathematical Modelling.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Mathematical Modelling. CO2 : explain the concept of mathematical modelling CO3 : formulate the real world problem into Mathematical form. CO4 :analyze the mathematical model. CO5 : Predict the future by using mathematical modelling. CO6 : Apply Mathematical modelling in social sciences, physical sciences, life sciences and a host of other disciplines

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics Ordinary differential equation
Course Content	Unit I: Mathematical modelling through ordinary differential equation of first order, Linear

	growth models; Linear decay models, Models for growth of Science and scientists. Unit II: Non-linear growth and decay models, Model of Logistic law of population, Spread of technological innovation, Spread of infectious diseases. Unit III: Mathematical models of geometrical problems through ordinary differential equation of first order, Simple geometrical problems, Orthogonal trajectories.
Reference Books	1. J. N. Kapoor: Mathematical Modelling, New Age International Publishers, New Delhi. 2. Kreysig: Advanced Engineering Mathematics, John Wiley, New York, 1999. 3. J. K. Sharma: OR Theory & Applications, Mac Milian India Ltd., 1998. 4. G.Hadley:Linear Programming, Narosa Publishing House, New Delhi,1995. 5. G. Paria : Linear Programming, Transportation, Assignment, Game, Books & Allied Pvt. Ltd. Calcutta.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 4th Semester

Course: E.G.-4002: Group of Symmetries-II

Course Code	**E.G.-4002**
Course Title	**Group of Symmetries-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2021
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group of Symmetries.
Course Objective	To make students acquainted with concepts of Artificial Intelligence and its applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of groups of symmetries. CO2 : Understand formation of groups of symmetries of the Chemical Molecules CO3 : Learn about Concept of isomorphism of groups. CO4 : Recognize Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3. CO5 :Determine Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries

	CO6 : Apply Group of Symmetries in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Group of Symmetries
Course Content	Unit I: Formation of groups of symmetries (in space) of the following Plane figures (regarded as rigid objects): An isosceles triangle (cyclic group C2 of order 2) An equilateral triangle (the group S3 of order 6) A rectangle (the group V4) A square (the group D4) Unit II: Formation of groups of symmetries of the following Chemical Molecules (Configuration of atoms). H2O (the group V4) H2O2 Trans- N2 – F2 (the group V4) NH3, PCl3, CHCl3(the group S3) Unit III: Concept of isomorphism of groups, Isomorphism of multiplicative group with the group C2 of the symmetries of an isosceles triangle, Isomorphism of multiplicative group with the group V4 of the symmetries of a rectangle, Isomorphism of group V4 of the symmetries of a rectangle with the group of symmetries of H2O, Isomorphism of group S3 of the symmetries of an equilateral triangle with the group of symmetries of NH3, PCl3, CHCl3.
Reference Books	1. F. A.Cotton: Chemical application of group theory, Wiley Inter Science, Wiley Eastern Ltd., New Delhi. 2. G. Davidson: Intro. Group Theory for Chemists, Applied Science Publisher. 3. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-501: Group Theory

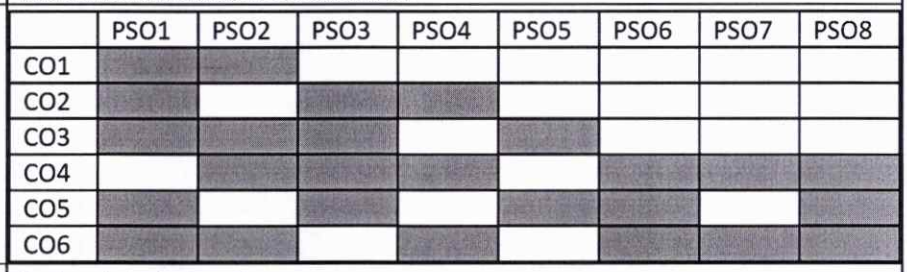
Course Code	**MTH-501**
Course Title	**Group Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2019
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Group theory.
Course Objective	To make students acquainted with concepts of group theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of group theory. CO2 : Understand Cosets, Lagrange's theorem, Euler's theorem, Fermat's theorem, counting principle CO3 : Learn about Concept of Normal subgroup & Quotient groups, Homomorphism with their properties. CO4 : Recognize Automorphisms, Cayley's theorem and its applications CO5 :Determine different permutation and Permutation Groups, even permutation, odd permutation. CO6 : Apply group theory in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Group theory
Course Content	Unit 1: Definition of a Group, Examples of Group, elementary properties of a Group, Finite Groups. Subgroups, Cyclic Groups, Order of an element. Unit 2: Cosets, Congruence Relation in Group Lagrange's theorem, Euler's theorem, Fermat's theorem, Counting principle. Unit 3: Normal subgroups &Quotientgroups, Homomorphism, Isomorphism, Isomorphic groups, Fundamental theorem of homomorphism, Automorphisms, Cayley's theorem. Unit 4: Permutation Groups, Orbit& Cycles, Even permutation, Odd permutation, Alternating Group.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■	■	■	■				
CO3	■	■	■		■			
CO4	■	■	■	■		■	■	■
CO5	■	■	■		■	■		
CO6	■	■		■		■	■	■

	4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-502: Linear Algebra - I

Course Code	**MTH-502**
Course Title	**Linear Algebra – I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theLinearAlgebra.
Course Objective	To make students acquainted with concepts of LinearAlgebra.
Course Outcomes	The course will enable the students to:
Mapping between COs with PSOs	
Pre-requisite	Basics of algebraic system
Course Content	Unit 1: Definition and examples of Vector space, Subspace, Necessary and sufficient condition for a subspace, Illustrations. Unit 2: Span of a set, union and intersection of subspaces, sum and direct sum of subspaces. Unit 3: Linearly dependent and independent vectors, checking of Linear dependence or independence. Unit 4:

	Dimension and Basis of a vector space, extension of a linearly independent set to a basis, dimension of sum.
Reference Books	1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi. 2. I. H. Sheth : Linear Algebra, NiravPrakashan. 3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000. 4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.). 5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-503: Real Analysis - I

Course Code	**MTH-503**
Course Title	**Real Analysis – I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Identify the convergent and divergent of series CO3 : Recognize Sequences of real numbers, Sub-sequences, limit of a sequence, Convergent sequences, Divergent sequences. CO4 : Learn about operations on convergent sequences. CO5 :Analyze Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence. CO6 : Apply Basic of real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■		■	■				
CO3	■	■	■		■			
CO4	■	■	■	■		■	■	
CO5	■		■		■	■		■
CO6	■	■		■		■		

Pre-requisite	Basics of Mathematics
Course Content	Unit 1:

	Bounded sequences, monotone sequences, operations on convergent sequences. Unit 2: Operations on divergent sequences, concepts of limit superior and inferior, Cauchy sequence. Unit 3: Convergence and divergence of series of real numbers, Series with non-negative terms, Alternating series, Conditional and absolute convergence. Unit 4: Tests for absolute convergence, Series whose terms form a non-increasing sequence.
Reference Books	1. R. R. Goldberg : Methods of Real Analysis, Oxford & TBH Pub. Co. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi. 3. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 4. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: MTH-504: Real Analysis - II

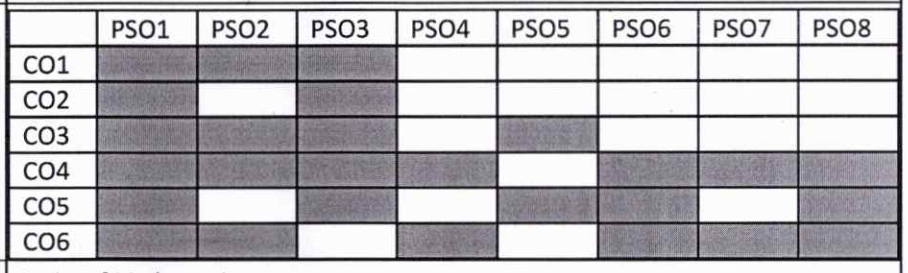
Course Code	**MTH-504**
Course Title	**Real Analysis – II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : Understand the Limit and Continuity of a function on the real line, Definition & examples of Metric spaces CO3 : Recognize Open ball in R1, open ball in metric space, functions continuous on metric spaces. CO4 : Learn about Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics.. CO5 :Analyze Open sets and their properties. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
	CO6								
Pre-requisite	Basics of Real analysis								
Course Content	Unit 1: Revision of Limit and Continuity of a function on the real line, Definition & examples of Metric spaces. Unit 2: Limit, Convergence and Cauchy sequence in metric space, Equivalent metrics. Unit 3: Open ball in R1, open ball in metric space, functions continuous on metric spaces. Unit 4: Open sets, more about open sets.								
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. D. SomSundaram& B. Chaudhari : A first course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997. 5. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.								
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment								
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination								

B.Sc. Mathematics 5th Semester

Course: MTH-505: Graph Theory

Course Code	**MTH-505**
Course Title	**Graph Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Graph theory
Course Objective	To make students acquainted with concepts of Graph Theory.
Course Outcomes	The course will enable the students to:

	CO1 : Explain the insight of the graph theory. CO2 : Understand the graph theory and relevant term CO3 : Recognize Subgraphs, Isomorphism between two graphs. CO4 : Learn about Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs and Components of graphs . CO5 :Analyze Euler graph and their properties. CO6 : Apply graph .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphs, various type of graphs, incidence and degree, isolated and pendent vertices, Subgraphs, Isomorphism between two graphs. Unit 2: Operations on graphs, Walks, Paths, Circuits, Connected graphs, Disconnected graphs, Components of graphs. Unit 3: Euler graphs, Arbitrary traceable graph, Hamiltonian Graphs, Applications of graphs: Konigsberg Bridge Problem, Seating Arrangement Problem, Utility Problem. Unit 4: Trees, Properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and Diameter of a Tree, Rooted & Binary trees.
Reference Books	1. NarsinghDeo : Graph Theory with applications to Engineering & Computer Science, Prentice Hall of India Pvt. Ltd., 2000. 2. R. J. Wilson : Introduction to Graph Theory, Academic Press, New York, 1972. 3. E. Harray : Graph Theory, Addison Wesley Pub. Co., 1969. 4. C. Berge : The Theory of Graphs and its Applications, John Wiley & Sons, 1962.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 5th Semester

Course: MTH-506: Number Theory - I

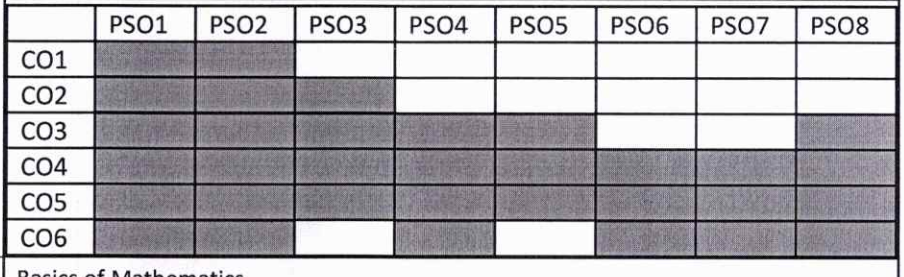
Course Code	**MTH-506**
Course Title	**Number Theory - I**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Understand the Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm CO3 : Compute the solutions of linear Diophantine equations in two variables CO4 :Learn about Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences CO5 :Analyze Basic properties of Congruence, divisibility tests. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Divisibility of integers, the Division Algorithm, Greatest Common Divisor of two integers, the Euclidean algorithm, relation between greatest common divisor and least common multiple of two integers. Unit 2: Computation of the solutions of linear Diophantine equations in two variables, Primes and composite numbers, the fundamental theorem of arithmetic, Pythagorean theorem for the irrationality of $\sqrt{p}$, for any prime p. Unit 3: Sieve of Eratosthenes, infinitude of primes, upper bound for the primes, Theory of Congruences. Unit 4: Basic properties of Congruence, divisibility tests of 9 and 11.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5001: Operations Research-I(ElectiveGeneric)

Course Code	**E.G.-5001**
Course Title	**Operations Research-I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operations research.
Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research. CO2 : Solve Linear programming problem and their Graphical solution. CO3 : Compute the solutions LPP by dual simplex method CO4 :Learn about Definition of the dual problem and their properties CO5 : Find the solution of LPP by Big-M method. CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Graphical Solution of Linear programming problem (LPP). Definition of the dual problem, General rules for converting any primal problem into it's dual, The symmetric dual problems.

	Unit 2: Basic concept of basic, non-basic, degenerate, non-degenerate and basic feasible solutions of LPP, slack & surplus variables, Unit-3: LPP in the standard matrix form, Slack & surplus variables, Solution of LPP using Simplex method. Unit 4: Solution of LPP using Two Phase Simplex method and Big-M method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998. 2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5002: Computer Oriented Numerical Methods – I(ElectiveGeneric)

Course Code	**E.G.-5002**
Course Title	**Computer Oriented Numerical Methods – I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 : Understand Flow charts and symbols, More flow charting examples and FORTRAN language CO3 : Compute the operations in expressions CO4 :Learn about Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries. CO5 : Familiarize with Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program.

	CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Flow charts and symbols, More flow charting examples. FORTRAN language, character used in FORTRAN, FORTRAN constants, FORTRAN variable names, Unit-2 Type declaration for integer and real, Arithmetic expression (real and integer expressions), Hierarchy of operations in expressions, Examples of Arithmetic expression. Unit 3: Arithmetic statement, Mode of Arithmetic expression, Special function, examples of use of functions, Program preparation preliminaries. Unit 4: Input-Output statement, STOP and END statement, FORTRAN coding form, Simple FORTRAN program, FORTRAN programming examples.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5003: Fourier Series (ElectiveGeneric)

<table>
<tr><td>Course Code</td><td>E.G.-5003</td></tr>
<tr><td>Course Title</td><td>Fourier Series</td></tr>
<tr><td>Credit</td><td>2</td></tr>
<tr><td>Teaching per Week</td><td>2 Hrs</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (Including Class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2022</td></tr>
<tr><td>Purpose of Course</td><td>The purpose of the course is to make the student capable to understand and implement the Fourier Series.</td></tr>
<tr><td>Course Objective</td><td>To make students acquainted with concepts of Fourier Series.</td></tr>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Fourier Series.
CO2 : Explain the Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion
CO3 : Compute the Fourier series of functions
CO4 :Learn about Functions having points of discontinuity, change in intervals, even and odd functions, Expansion of even or odd periodic functions.
CO5 : Familiarize with Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series.
CO6 : Apply Fourier series in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Mathematics</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Definition of Fourier series, Euler's formulae, Evaluation of definite integrals, Conditions for a Fourier expansion.
Unit 2:
Functions having points of discontinuity, change in intervals, even and odd functions
Unit-3:
Expansion of even or odd periodic functions, Half range series, Typical waveforms
Unit 4:
Half range series, Typical waveforms, Parseval's formula, Root mean square value, Complex form of Fourier series.</td></tr>
<tr><td>Reference Books</td><td>1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi.
2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi.
3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New</td></tr>
</table>

	Delhi. 4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE. 5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 5th Semester

Course: E.G.-5004: Computer Programming in FORTRAN 90 and 95–I (ElectiveGeneric)

Course Code	**E.G.-5004**
Course Title	**Computer Programming in FORTRAN 90 and 95–I**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Programming.
Course Objective	To make students acquainted with concepts of programming.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Programming in FORTRAN. CO2 : Explain the program, Input statementand basic statements of programming CO3 : Compute the basics problems solution CO4 :Learn about arithmetic operations and functions CO5 : Familiarize with Assignment statements and some problems. CO6 : Apply Programming for solution of problems
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Simple FORTRAN 90 programs-Writing a program, Input statement, Examples of FORTRAN 90 program Unit 2: Numeric Constants and Variables-Constants, Scalar Variables, Declaring Variable Names, Implicit Declaration, Named Constants and examples.

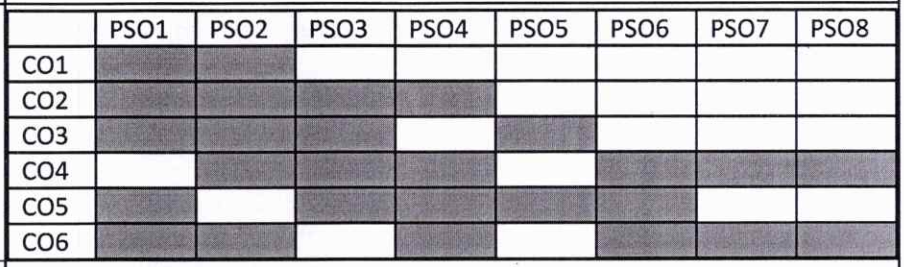
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Unit 3: Arithmetic Expressions-Arithmetic Operator and Modes of Expressions, Real Expressions, Integer Expressions, Precedence of operations in expressions, Examples of Arithmetic expressions. Unit 4: Assignment Statements-Defining Variables, Some problems Due to Rounding of real numbers, Mixed Mode Expressions, Intrinsic function.
Reference Books	1. Computer Programming in FORTRAN 90 and 95: V.RAJARAMAN, PHI Learning Private Limited, Seventeenth Printing-March-2015. 2. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 3. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 4. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 5. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 6. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 7. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-601: Ring Theory

Course Code	**MTH-601**
Course Title	**Ring Theory**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Ring theory.
Course Objective	To make students acquainted with concepts of ring theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Formation of Ring theory. CO2 : identify Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal CO3 : Learn about different kinds of ring and their properties.. CO4 : Recognize Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring. CO5 : Link theParticular Euclidean Ring, Polynomial Ring, Degree of a Polynomial, Division Algorithm, Irreducible polynomial. CO6 : Apply Ring theory in social sciences, physical sciences, life sciences and a

	host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of group theory
Course Content	Unit 1: Definition of a Ring, Examples of Ring, Integral Domain, Field, Boolean Ring. Unit 2: Ring Homomorphism and Isomorphism, Ideals & Quotient rings, Maximal Ideal, Principal Ideal. Unit 3: Euclidean rings, Divisibility in commutative ring, GCD of two elements in a ring, Units and Associates in rings. Unit 4: Prime element in a Euclidean Ring, Unique factorization theorem in a Euclidean ring.
Reference Books	1. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1983. 2. I. H. Sheth : Abstract Algebra, NiravPrakashan, Ahmedabad. 3. N. S. GopalKrishnan : University Algebra, Wiley Eastern Ltd. 4. P. R. Bhattacharya, S. K. Jain and S. R. Nagpaul : Basic Abstract Algebra, Cambridge University Press, Indian Edition, 1997. 5. Shantinarayan :Modern Algebra, S. Chand & Co. 6. Serge Lang : Algebra, ed. Addition Wesley, 1993. 7. Surjeet&KaziZameeruddin : Modern Algebra, Vikas Publishing House.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-602: Linear Algebra - II

Course Code	**MTH-602**
Course Title	**Linear Algebra - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement theLinearAlgebra.
Course Objective	To make students acquainted with concepts of LinearAlgebra.

<table>
<tr><td>Course Outcomes</td><td>The course will enable the students to:
CO1 : Explain the insight of the Linear algebra.
CO2 : learn Linear Transformation and their properties
CO3 : Learn about rank nullity and their properties
CO4 : Recognize Matrix associated with linear transformations.
CO5 :Analyze Inner product spaces, Norm of a vector and properties.
CO6 : Apply linear algebra in social sciences, physical sciences, life sciences and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of linear algebra</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Definition and examples of Linear transformation, Range and kernel of a linear transformation.
Unit 2:
Rank-Nullity Theorem, Inverse of a linear transformation, Consequences of Rank-Nullity Theorem, Composition of linear transformations.
Unit 3:
Matrix associated with linear transformations, linear transformation associated with a matrix, Application of Rank-Nullity Theorem for matrix.
Unit 4:
Inner product spaces, Norm of a vector, Cauchy-Schwarz's inequality, Triangular inequality, Orthogonalvectors, Vector Projection, Gram-Schmidt Orthogonalization Process, OrthonormalSet.</td></tr>
<tr><td>Reference Books</td><td>1. V. Krishnamurthy, V. P. Mainra& J. L. Arora : An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi.
2. I. H. Sheth : Linear Algebra, NiravPrakashan.
3. S. Kumaresan : Linear Algebra, Prentice Hall of India, 2000.
4. Serge Lang : Linear Algebra, Addition-Wesley Pub. Co. (Student Ed.).
5. Balakrishnan : Linear Algebra, Tata-McGraw Hill Ed.</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

B.Sc. Mathematics 6th Semester

Course: MTH-603: Real Analysis - III

Course Code	**MTH-603**
Course Title	**Real Analysis - III**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : analyseSummability of sequences CO3 : Recognize Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. CO4 : Learn about different type of series . CO5 :Analyze Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Real analysis
Course Content	Unit 1: Summability of sequences, Addition and subtraction of (C, 1) Summable sequences, (C, 2) Summable sequences, (C, 1) Summability of series. Unit 2: Sequences of functions, Pointwise convergence of Sequences of functions, Uniform convergence of Sequences of functions. Unit 3: Sets of measure zero, definition of the Riemann Integral, Algebraic properties of Riemann Integral. Unit 4: Non Algebraic properties of Riemann Integral Fundamental theorems of Integral Calculus, Mean-value Theorems of Integral Calculus.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. Louis Leithold : Calculus with analytic Geometry, Harper and Collins Pub. Co.

	5. J. B. Thomas and Finney : Calculus with analytic Geometry. 6. E. T. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-604: Real Analysis - IV

Course Code	**MTH-604**
Course Title	**Real Analysis - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Real analysis.
Course Objective	To make students acquainted with concepts of Real analysis.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the real analysis. CO2 : identify Limit points, closure of a set, closed sets, homeomorphism of metric spaces CO3 : Recognize Connected sets, Bounded sets, Totally bounded sets. CO4 : Learn about Complete metric spaces, Contraction mapping, Picard's fixed point theorem. CO5 :Analyze Open covering, Heine-Borel property. CO6 : Apply real analysis .in social sciences, physical sciences, life sciences and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■	■	■				
CO2	■		■	■				
CO3	■	■	■		■			
CO4	■	■	■	■		■		
CO5	■		■		■	■		■
CO6	■	■		■				

Pre-requisite	Basics of real analysis
Course Content	Unit 1: Limit points, closure of a set, closed sets, homeomorphism of metric spaces, dense set. Unit 2: Connected sets, Bounded sets, Totally bounded sets. Unit 3: Complete metric spaces, Contraction mapping, Picard's fixed point theorem.

	Unit 4: Compact metric spaces, Open covering, Heine-Borel property, Finite Intersection property.
Reference Books	1. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd., New Delhi. 2. T. M. Apostol : Mathematical Analysis, Narosa Publishing House, New Delhi, 1985. 3. S. Lang : Undergraduate Analysis, Springer-Verlag, New York, 1983. 4. S. C. Malik : Real Analysis, Wiley-Eastern Pub. Co., New Delhi. 5. Walter Rudin : Principles of Mathematical Analysis, McGraw Hill book Company. 6. Copson : Metric Spaces, Cambridge University Press, 1968. 7. P. K. Jain & K. Ahmed : Metric Spaces, Narosa Pub. House, New Delhi, 1996.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: 605: Discrete Mathematics

Course Code	**MTH-605**
Course Title	**Discrete Mathematics**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Discrete Mathematics
Course Objective	To make students acquainted with concepts of Discrete Mathematics.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Discrete Mathematics. CO2 : Identify the relation , lattice and relevant term CO3 : Recognize Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. CO4 : Learn about Boolean Algebra as an algebraic system, Boolean expressions. CO5 :Determine Minimization of Boolean functions by Karnaugh Map method. CO6 : Apply Discrete Mathematics .in social sciences, physical sciences, life sciences and a host of other disciplines

Mapping between COs with PSOs

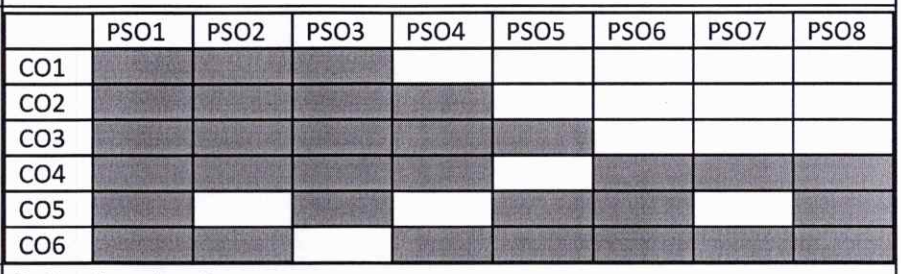
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Binary relations, Properties of binary relations, Equivalence relation, Partial ordered relation, Partially ordered sets, Upper bounds, Lower bounds, GLB & LUB of sets, Totally ordered sets, Well ordered sets, Hasse Diagram, Lattices and its properties. Unit 2: Lattices as algebraic systems, Lattice homomorphism, Different types of lattices. Unit 3: Boolean Algebra as an algebraic system, Boolean expressions (forms), Different representation of Boolean forms, Sum of products canonical form and product of sums canonical forms of Boolean expressions. Unit 4: Minimization of Boolean functions by Karnaugh Map method and Quine- McCluskey algorithm, AND, OR & NOT gates, Reduction of switching circuit diagram.
Reference Books	1. J. P. Tremblay & R. Manohar : Discrete mathematical Structures with Applications to Computer Science., McGraw Hill Book Co., 1999. 2. B. Kolman, R. C. Busby & S. Ross : Discrete Mathematical Structures, Prentice Hall of India Pvt. Ltd., 3rd ed. 2001. 3. Elements of Discrete Mathematics, C. L. Liu, D. P. Mohapatra, Tata McGraw Hill, 2008. 4. Discrete Mathematics with Applications, Thomas Koshy, Academic Press, 2004.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: MTH-606: Number Theory - II

Course Code	**MTH-606**
Course Title	**Number Theory - II**
Credit	3
Teaching per Week	3 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Number theory
Course Objective	To make students acquainted with concepts of Number theory.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the number theory. CO2 : Explain little theorem, Pseudo-primes, Wilson's theorem CO3 : Compute the solutions of linear congruence , the Chinese Remainder Theorem CO4 :Learn about The number of positive divisors, multiplicative nature of functions, The Möbius Inversion formula CO5 :Analyze Euler's Phi-function and related theorem. CO6 : Apply Number theory .in social sciences, physical sciences, life sciences

	and a host of other disciplines
Mapping between COs with PSOs	
Pre-requisite	Basics of number theory
Course Content	Unit 1: Computation of the solutions of linear congruence , the Chinese Remainder Theorem. Unit 2: Fermat's little theorem, Pseudo-primes, Wilson's theorem. Unit 3: The number of positive divisors and sum of all positive divisors of an integer, basic properties and multiplicative nature of these functions, The Möbius Inversion formula (without proof), the greatest integer function. Unit 4: Introduction of Euler's Phi-function , multiplicative nature of (statement only), Euler's Theorem.
Reference Books	1. David M. Burton : Elementary Number Theory, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 6th Ed., 2006. 2. S. G. Telang : Number Theory, The Tata McGraw Hill Co. Ltd., New Delhi. 3. I. Niven, S. Zuckerman & L. Montgomery: An Introduction to Theory of Numbers, John Wiley, 1991. 4. George Andrews : Number Theory, The Hindustan Pub. Corporation, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

B.Sc. Mathematics 6th Semester

Course: E.G. 6001: Operations Research-II (ElectiveGeneric)

Course Code	**E.G.- 6001**
Course Title	**Operations Research-II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Operation research.
Course Objective	To make students acquainted with concepts of Operations research.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Operations research. CO2 : Understand the transportation problem and their solutions. CO3 : Compute the solutions of Assignment problem CO4 :Learn about Competitive games theory CO5 : Find the solution Game theory problem by graphical method CO6 : Apply Operations Research in social sciences, physical sciences, life Science and a host of other disciplines

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Transportation problem, methods for finding initial basic feasible solution, solution of Transportation problem by MODImethod, Unbalanced Transportation problem. Unit 2: Assignment problems, The Hungarian method, balanced & unbalance assignment problems. Unit 3: Competitive games, two-person zero-sum game, maximin and minimax principle, saddle points and the value of the game (based on pure strategies), mixed strategies Unit-4 solution of games with saddle point, Game without saddle points, Dominance rule, solution of m×2 and 2×n games using graphical method.
Reference Books	1. J. K. Sharma : Operations Research: Theory & Applications, McMillan India Ltd., 1998.

	2. KantiSwaroop, P. K. Gupta & Man Mohan : Operations Research, S. Chand & Sons, New Delhi, 1998. 3. G. Hadley : Linear Programming, Narosa Publishing House, New Delhi, 1995. 4. S. D. Sharma: Operations Research, KedarnathRamnath& Co. 5. P. M. Karak : Linear Programming, New Central Book Agency Pvt. Ltd. Calcutta - 9. 6. K. V. Mittal & L. Mohan : Optimization methods in O.R. and System Analysis, New Age International Publications. 7. Goel&Mittal : O.R., PragatiPrakashan, Meerut
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.-6002: Computer Oriented Numerical Methods – II

(ElectiveGeneric)

Course Code	**E.G.-6002**
Course Title	**Computer Oriented Numerical Methods – II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Computer Oriented Numerical Methods.
Course Objective	To make students acquainted with concepts of Computer Oriented Numerical Methods.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Oriented Numerical Methods. CO2 :Recognize Control statements, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement CO3 : Apply the Statement labels, GO TO statement and DO statement CO4 :Learn about Rules to be followed in utilizing DO loops, Subscripted variables, Subscripted expression, Dimension statement, DO type notation for input / output statement. CO5 : Familiarize with FORMAT specification and FORMAT specification for a numerical data. CO6 : Apply Computer Oriented Numerical Methods in social sciences, physical sciences, life Science and a host of other disciplines
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■	■	■					
CO3	■	■	■	■	■			■
CO4	■	■	■	■	■	■	■	■
CO5	■		■	■	■	■		
CO6	■	■				■	■	■

Pre-requisite	Basics of Computer Oriented Numerical Methods

Course Content	Unit1: Controlstatements,Relationaloperators,LogicalIFstatement,ArithmeticIFstatement,Block IFstatement. Statement labels, GO TO statement, Example of use of Logical IF statement. Unit2: Nested logical IF statement, Computed GO TO statement, DO statement, Examples of DO statement. Rules to be followed in utilizing DO loops, Subscripted variables Unit 3 Sub scripted Expression. Dimension statement, DO type notation for input/output statement. FORMAT specification. Unit4: FORMATspecificationforanumericaldata, Iterative methods. Numerical integrations and differentiations. Numerical solution of ordinary differential equations.
Reference Books	1. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 2. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 3. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley Eastern Ltd. 4. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 5. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 6. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, N.Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

B.Sc. Mathematics 6th Semester

Course: E.G.-6003: Fourier Transform and its Applications (ElectiveGeneric)

Course Code	**E.G.-6003**
Course Title	**Fourier Transform and its Applications**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the Fourier Transform and its Applications.
Course Objective	To make students acquainted with concepts of Fourier Transform and its Applications.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Fourier Transform and its Applications. CO2 : identify the Integral transforms, Fourier Transforms, Properties of Fourier Transform CO3 : Compute the Fourier Transform CO4 :Learn about Convolution, Convolution theorem for Fourier transforms, Parseval's Identity for Fourier transform

<table>
<tr><td></td><td>CO5 : Familiarize with Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function
CO6 : Apply Fourier Transform in social sciences, physical sciences, life Science and a host of other disciplines</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Fourier series</td></tr>
<tr><td>Course Content</td><td>Unit 1:
Integral transforms, Fourier Transforms, Properties of Fourier Transform and its application.
Unit 2:
Convolution, Convolution theorem for Fourier transforms
Unit 3:
Parseval's Identity for Fourier transform, Examples to use Parseval's Identity
Unit 4:
Relation between Fourier and Laplace Transforms, Fourier transforms of the derivatives of a function, Fourier transform and its applications.</td></tr>
<tr><td>Reference Books</td><td>1. B. S. Grewal : Higher Engineering Mathematics, KhannaPrakashan, New Delhi.
2. S. K. Jain : Fourier series and Fourier Transforms, Swarup and Sons Pub., New Delhi.
3. R. R. Goldberg : Method of Real Analysis, Oxford & IBH Pub. Co. Ltd. New Delhi.
4. R. V. Churchil : Fourier series and Boundary value problems, McGraw Hill ISE.
5. Vashishtha and Gupta :Integral Transforms, Krishna Publications, Meerut</td></tr>
<tr><td>Teaching Methodology</td><td>Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

B.Sc. Mathematics 5th Semester

Course: E.G.-6004: Computer Programming in FORTRAN 90 and 95–II (ElectiveGeneric)

Course Code	**E.G.-6004**
Course Title	**Computer Programming in FORTRAN 90 and 95–II**
Credit	2
Teaching per Week	2 Hrs
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Effective From	June 2022
Purpose of Course	The purpose of the course is to make the student capable to understand and implement the programming.
Course Objective	To make students acquainted with concepts of Programming.
Course Outcomes	The course will enable the students to: CO1 : Explain the insight of the Computer Programming in FORTRAN. CO2 : Explain the different programme statements CO3 : Write conditional statements CO4 :Learn about different loops CO5 : Familiarize withblock DO loops. CO6 : Apply Programming for solution of problems
Mapping between COs with PSOs	
Pre-requisite	Basics of Mathematics
Course Content	Unit 1: Input-Output Statements, List-Directed Input statements, List-Directed Output statements, Examples of programs. Unit 2: Conditional Statements, Relational Operators, The Block IF Construct, Examples of Programs using IF structures. Unit 3: The Necessity of loops constructs in a Programming Language, The block DO loops in FORTRAN 90, Examples of Programs. Unit 4: Count Controlled DO loops in FORTRAN 90,Rules To be followed in writing DO loops, Examples of programs.
Reference Books	1. Computer Programming in FORTRAN 90 and 95: V.RAJARAMAN, PHI Learning Private Limited, Seventeenth Printing-March-2015. 2. V. Rajaraman : Computer Programming in FORTRAN 77, PHI. 3. V. Rajaraman : Computer Oriented Numerical Methods, PHI. 4. Dhaliwal, Agarwal and Gupta : Programming with FORTRAN 77, Wiley

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

	Eastern Ltd. 5. R. S. Salaria : Computer Oriented Numerical Methods, Khanna Book Pub. Co. Ltd. 6. R. Sirkar : FORTRAN based Algorithms, New Central Book Agency, Calcutta. 7. V. Krishnamurthy : FORTRAN based Algorithms, East-West Press, New Delhi.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination