Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College Vashi, Navi Mumbai

Autonomous College

[University of Mumbai]

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of Course	T.Y.B.Sc. Mathematics
2	Eligibility for Admission	S.Y.B.Sc. (with Mathematics as one of the subject)
3	Passing Marks	40%
4	Ordinances/Regulations (if any)	
5	No. of Years/Semesters	One year/Two semester
6	Level	U.G.
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic year	2023-2024

Date: _____

Signature: _____

Name of BOS Chairman: _____

AC- 2022-23

Item No- 5.26

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE, VASHI.

NAVI MUMBAI

Sector-15- A, Vashi, Navi Mumbai - 400 703

(**AUTONOMOUS COLLEGE**)

Syllabus for Mathematics

Program: B.Sc.

Course: TY B.Sc. Mathematics

(Choice Based Credit System with effect from the academic year 2023-2024)

TY Mathematics Courses for 2023-24

CLASS	SEM	CORE COURSES - CC	Ability Enhancement Compulsory Courses - AECC (2)	Skill Enhancement Courses – SEC (4 Credit)	Discipline-Specific Elective – DSE (Credit 4.5=3(Theory)+1.5 Practical)
TYBSC	V	…..	…..	Maths_SEC-3: Python-I OR PL/SQL	**Choose any Three Elective papers**
					Abstract Algebra-II
					Topology of metric spaces (Real Analysis-I)
					Numerical Analysis
					Financial Mathematics
	VI	…..	…..	Maths_SEC-4: Python-II OR JAVA Programming	**Choose any Three elective papers**
					Linear Algebra-II
					Topology (Real Analysis-II)
					Basic Complex Analysis
					Plane and Solid Geometry
					Project Dissertation
		Project Dissertation: To build conceptual understanding, computational skills, and innovation in the form of a written project in Mathematics with applications based on the knowledge acquired during the undergraduate course of studies.			

Rayat Shikshan Sanstha's
KARMAVEER BHAURAO PATIL COLLEGE, VASHI.
NAVI MUMBAI (Autonomous)
Department of Mathematics
B. Sc. Mathematics

Program Outcomes (POs)

Learners are able to–

PO-1	**Disciplinary Knowledge**	Understand the basic concepts, fundamental principles, theoretical formulations, and experimental findings, and the scientific theories related to Physics, Chemistry, Mathematics, Microbiology, Computer Science, Biotechnology, Information Technology and its other fields related to the program.
PO-2	**Communication Skills**	Develop various communication skills such as reading, listening, and speaking skills to express ideas and views clearly and effectively.
PO-3	**Critical Thinking**	Propose novel ideas in explaining the scientific data, facts and figures related to science and technology.
PO-4	**Analytical Reasoning and Problem Solving**	Hypothesize, analyze, formulate and interpret the data systematically and solve theoretical and numerical problems in the diverse areas of science and technology.
PO-5	**Sense of Inquiry**	Curiously ask relevant questions for a better understanding of fundamental concepts and principles, scientific theories and applications related to the study.
PO-6	**Use of Modern Tools**	Operate modern tools, equipments, instruments and laboratory techniques to perform the experiments and write the programs in different languages (software).
PO-7	**Research Skills**	Understand to design, collect, analyze, interpret and evaluate information/data that is relevant to science and technology.
PO-8	**Application of Knowledge**	Develop scientific outlook and apply the knowledge with respect to subject.
PO-9	**Ethical Awareness**	Imbibe ethical, moral and social values and exercise it in day to day life.
PO-10	**Teamwork**	Work collectively and participate to take initiative for various field-based situations related to science, technology and society at large.
PO-11	**Environment and Sustainability**	Create social awareness about environment and develop sustainability for betterment of future.
PO-12	**Lifelong Learning**	Ability of self-driven to explore, learn and gain knowledge and new skills to improve the quality of life and sense of self-worth by paying attention to the ideas and goals throughout the life.

Program Specific Outcomes (PSO)

PSO-1	Recalling the concepts of mathematics and applying them to the various courses like algebra, analysis, Differential equations, statistics, etc to form mathematical models.
PSO-2	To apply knowledge of Mathematics for pursuing higher studies at reputed national and international institutes including higher research.
PSO-3	Apply Mathematics to interdisciplinary ways like statistician, mathematical finance, industry expertise and interpret quantitative ideas.

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE, VASHI.
NAVI MUMBAI (Autonomous)
(w.e.f. the academic year 2023-24)

Semester-V

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks				Credit Scheme		
		Lecture	Practical	Tutorial	CIE	Sem End-Exam	Practical	Total	Theory	Practical	Total
UGMTDSE501	Abstract Algebra-II	4	2	-	40	60	50*	150	4	2	6
UGMTDSE502	Topology of Metric Spaces	4	2	-	40	60	50*	150	4	2	6
Choose any one from the following Discipline Specific Elective (DSE)											
UGMTDSE503A	Numerical Analysis	4	2	-	40	60	50*	150	4	2	6
UGMTDSE503B	Financial Mathematics	4	2	-	40	60	50*	150	4	2	6
Skill Enhancement Courses (SEC)											
UGMTSEC03A OR UGMTSEC03B	Python-I OR PL/SQL	02	02	-	40	60	--	100	02	2	4
UGMTP05	Practical Exam based on UGMTDSE501, UGMTDSE502 and UGMTDSE503										
Total		**14**	**08**	**-**	**160**	**240**	**150**	**550**	**14**	**08**	**22**
Total Credit									**14**	**08**	**22**

Semester-VI

UGMTDSE601	ear Algebra II	4	2	-	40	60	50*	150	4	2	6
UGMTDSE 602	Topology and Real Analysis	4	2	-	40	60	50*	150	4	2	6
Choose any one from the following Discipline Specific Elective (DSE)											
UGMTDSE603A	Basic Complex Analysis	4	2	-	40	60	50*	150	4	2	6
UGMTDSE603B	Plane and Solid Geometry	4	2	-	40	60	50*	150	4	2	6
UGMTPR	Project Dissertation	4	2	-	40	60	50*	150	4	2	6
Skill Enhancement Courses (SEC)											
UGMTSEC04A OR UGMTSEC04B	Python-II OR JAVA Programming	02	02	-	40	60	--	100	02	2	4
UGMTP06	Practical Exam based on UGMTDSE601, UGMTDSE602 and UGMTDSE603										
Total		**14**	**08**	**-**	**160**	**240**	**150**	**550**	**14**	**08**	**22**
Total Credit									**14**	**08**	**22**

Project Dissertation: To build conceptual understanding, computational skills, and innovation in the form of a written project in Mathematics with applications based on the knowledge acquired during the undergraduate course of studies.

Syllabus of CBCS Curriculum

COURSE STRUCTURE FOR TYBSC MATHEMATICS

SEMESTER V

	Course Code	UNIT	TOPICS	Credits	L/Week
DSE	**Abstract Algebra II**				
	UGMTDSE **501**	I	Group Theory	4	4
		II	Ring Theory		
		III	Polynomial Rings and Field theory		
	Topology of Metric Spaces				
	UGMTDSE**502**	I	Metric spaces	4	4
		II	Sequences and Complete metric spaces		
		III	Continuous functions on Metric spaces		
	Numerical Methods				
	UGMTDSE**503A**	I	Errors Analysis and Transcendental & Polynomial Equations	4	4
		II	System of linear equations, Eigen value problem and ODE		
		III	Interpolation		
	Financial Mathematics				
	UGMTDSE**504B**	I	Mathematical Models in Economics	4	4
		II	The elements of finance and the cobweb model		
		III	The derivative in economics		
SEC	**Python-I**				
	UGMTSEC**03A**	I	Python 3.1	4	4
		II	Strings, List, and Dictionaries		
		III	Doing Math with Python		
	DBMS and PL/SQL				
	UGMTSEC**03B**	I	Data Base Management System	4	4
		II	Relational Data Base Management System		
		III	Introduction to PL/SQL		

	PRACTICALS				
Practical	**UGMTP05**		Practical based on UGMTDSE501, UGMTDSE502 and UGMTDSE503	6	12

SEMESTER VI

	Course Code	UNIT	TOPICS	Credits	L/Week
DSE	**Linear Algebra II**				
	UGMTDSE601	I	Quotient Spaces and Orthogonal Linear Transformations	4	4
		II	Eigenvalues and Eigenvectors		
		III	Diagonalisation		
	Topology and Real Analysis				
	UGMTDSE602	I	Sequences and series of functions and Fourier Series	4	4
		II	Connected Sets		
		III	Compact Sets		
	Basic Complex Analysis				
	UGDSE603A	I	Introduction to Complex Analysis	4	4
		II	Cauchy Integral Formula		
		III	Complex power series, Laurent series and isolated singularities		
	Plane and Solid Geometry				
	UGDSE604B	I	Plane	4	4
		II	Cone		
		III	Cylinder		
SEC	**Python-II**				
	UGMTSEC04A	I	Python File Input-Output & Regular Expressions	4	4
		II	GUI Programming in Python (using Tkinter/wxPython/Qt)		
		III	Database connectivity in Python, Network connectivity & Algorithm, Searching and sorting		
	JAVA PROGRAMMING				

	UGMTSEC04B	I	INTRODUCTION TO JAVA PROGRAMMING	4	4
		II	Inheritance, Exception Handling		
		III	JAVA APPLETS AND GRAPHICS PROGRAMMING		
	PRACTICALS				
PRACTICALS	**UGMTP601**		Practicals based on UGMTDSE601 UGMTDSE602 and UGMTDSE603	6	12

Note: 1. Blue Highlighted Topic / Course has focused on employability/ entrepreneurship/skill development 2. Yellow Highlighted Topic / Course is related to professional ethics, gender, human values, Environment & sustainability

3. Green Highlighted Topic / Course is related to local/national/regional & global development needs.

Semester V

UGMTDSE501 Abstract Algebra II

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

UNIT I: Group Theory (20 Lectures):

Groups and Group homomorphisms (Review), isomorphisms, automorphisms, inner automorphisms.

Normal subgroups: Normal subgroups of a group, definition and examples including center of a group, Quotient group, Alternating group A_n, Cycles. Listing normal subgroups of A_4, S_3. First Isomorphism theorem (or Fundamental Theorem of homomorphisms of groups), Second Isomorphism theorem, third Isomorphism theorem, Cayley's theorem, External direct product of a group, Properties of external direct products, Order of an element in a direct product, criterion for direct product to be cyclic, Classification of groups of order ≤ 7.

UNIT II: Ring Theory (20 Lectures):

Exàmples of rings: Integers & Polynomials. Definitions of a ring (The definition should include the existence of a unit element), zero divisor, unit, the multiplicative group of units of a ring. Basic Properties & examples of rings, including Z; Q; R; C; $M_n(R)$; Q [X]; R [X]; C [X]; Z [i]; Z [$\sqrt{2}$]; Z [$\sqrt{-5}$]; Z_n.

Definitions of integral domain, Division ring and examples. Definitions of Subring, examples. Ring homomorphisms, Properties of ring homomorphisms, Kernel of ring homomorphism, Ideals, Operations on ideals and Quotient rings, examples. Factor theorem and First and second Isomorphism theorems for rings, Correspondence Theorem for ideals in a quotient ring. Definition of characteristic of a ring, Characteristic of an Integral Domain.

UNIT III: Polynomial Rings and Field Theory (20 Lectures):

Principal ideal, maximal ideal, prime ideal, the characterization of the prime and maximal ideals in terms of quotient rings. Polynomial rings, R[X] when R is an integral domain/ Field. Divisibility in Integral Domain, Definitions of associates, irreducible and primes. Prime (irreducible) elements in R [X]; Q [X]; Z_p [X]. Eisenstein's criterion for irreducibility of a polynomial over Z. Prime and maximal ideals in polynomial rings. Definition of field, sub field and examples, characteristic of fields. Characterization of fields in terms of maximal ideals, irreducible polynomials. Construction of quotient field of an integral domain (Emphasis on $Z$and$Q$). Prime subfield of a field.

Recommended Book:

1. I. N. Herstein, Topics in Algebra, second edition, Wiley student edition.
2. Joseph Gallian, Contemporary abstract algebra, Narosa publication.

Reference Book:

1. John. B. Fraleigh, A first course in abstract algebra, 6th edition, Narosa Publishing House, New Delhi.
2. Basic Abstract Algebra by P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, Cambridge University Press, 1994.
3. U. M. Swamy, A. V. S. N. Murthy Algebra Abstract and Modern, Pearson.

UGMTDSE501

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem-Solving, Participative and Community services (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://archive.nptel.ac.in/courses/111/106/111106113/
2) https://archive.nptel.ac.in/courses/111/106/111106131/
3) https://nptel.ac.in/courses/111106131

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-		-	-	-	-	-	-	-	1
CO2	2	-	2	1	-	-	-	-	-	-	-	1
CO3	2	-	2	3	-	-	-	-	-	-	-	1
CO4	1	-	3	-	-	-	-	-	-	-	-	1
CO5	1	2	-	-	-	-	-	-	-	-	-	1

UGMTDSE502 Topology of Metric Spaces

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics, and also comprehension of unseen passages.)

UNIT I: Metric spaces (20 Lectures)

Learning Outcomes:

1. Define metric spaces, discrete metric space and metric subspace.
2. Explain properties of metric space.
3. Define open set. Closed set. Interior, closure of a subset of metric space.
4. State Hausdorff property.
5. Find the distance of a point from a given set.

Content of the unit:

Definition, examples of metrics in R and R^2.R^n with its Euclidean, sup and sum metric, C (complex numbers), the spaces l^1 and l^2 of sequences and the space C[a, b], of real valued continuous functions on [a, b]. Discrete metric space. Metric Derived from other Metrics. Distance metric induced by the norm and its translation invariance. Metric subspaces, Product of two metric spaces. Open balls and open set in a metric space, examples of open sets in various metric spaces. Hausdorff property. Interior of a set. Properties of open sets. Structure of an open set in R. Equivalent metrics. Distance of a point from a set, between sets, diameter of a set in a metric space and bounded sets. Closed ball in a metric space, closed sets- definition, examples. Limit point of a set, isolated point, a closed set contains all its limit points, Closure of a set and boundary of a set.

UNIT II: Sequences and Complete metric spaces (20 Lectures)

Learning Outcomes:

1. Define sequences, convergent sequences and Cauchy sequences in a metric space.
2. Give examples of convergent and Cauchy sequences in infinite metric spaces.
3. Characterize limit points and closure in terms of sequences.
4. Define complete metric spaces and state nested interval theorem.
5. Apply Cantor's intersection theorem to show that the set of Real numbers is uncountable.

Content of the unit:

Sequences in a metric space, Convergent sequence in metric space, Cauchy sequence in a metric space, subsequences, examples of convergent and Cauchy sequence in metric spaces, $R^n$with different metrics and other metric spaces.

Characterization of limit points and closure points in terms of sequences, Definition and examples of relative openness/closeness in subspaces. Dense subsets in a metric space and Separability.

Definition of complete metric spaces, Examples of complete metric spaces, Completeness property in subspaces, Cantor's Intersection Theorem and its Applications Bair's category theorem. Density of rational Numbers, Intermediate Value theorem.

UNIT III: Continuous functions on metric spaces (20 Lectures)

Learning Outcomes:

1. Define continuity of function from one metric space to another.
2. Solve examples on open and closed sets of a metric space.

3. Prove algebra of continuous real valued functions in a metric space.
4. Solve examples on uniform continuity of a metric space.

Content of the unit:

Epsilon-delta definition of continuity at a point of a function from one metric space to another with examples. Characterization of continuity at a point in terms of sequences(Sequential continuity), open sets and closed sets and equivalent conditions of continuity of functions, Algebra of continuous real valued functions on a metric space. Continuity of composite continuous function. Uniform continuity in a metric space, definition, and examples (emphasis on R), Uniform Continuity of Function with properties, Urysochn's Lemma. Lipschitz Inequality.

Reference books:

1. S. Kumaresan, Topology of Metric spaces.
2. E. T. Copson. Metric Spaces. Universal Book Stall, New Delhi, 1996.
3. Expository articles of MTTS programme

Other references:

1. T. Apostol. Mathematical Analysis, Second edition, Narosa, New Delhi, 1974
2. E. T. Copson. Metric Spaces. Universal Book Stall, New Delhi, 1996.
3. R. R. Goldberg Methods of Real Analysis, Oxford and IBH Pub. Co., New Delhi 1970.
4. P.K.Jain. K. Ahmed. Metric Spaces. Narosa, New Delhi, 1996.
5. W. Rudin. Principles of Mathematical Analysis, Third Ed, McGraw-Hill, Auckland, 1976.
6. D. Somasundaram, B. Choudhary. A first Course in Mathematical Analysis. Narosa, New Delhi.
7. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hi, New York, 1963.
8. Satish Shirali, Harkrishan Vasudeva. Metric Spaces, Springer 2006.
9. Ghorpade S.R., Limaye B.V - A course in calculus and real analysis-Springer (2018)

UGMTDSE502

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving, Participative and Community Services (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://nptel.ac.in/courses/111105037
2) https://nptel.ac.in/courses/111106053

3) https://nptel.ac.in/courses/111106054
4) https://archive.nptel.ac.in/courses/111/106/111106159/
5) https://4dspace.mtts.org.in/expository-articles-list.php?pn=10

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-		-	-	-	-	-	-	-	1
CO2	-	-	1	3	-	-	-	-	-	-	-	1
CO3	2	1	-	-	-	-	-	-	-	-	-	1
CO4	-	-	1	3	-	-	-	-	-	-	-	1
CO5	-	3	-	-	-	-	-	-	-	-	-	1

UGMTDSE503A Numerical Methods

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

UNIT I: Errors Analysis and Transcendental & Polynomial Equations (20 Lectures)

Learning Outcomes:

1. Have knowledge of iterative methods based on first- and second-degree equations.
2. Define relative, absolute and percentage errors. Find errors in different iterative methods.
3. Apply iterative methods based on first degree equation such as Newton Raphson method, secant method etc., to find roots of polynomial.
4. Apply iterative methods for polynomial equations such as Descartes rule of signs, Berge-Vieta method etc., to find the roots of polynomials.
5. Find rate of convergence of various iterative methods.
6. Analyze the errors obtained in the numerical solution of problems.

Content of the unit:

Measures of Errors: Relative, absolute and percentage errors. Types of errors: Inherent error, Round-off error and Truncation error. Taylor's series example. Significant digits and numerical stability.

Concept of simple and multiple roots. Iterative methods, error tolerance, use of intermediate value theorem. Iteration methods based on first degree equation: Newton-Raphson method, Secant method, Regula-Falsi method, Iteration Method. Conditions for convergence and Rate of convergence of all above methods.

Iteration methods based on second degree equation: Muller method, Chebyshev method, Multipoint iteration method. Iterative methods for polynomial equations; Berge-Vieta method, Bairstow method.

Methods for multiple roots. Newton- Raphson method for System of non-linear equations and for complex roots. Conditions for convergence and Rate of convergence of all above methods.

UNIT II: System of linear equations, Eigen value problem and ODE (20 Lectures)
Learning Outcomes:

1. Using appropriate numerical methods, determine approximate solutions to systems of linear equations.
2. Express the given system of linear equation in matrix form and apply Gaussian method to find the solution of the given system.
3. Use Triangularization methods such as Doolittle and Crout's method, Cholesky method etc., to find the solution of system of linear equations.
4. Find the largest and smallest Eigen value of a matrix using power method.
5. Find the Eigen values of symmetric matrices using Jacobi method.
6. Using appropriate numerical methods, determine approximate solutions to ordinary differential equations.

Content of the unit:
Matrices: Pivot element, Partial and complete pivoting, Forward and backward substitution method, LU decomposition: Doolittle and Crout's method, Cholesky method. Error analysis of direct methods.
Iteration methods: Jacobi iteration method, Gauss-Seidel method, Relaxation method. Convergence analysis of iterative method.
Eigen value problem, Jacobi's method for symmetric matrices Power method to determine largest eigenvalue and eigenvector. Solution of Initial value problem of an ordinary first order differential equation: One step method; Taylor's series method, Picard's method, Euler's method, Heun's method, Polygon method, Runge-Kutta method of second and fourth order;

UNIT III: Interpolation (20 Lectures)
Learning Outcomes:

1. Define Basic concepts of operator's Δ, E, ∇.
2. Find the difference of polynomial.
3. Perform interpolation such as linear, quadratic and cubic interpolation to find the polynomial.
4. Derive formula and solve problems using Newton forward formula and Newton backward formula.
5. Perform piecewise interpolation such as linear, quadratic and cubic interpolation to find the polynomial.
6. Derive formula and solve problems using Lagrange's bivariate interpolation and Newton's bivariate interpolation.
7. Derive Newton-Cotes method, Simpson's 1/3, 3/8 rules, trapezoidal rule, composite Simpson's and trapezoidal rule.
8. Evaluate the numerical integration using Simpson's 1/8, 3/8 rules and trapezoidal rule.
9. Analyze the errors obtained in the numerical solution of problems.

Content of the unit:

Interpolating polynomials, Uniqueness of interpolating polynomials. Linear, Quadratic and Higher order interpolation. Lagrange's Interpolation. Finite difference operators: Shift operator, forward, backward and central difference operator, Average operator and relation between them. Difference table, Relation between difference and derivatives. Interpolating polynomials using finite differences Gregory-Newton forward difference interpolation, Gregory-Newton backward difference interpolation, Stirling's Interpolation. Results on interpolation error.

Piecewise Interpolation: Linear, Quadratic and Cubic. Bivariate Interpolation: Lagrange's Bivariate Interpolation, Newton's Bivariate Interpolation.

Recommended Books

1. Kendall E. and Atkinson, An Introduction to Numerical Analysis, Wiley.
2. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
3. S.D. Comte and Carl de Boor, Elementary Numerical Analysis, An algorithmic approach, McGrawHillll International Book Company.
4. S. Sastry, Introductory methods of Numerical Analysis, PHI Learning.
5. Hildebrand F.B., Introduction to Numerical Analysis, Dover Publication, NY.
6. Scarborough James B., Numerical Mathematical Analysis, Oxford University Press, New Delhi.

UGMTDSE503A

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen problems.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving, Participative and Community Services (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://archive.nptel.ac.in/courses/111/107/111107105/
2) https://archive.nptel.ac.in/courses/127/106/127106019/
3) https://nptel.ac.in/courses/111106101

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	2	2	2	-	-	1	-	2	-	-	-	1
CO3	1	-	3	2	-	-	-	2	-	-	-	2
CO4	2	2	-	2	-	2	-	-	-	-	-	2
CO5	2	-	2	3	-	2	-	-	-	-	-	1

UGMTDSE503B Financial Mathematics

Unit-I. Mathematical models in Economics (20 Lectures)

Introduction, a model of the market, market equilibrium and excise tax. The first-order recurrence, limits, special cases, continuous compounding of interest. Interest and capital growth, income generation, the interval of compounding.

Unit-II. The elements of finance and the cobweb model (20 Lectures)

Stability of market equilibrium, the general linear case and economic interpretation. Marginal cost as a derivative, Profit maximization, critical points, optimization in an interval and infinite intervals the general linear case and economic interpretation.

Introduction to optimization: Profit maximization, critical points, optimization in an interval and infinite intervals.

Unit-III. The derivative in economics (20 Lectures)

Elasticity of demand, profit maximization again, competition versus monopoly, the efficient small firm, startup and break even points. **Linear equations and the input-output model** Making money with matrices, a two-industry 'economy', arbitrage portfolios and state prices and IS-LM analysis. An economy with many industries and the technology matrix.

Reference Book:

1. Edward T. Dowling, Mathematical Economics, Second Edition, Schaum's Outline Series, McGraw Hill Intern

2.Martin Anthony and Norman Biggs, Mathematics for Economics and Finance Methods and Modelling, Cambridge University Press, Reprint 2012.

UGMTDSE503B

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen problems.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving, Participative and Community Services (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://archive.nptel.ac.in/courses/109/103/109103188/
2) https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/261
3) https://onlinecourses.nptel.ac.in/noc23_mg92/preview
4) https://onlinecourses.nptel.ac.in/noc23_ec02/preview

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	-	-	-	-	-	-	1
CO2	1	2	-	-	-	-	-	-	-	-	-	1
CO3	2	-	2	-	1	-	-	1	-	-	-	1
CO4	2	1	2	2	1	-	-	-	-	-	-	1
CO5	1	1		2	-	-	-	-	-	-	-	1

UGMTSEC03A Python-I

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen problems.)

UNIT I: PYTHON 3.1 (15 LECTURES)

1.Introduction: The Python Programming Language, History, features, Installing Python. Running Code in the Interactive Shell, IDLE. Input, Processing, and Output, Editing, Saving, and Running a Script, Debugging: Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging.

2.Data types and expressions: Variables and the Assignment Statement, Program Comments and Doc strings . Data Types-Numeric integers & Floating-point numbers. Boolean, string. Mathematical operators +, - *, ** , %. PEMDAS. Arithmetic expressions, Mixed-Mode Arithmetic and type Conversion, type( ). Input( ), print( ), program comments. id( ), int( ), str( ), float( ).

3.Loops and selection statements: Definite Iteration: The for Loop, Executing statements a given number of times, Specifying the steps using range( ), Loops that count down, Boolean and Comparison operators and Expressions, Conditional and alternative statements- Chained and Nested.

Conditionals: if, if-else, if-elif-else, nested if, nested if-else. Compound Boolean Expressions

Conditional Iteration: The while Loop –with True condition, the break Statement. Random Numbers. Loop Logic, errors, and testing.

Reference Fundamentals of Python First programs 2nd edition by Kenneth A Lambert chapter 1,2,3.

Unit II: STRINGS, LIST AND DICTIONARIES. (15 LECTURES)

1. Strings, Lists, Tuple and Dictionary: Accessing characters, indexing, slicing, replacing. Concatenation (+), Repetition (*). Searching a substring with the 'in' Operator, traversing string using while and for. String methods- find, join, split, lower, upper. len( ).
2. Lists – Accessing and slicing, Basic Operations (Comparison, +), List membership and for loop.Replacing element (list is mutable). List methods- append, extend, insert, pop, sort. Max(),min (). Tuples. Dictionaries-Creating a Dictionary, adding keys and replacing Values, dictionary – key (), value (), get (), pop (), Traversing a Dictionary. Math module: sin (), cos (), exp (), sqrt (), Constants- pi, e.
3. Design with functions: Defining Simple Functions- Parameters and Arguments, the return Statement, tuple as return value. Boolean Functions. Defining a main function. Defining and tracing Recursive functions.
4. Exception handling: try- except.

Fundamentals of Python First programs 2nd edition by Kenneth A Lambert chapters 4,5,6.

UNIT III: DOING MATH WITH PYTHON (15 LECTURES)

1. **Working with Numbers:** Calculating the Factors of an Integer, Generating Multiplication Tables, converting units of Measurement, Finding the roots of a Quadratic Equation
2. **Algebra and Symbolic Math with SymPy:** symbolic math using the SymPy library. Defining Symbols and Symbolic Operations, factorizing and expanding expressions, substituting in Values, Converting strings to mathematical expressions. Solving equations, Solving Quadratic equations, solving for one variable in terms of others, solving a system of linear equations, Plotting using SymPy, Plotting expressions input by the user, Plotting multiple functions.

Reference: Doing math with Python by Amit Saha (Internet source) chapter 1, 4

References:
1. Programming with Java: A Primer 4th Edition by E. Balagurusamy, Tata McGraw Hill.
2. JavaTheCompleteReference,8thEdition, Herbert Schildt, Tata McGraw Hill
3. Fundamentals of Python First programs 2nd edition - Kenneth A Lambert, Cengage Learning India.
4. Doing Math with Python - Amit Saha, No starch ptress,

Additional References:

Eric Jendrock, Jennifer Ball, D Carson and others, TheJavaEE5Tutorial, Pearson Education, Third Edition,2003.

1. Ivan Bay Ross, Web Enabled Commercial Applications Development UsingJava2, BPB Publications, Revised Edition, 2006.
2. Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD), ThirdEdition,2004.
3. The Java Tutorials of Sun Microsystems Inc. http://docs.oracle.com/javase/tutorial
4. Problem solving and Python programming- E. Balgurusamy, TataMcGrawHill.

UGMTSEC03A

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen problems.)

ICT Tools Used: Videos, PPT, PC, Python language

Students Centric Methods: Problem Solving and Participative
(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://nptel.ac.in/courses/106106145
2) https://nptel.ac.in/courses/106106182
3) https://www.python.org/about/gettingstarted/

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	1	-	1	-	-	-	-	-	1
CO2	1	2	2	1	-	1	-	-	-	-	-	1
CO3	2	1	-	2	-	2	-	-	-	-	-	1
CO4	1	2	1	1	2	1	-	-	-	-	-	1
CO5	1	1	1	-	2	1	-	-	-	-	-	1

UGMTSEC03B DBMS and PL/SQL

UNIT I: DATA BASE MANAGEMENT SYSTEM – [15 Lectures]

Introduction to Databases and Transactions: what is database system, purpose of database system, view of data, relational databases, database architecture, transaction management,

Data Models: The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.

UNIT II: RELATIONAL DATA BASE MANAGEMENT SYSTEM – [15 Lectures]

1. **Introduction to Data base Concepts**: Database, Overview of data base management system. Data base Languages- Data Definition Languages (DDL) and Data Manipulation Languages (DML).

2. **Entity Relation Model:** Entity, attributes, keys, relations, Designing ER diagram, integrity Constraints over relations, conversion of ER to relations with and without constrains.

3. **SQL Commands and functions**

1. Creating and altering tables: CREATE statement with constraints like KEY, CHECK, DEFAULT, ALTER and DROP statement.
2. Handling data using SQL: selecting data using SELECT statement, FROM clause, WHERE clause, HAVING clause, ORDERBY, GROUP BY, DISTINCT and ALL predicates, adding data with INSERT statement, changing data with UPDATE statement, removing data with DELETE statement.
3. Functions: Aggregate functions- AVG, SUM, MIN, MAX and COUNT, Date functions- ADD_MONTHS (), CURRENT_DATE (), LAST_DAY (), MONTHS_BETWEEN (), NEXT_DAY ().
   String functions- LOWER (), UPPER (), LTRIN (), RTRIM (), TRIN (), INSERT (), RIGHT (), LEFT (), LENGTH (), SUBSTR (). Numeric functions: ABS (), EXP (), LOG (), SQRT (), POWER (), SIGN (), ROUND (number).
4. Joining tables: Inner, outer and cross joins, union.

UNIT III: INTRODUCTION TO PL/SQL – [15 Lectures]

1. **Fundamentals of PL/SQL:** Defining variables and constants, PL/SQL expressions and comparisons: Logical Operators, Boolean Expressions, CASE Expressions Handling, Null Values in Comparisons and Conditional Statements,
2. **PL/SQL Data Types:** Number Types, Character Types, Boolean Type. Date time and Interval types.
3. **Overview of PL/SQL Control Structures:** Conditional Control: IF and CASE Statements, IF-THEN Statement, IF-THEN-ELSE Statement, IF-THEN-ELSIF Statement, CASE Statement,
4. **Iterative Control:** LOOP and EXIT Statements, WHILE-LOOP, FOR-LOOP, Sequential Control: GOTO and NULL Statements.

References:

1.Data base management system, RamKrishnam, Gehrke, McGraw-Hill
2.Ivan Bayross, "SQL, PL/SQL – The Programming languages of Oracle" B.P.B. Publications, 3rd Revised Edition.
3.George Koch and Kevin Loney, ORACLE "The complete Reference", Tata McGraw Hill, New Delhi.
4.Elsmasri and Navathe, "Fundamentals of Database Systems" Pearson Education.
5.Peter Roband Coronel, "Database System, Design, Implementation and Management", Thomson Learning.
6.C.J. Date, Longman, "Introduction database system", Pearson Education.
7.Jeffrey D. Ullman, Jennifer Widsom, "A First Course in Database Systems",Pearson Education.
8.Martin Gruber, "Understanding SQL", B.P.B. Publications.

Additional References:

1. Eric Jend rock, Jennifer Ball, D Carson and others, The Java EE5 Tutorial, Pearson Education, Third Edition 2003.
2. Ivan Bayross, Web Enabled Commercial Applications Development using Java 2, BPB Publications, Revised Edition, 2006.
3. Joe Wiggles worth and Paula Mc Millan, Java Programming: Advanced Topics, Thomson Course Technology (SPPD), Third Edition 2004.

The Java Tutorials of Sun Microsystems Inc .http://docs.oracle.com/javase/tutorial Suggested Practicals

UGMTSEC03B

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem-Solving and Participative
(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://nptel.ac.in/courses/106105175
2) https://swayam-uat-node1.appspot.com/proc_9i/preview
3) https://online-degree.swayam2.ac.in/mri22_01_d01_s1_cc6/preview

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	1	-	1	-	-	-	-	-	1
CO2	1	2	2	-	-	-	-	-	-	-	-	1
CO3	2	1	-	-	-	1	-	-	-	-	-	1
CO4	1	2	1	1	2	-	-	-	-	-	-	1
CO5	1	1	1	-	2	1	-	-	-	-	-	1

SEMISTER VI

UGMTDSE601 Linear Algebra II

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

UNIT I: Quotient Spaces and Orthogonal Linear Transformations (20 Lectures)

Review of linear transformations & inner product spaces.

Orthogonal transformations: Isometries of a real finite dimensional inner product space, Translations and Reflections with respect to a hyperplane, Orthogonal matrices over R , Equivalence of orthogonal transformations and Isometries fixing origin on a finite dimensional inner product space, Orthogonal transformation of R^2, Any orthogonal transformation in R^2 is a reflection or a rotation, Characterization of isometries as composites of orthogonal transformations and translation.

Quotient Spaces: For a real vector space V and a subspace W, the cosets V + W and the quotient space V /W, First Isomorphism theorem of real vector spaces (fundamental theorem of homomorphism of vector spaces), Dimension and basis of the quotient space V/W.

UNIT II: Eigenvalues and Eigenvectors (20 Lectures)

Eigenvalues and Eigenvectors of a linear transformation, T: $V \to V$, where V is a finite dimensional real vector space and examples, Eigenvalues and Eigenvectors of $n \times n$ real matrices, The linear independence of eigenvectors corresponding to distinct eigenvalues of a linear transformation and a Matrix.

The characteristic polynomial of an $n \times n$ real matrix and a linear transformation of a finite dimensional real vector space to itself, characteristic roots,

Cayley Hamilton Theorem and its Applications.

Similar matrices, Relation with change of basis, Invariance of the characteristic polynomial and (hence of the) Eigenvalues of similar matrices, every square matrix is similar to an upper triangular matrix. Minimal Polynomial of a matrix, Examples like minimal polynomial of scalar matrix, diagonal matrix, similar matrix.

UNIT III: Diagonalisation (20 Lectures)

Invariant subspaces and block diagonal matrices. Geometric multiplicity and Algebraic multiplicity of eigenvalues of an $n \times n$ real matrix, An $n \times n$ matrix A is diagonalizable if and only if it has a basis of eigenvectors of A, if and only if the sum of dimension of eigenspaces of A is n, if and only if the algebraic and geometric multiplicities of eigenvalues of A coincide, Examples of non-diagonalizable matrices, Diagonalization of a linear transformation $T : V \rightarrow V$, where V is a finite dimensional real vector space and examples. Orthogonal diagonalisation and Quadratic Forms. Diagonalisation of real Symmetric matrices, Examples, Applications to real Quadratic forms, Rank and Signature of a Real Quadratic form, Classification of conics inR^2 and quadric surfaces inR^3. Positive definite and semi definite matrices, Characterization of positive definite matrices in terms of principal minors.

Recommended Book:

1. Kenneth Hoffman and Ray Kunze, Linear Algebra, Prentice Hall of India, New Delhi.
2. S. Kumaresan, Linear Algebra: A Geometric Approach, PHI Learning 2001.

Reference Book:

1. Ramachandra Rao and P. Bhimasankaram, Tata McGraw Hill Publishing Company.
2. L. Smith, Linear Algebra, Springer.
3. M. R. Adhikari and Avishek Adhikari, Introduction to linear Algebra, Asian Books Private Ltd.
4. Inder K Rana, Introduction to Linear Algebra, Ane Books Pvt. Ltd.

UGMTDSE601

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving and Participative
(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://archive.nptel.ac.in/courses/111/106/111106135/
2) https://nptel.ac.in/courses/111106051
3) https://archive.nptel.ac.in/courses/111/104/111104137/
4) https://home.iitk.ac.in/~arlal/book/nptel/pdf/booklinear.html

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	1

CO2	1	2	2	1	-	-	-	-	-	-	-	1
CO3	2	1	-	-	-	-	-	-	-	-	-	1
CO4	1	2	1	1	-	-	-	-	-	-	-	1
CO5	1	1	1	-	-	-	-	-	-	-	-	1

UGMTDSE602 Topology and Real Analysis

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

UNIT I: Sequence and series of functions (20 Lectures)

Learning Outcomes:

1. Define sequence of functions, point wise and uniform convergence of real value functions.
2. Give example to show that point wise convergence does not imply uniform convergence.
3. Find radius of convergence, region of convergence of infinite series.

Content of the unit:

Sequence of functions - pointwise and uniform convergence of sequences of real- valued functions, examples. Uniform convergence implies pointwise convergence, example to show converse not true, series of functions, convergence of series of functions, Weierstrass M-test. Examples. Properties of uniform convergence: Continuity of the uniform limit of a sequence of continuous function, conditions under which integral and the derivative of sequence of functions converge to the integral and derivative of uniform limit on a closed and bounded interval. Examples. Consequences of these properties for series of functions, term by term differentiation and integration.

Power series in R centered at origin and at some point in R , radius of convergence, region (interval) of convergence, uniform convergence, term by-term differentiation and integration of power series, Examples. Uniqueness of series representation, functions represented by power series, classical functions defined by power series such as exponential, cosine and sine functions, the basic properties of these functions.

Fourier Series: Definition, Dirichlet's conditions, Full Range Fourier Series on $(c, c + 2\pi), (-\pi, \pi)$, Half Range Fourier Series, Harmonic Analysis and Applications.

UNIT II: Connected sets (20 Lectures)

Learning Outcomes:

1. Define connected, separable sets in metric space.
2. Explain the properties of connected sets.
3. Define path connected sets and solve examples based on the same.
4. Give an example of a connected set which is not path connected.

Content of the unit:

Separated sets- Definition and examples, disconnected sets, disconnected and connected metric spaces, connected subsets of a metric space, Connected subsets of R. A subset of R is connected if and only if it is an interval. A continuous image of a connected set is connected. Characterization of a connected space, Path connectedness in R^n, definition and examples. A path connected subset of R^n is connected, convex sets are path connected. Connected components. An example of a connected subset of R^n which is not path connected.

UNIT III: Compact sets (20 Lectures)

Learning Outcomes:

1. Define compact metric space using open cover, sequentially compact metric space and solve examples.
2. Explain properties of compact metric space.
3. State and explain Heine Borel property, closed and boundedness property and Bolzano-weierstrass property.

Content of the unit:

Definition of compact metric space using open cover, examples of compact sets in different metric spaces in R,R^2 and R^n, Properties of compact sets: closed and boundedness, Existence of limit points for infinite bounded subset, Finite intersection Property. Compactness of closed subsets. Union and Intersection of Compact sets. Continuous image of compact set is compact, continuous on compact space is uniform continuous Equivalent statements for compact sets in R. Totally boundedness, relation between boundedness and totally boundedness, sequentially compactness property. Heine-Borel property. Bolzano-Weierstrass property. Relation between compactness and completeness.

References for Units I, II, III:

1. S. Kumaresan, Topology of Metric spaces.
2. E. T. Copson. Metric Spaces. Universal Book Stall, New Delhi, 1996.
3. Robert Bartle and Donald R. Sherbert, Introduction to Real Analysis, Second Edition, John Wiley and Sons.
4. Ajit Kumar, S. Kumaresan, Introduction to Real Analysis
5. R.R. Goldberg, Methods of Real Analysis, Oxford and International Book House (IBH) Publishers, New Delhi.

Other references:

1. T. Apostol. Mathematical Analysis, Second edition, Narosa, New Delhi, 1974
2. E. T. Copson. Metric Spaces. Universal Book Stall, New Delhi, 1996.
3. R. R. Goldberg Methods of Real Analysis, Oxford and IBH Pub. Co., New Delhi 1970.
4. P.K.Jain. K. Ahmed. Metric Spaces. Narosa, New Delhi, 1996.
5. W. Rudin. Principles of Mathematical Analysis, Third Ed, McGraw-Hill, Auckland, 1976.
6. D. Somasundaram, B. Choudhary. A first Course in Mathematical Analysis. Narosa, New Delhi

8. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hi, New York, 1963.
9. Ghorpade S.R., Limaye B.V - A course in calculus and real analysis-Springer (2018)

UGMTDSE602

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving and Participative
(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:
1) https://nptel.ac.in/courses/111106053
2) https://nptel.ac.in/courses/111106159

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	-	-	-	-	-	1
CO2	1	2	-	-	-	-	-	-	-	-	-	1
CO3	2	1	-	-	-	-	-	-	-	-	-	1
CO4	1	2	1	-	-	-	-	-	-	-	-	1
CO5	1	1	1	-	-	-	-	-	-	-	-	1

UGMTDSE603A Basic Complex Analysis

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

UNIT I: Introduction to Complex Analysis (20 Lectures)

Learning Outcomes:

1. Explain limits and convergence of sequences of complex numbers and results using properties of real sequences.
2. Compare the difference between differentiability in real and complex sense.
3. Define harmonic functions, harmonic conjugate of a complex valued functions and find the same.
4. Apply the Cauchy-Riemann equation to check the differentiability of a complex valued function.

Content of the unit:

Review of complex numbers: Complex plane, polar coordinates, exponential map, powers and roots of complex numbers, De Moivres formula, Cas a metric space, bounded and unbounded sets, point at infinity-extended complex plane, sketching of set in complex plane.

Limit at a point, theorems on limits, convergence of sequences of complex numbers and results using properties of real sequences. Functions $f : C \to C$, real and imaginary part of functions, continuity at a point and algebra of continuous functions. Derivative of $f : C \to C$, comparison between differentiability in real and complex sense, Cauchy-Riemann equations, sufficient conditions for differentiability, analytic function, f, g analytic then f + g; f - g; fg and f/g are analytic, chain rule. Theorem: If f(z) = 0 everywhere in a domain D, then f(z) must be constant throughout D. Harmonic functions and harmonic conjugate.

UNIT II: Cauchy Integral Formula (20 Lectures)

Learning Outcomes:

1. Explain how to evaluate the line integral and hence prove the Cauchy integral formula.
2. State the Taylor's theorem for analytic functions.
3. Define mobius transformations and solve examples.
4. Define exponential functions and state its properties.

Content of the unit:

Explain how to evaluate the line integral $\int_C f(z)dz \ over \ |z - z_0| = r$ and prove the Cauchy integral formula: If f is analytic in $B(z_0, r)$ then for any w in $B(z_0, r)$ we have $f(w) = \frac{1}{2\pi i}\int_c \frac{f(z)}{z-w}dz$.

Taylors theorem for analytic function, Exponential function, its properties, trigonometric function, hyperbolic functions. Mobius transformations: definition and examples.

UNIT III: Complex power series, Laurent series and isolated singularities (20 Lectures)

Learning Outcomes:

1. Define power series of complex numbers.
2. Establish the uniqueness of power series representation.
3. Classify the different types of singularities.
4. Apply residue theorem to find value of a complex integral.
5. Calculate residues of a complex function.

Content of the unit:

Power series of complex numbers and related results following from Unit I, radius of convergences, disc of convergence, uniqueness of series representation, examples. Definition of Laurent series , Definition of isolated singularity, statement (without proof) of existence of

Laurent series expansion in neighborhood of an isolated singularity, type of isolated singularities viz. removable, pole and essential defined using Laurent series expansion, examples Statement of Residue theorem and calculation of residue.

Reference:

1. J.W. Brown and R.V. Churchill, Complex analysis and Applications : Sections 18, 19, 20, 21, 23, 24, 25, 28, 33, 34, 47, 48, 53, 54, 55 , Chapter 5, page 231 section 65, de ne residue of a function at a pole using Theorem in section 66 page 234, Statement of Cauchys residue theorem on page 225, section 71 and 72 from chapter 7.

Other References:

1. Robert E. Greene and Steven G. Krantz, Function theory of one complex variable
2. T.W. Gamelin, Complex analysis.

UGMTDSE603A

Course Outcomes: After successful completion of this course, students will be able to:

CO1:know and recall the core knowledge of the syllabus. (To measure this outcome, questions may be of the type- objective, define, identify, state, match, list, name etc.)

CO2:understand the concept. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3:analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4:give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5:apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving and Participative
(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://archive.nptel.ac.in/courses/111/106/111106141/
2) https://archive.nptel.ac.in/courses/111/103/111103070/
3) https://archive.nptel.ac.in/courses/111/106/111106084/

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	1
CO2	2	-	-	1	-	-	-	-	-	-	-	1
CO3	1	-	2	-	-	-	-	-	-	-	-	1
CO4	1	1	1	1	-	-	-	-	-	-	-	1
CO5	1	1	-	-	-	-	-	-	-	-	-	1

UGMTDSE603B Plane and Solid Geometry

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Unit-I Plane (20 Lectures)

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

Sphere: Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line, Tangent plane; Plane of contact, Angle of the intersection of two spheres; Conditions for two spheres to be orthogonal.

Unit-II Cone (20 Lectures)

Definitions of a cone; vertex, guiding curve, generators, Equation of the cone with a given vertex and guiding curve, Enveloping cone of a sphere, Equations of cones with vertex at origin are homogenous, Condition that the general equation of the second degree should represent a cone, Condition that a cone may have three mutually perpendicular generators, Intersection of a line and a quadric cone, Tangent lines and tangent plane at a point, Condition that a plane may touch a cone, Reciprocal cones, Intersection of two cones with a common vertex, Right circular cone, Equation of the right circular cone with a given vertex, axis and semi-vertical angle.

Unit-III Cylinder (20 Lectures)

Definition of a cylinder; Equation to the cylinder whose generators intersect a given conic and are parallel to a given line, Enveloping cylinder of a sphere; The right circular cylinder; Equation of the right circular cylinder with a given axis and radius. The general equation of the second degree and the various surfaces represented by it, shapes of some surfaces, Nature of Ellipsoid, Nature of Hyperboloid of one sheet.

Prescribed Text book:

1) Scope as in Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, Published by S. Chand & Company Ltd.

2) l. V.Krishna Murthy & others "A text book of Mathematics for BA/BSc Vol l S.Chand& Company, New Delhi

3) P.K. Jain and Khaleel Ahmed, "A Text Book of Analytical Geometry of Three dimensions", Wiley Eastern Ltd., 1999..

UGMTDSE603B

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen problems.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving, Participative and Community Services (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:
1) https://onlinecourses.nptel.ac.in/noc23_ma63/preview
2) https://nptel.ac.in/courses/111104095

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	1
CO2	1	2	1	-	-	-	-	-	-	-	-	1
CO3	1	1	-	-	-	-	-	-	-	-	-	1
CO4	-	1	1	1	-	-	-	-	-	-	-	1
CO5	1	-	1	-	-	-	-	-	-	-	-	1

UGMTSEC04A Python-II

Course Outcomes: After successful completion of this course, students will be able to:
CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Learning Outcomes:
1. Understand how to read and write files using access modes in python.
2. Create directories and perform various operations on them.
3. Process text using regular expressions.
4. Search text using regular expressions.
5. Understand GUI controls and designing GUI applications.
6. Implement code GUI for Python application.
7. Implement leverage OS services.
8. Make GUI code robust by handling errors and exceptions properly.
9. Access database using python programming.

10. Move the data to/from the application in the database.
11. Connect to computers, read from URL and send email.
12. Interact with network services.
13. Implement algorithm and apply techniques for searching and sorting.

UNIT I: Python File Input-Output & Regular Expressions (15 LECTURES)

Python File Input-Output: Opening and closing files, various types of file modes, reading and writing to files, manipulating directories. Iterables, iterators and their problem solving applications.

Regular Expressions: Concept of regular expression, various types of regular expressions, using match function.

UNIT II: GUI Programming in Python (using Tkinter/wxPython/Qt) (15 LECTURES)

GUI Programming in Python (using Tkinter / wxPython/Qt): What is GUI, Advantages of GUI, introduction to GUI library, Layout management, events and bindings, fonts, colours, drawing on canvas (line, oval, rectangle, etc.) Widgets such as: frame, label, button, checkbutton, entry, listbox, message, radiobutton, text, spinbox etc.

Unit III: Database connectivity in Python, **Network connectivity** &**Algorithm, Searching and sorting (15 LECTURES)**

Database connectivity in Python: Installing MySQL connector, accessing connector module module, using connect, cursor, execute & close functions, reading single & multiple results of query execution, executing different types of statements, executing transactions, understanding exceptions in database connectivity.
Network connectivity: Socket module, creating server-client programs, sending email, reading from URL
Algorithm, Searching and Sorting – Searching and sorting techniques, Efficiency of algorithms

Text books:

1.Paul Gries , Jennifer Campbell, Jason Montojo, *Practical Programming: An Introduction to Computer Science Using Python 3*, Pragmatic Bookshelf, 2/E 2014
2.James Payne ,*Beginning Python: Using Python 2.6 and Python 3*, Wiley India, 2010

Additional References:

1. James Payne ,*Beginning Python: Using Python 2.6 and Python 3*, Wiley India, 2010
2. A. Lukaszewski, MySQL for Python: Database Access Made Easy, Pact Publisher, 2010

Links:

https://www.python-course.eu/advanced_topics.php
https://www.slideshare.net/vishnukraj/advanced-python-programming

UGMTSEC04A

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem-Solving and Participative
(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://nptel.ac.in/courses/106106145
2) https://nptel.ac.in/courses/106106182
3) https://www.python.org/about/gettingstarted/

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	1	-	1	-	-	-	-	-	1
CO2	1	2	2	1	-	1	-	-	-	-	-	1
CO3	2	1	-	2	-	2	-	-	-	-	-	1
CO4	1	2	1	1	2	1	-	-	-	-	-	1
CO5	1	1	1	-	2	1	-	-	-	-	-	1

UGMTSEC04B JAVA PROGRAMMING

Course Outcomes: After successful completion of this course, students will be able to:
CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

UNIT I :INTRODUCTION TO JAVA PROGRAMMING– 15 Lectures

a) Object-Oriented approach: Features of object-orientations: Abstraction, Inheritance, Encapsulation and Polymorphism.

b) **Introduction:** History of Java features, different types of Java programs, Differentiate Java with C. Java Virtual Machine.
c) **Java Basics:** Variables and data types, declaring variables, literals numeric, Boolean, character and string literals, keywords, type conversion and casting. Standard default values. Java Operators, Loops and Controls
d) **Classes:** Defining a class, creating instance and class members: creating object of a class, accessing, instance variables of a class, creating method, naming method of a class, accessing method of a class, overloading method, 'this' keyword, constructor and Finalizer: Basic Constructor, parameterized constructor, calling another constructor, finalize () method, overloading constructor.
e) **Arrays:** one and two – dimensional array, declaring array variables, creating array objects, accessing array elements.
f) **Access control:** public access, friendly access, protected access, private access.

UNIT II : Inheritance, Exception Handling 15 Lectures

a) **Inheritance:** Various types of inheritance, super and sub classes, keywords-'extends', 'super', over riding method, final and abstract class: final variables and methods, final classes, abstract methods and classes. Concepts of inter face.
b) **Exception Handling and Packages:** Need for Expectational Handling, Exception Handling techniques: try and catch, multiple catch statements, finally block, us age of throw and throws. Concept of packages. Inter class method: parse Int ().

UNIT III: JAVA APPLETS AND GRAPHICS PROGRAMMING- 15 Lectures
a) Applets: Difference of applet and application, creating applets, applet life cycle, passing parameters to applets.
b) Graphics, Fonts and Color: The graphics class, painting, repainting and updating an applet, sizing graphics. Font class, draw graphical figures-lines and rectangle, circle and ellipse, drawing arcs, drawing polygons. Working with Colors: Color methods, setting the paint mode.
c) AWT package: Containers: Frame and Dialog classes, Components: Label; Button; Checkbox; Text Field, Text Area.

References:
1. Programming with Java: A Primer 4th Edition by E. Balagurusamy, Tata McGraw Hill.
2. JavaTheCompleteReference,8thEdition, Herbert Schildt, Tata McGraw Hill

Additional References:
1. Eric Jendrock, Jennifer Ball, D Carson and others, TheJ ava EE5 Tutorial, PearsonEducation, Third Edition,2003.
2. Ivan Bay Ross, Web Enabled Commercial Applications Development UsingJava2, BPB Publications, Revised Edition, 2006
3. Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD), Third Edition,2004
4. The Java Tutorials of Sun Microsystems Inc. http://docs.oracle.com/javase/tutorial

UGMTSEC04B

Course Outcomes: After successful completion of this course, students will be able to:

Course Outcomes: After successful completion of this course, students will be able to:

CO1. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)

CO2. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)

CO3. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)

CO4. Give reasoning and explain. (To measure this outcome, questions may be of the type multiple choice questions with justification, theoretical fill-in-the-blanks, theoretical problems, prove implications or corollaries of theorems, etc.)

CO5. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

ICT Tools Used: Videos, PPT, Pen-Tablet, Scilab for graph plotting

Students Centric Methods: Problem Solving and Participative
(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1) https://nptel.ac.in/courses/111107108
2) https://nptel.ac.in/courses/111104125

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2		-	-	-	-	-	-	-	1
CO2	2	-	1	1	2	-	-	-	-	-	-	1
CO3	-	2	-	-	-	1	-	-	-	-	-	1
CO4	-	2	1	1	-	1	-	-	-	-	-	1
CO5	1	1	-	-	-	-	-	-	-	-	-	1

Examination Scheme

- **Question Paper Pattern (100 Marks) Theory Exam**
- **Internal (40Marks) + External(60 Marks)**
  - **Internal (40 Marks):** Continuous Internal Evaluation by conducting Class Test, assignments, seminars, Poster presentation, etc.
  - **External (60 Marks): Semester End Examination**

Que No.	Options	Unit	Marks
Question No 1	Any 3 out of 6	Unit-I	15
Question No 2	Any 3 out of 6	Unit-II	15
Question No 3	Any 3 out of 6	Unit-III	15
Question No 4	Any 3 out of 6	Unit-IV	15

- **Practical Examination (50Marks)**

Que	Options	Unit	Marks
Question No 1	Objective Question for 1 or 2 marks.	All Units	26
Question No 2	Any 3 out of 4	All Units	24