Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

NAAC- 'A $^{+}$' Grade

CIRCULAR NO.SU/ Sci./College/NEP-2020/73/2025

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/ Ad-hoc Boards/Committee and recommended by the Dean, Faculty of Science & Technology, the Academic Council at its meeting held on 09 May 2025 has been accepted **the following B.Sc. Course Structure & Curriculum** under the Faculty of Science & Technology as per National Education Policy – 2020 run at the Affiliated Colleges of Dr. Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	B.Sc. Physics	IIIrd and IVth Semester
2	B.Sc. Electronics	IIIrd and IVth Semester
3	B.A. / B.Sc. Mathematics	IIIrd and IVth Semester
4	B.Sc. Industrial Chemistry	IIIrd and IVth Semester
5	B.Sc. Agrochemical and Fertilize	IIIrd and IVth Semester
6	B.Sc. Horticulture	IIIrd and IVth Semester
7	B.Sc. Biochemistry	IIIrd and IVth Semester
8	B.Sc. Botany	IIIrd and IVth Semester
9	B.Sc. Zoology	IIIrd and IVth Semester
10	B.Sc. Biotechnology	IIIrd and IVth Semester
11	B.Sc. Microbiology	IIIrd and IVth Semester
12	B.Sc. Diary Science and Technology	IIIrd and IVth Semester
13	B.Sc. Statistics	IIIrd and IVth Semester
14	B.Sc. Computer Science	IIIrd and IVth Semester
15	B.Sc. Geology	IIIrd and IVth Semester
16	B.Sc. Chemistry	IIIrd and IVth Semester
17	B.Sc. Analytical Chemistry	IIIrd and IVth Semester
18	B.Sc. Polymer Chemistry	IIIrd and IVth Semester
19	B.Sc. Environmental Science	IIIrd and IVth Semester
20.	B.Sc. Fisheries Science	IIIrd and IVth Semester

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21.	B.Sc. Home Science	IIIrd and IVth Semester
22.	B.Sc. Data Science	IIIrd and IVth Semester
23.	B.Sc. Information Technology	IIIrd and IVth Semester
24.	B.Sc. Networking and Multimedia	IIIrd and IVth Semester
25.	B.Sc. Automobile Technology	IIIrd and IVth Semester
26.	B.Sc. Forensic Science	IIIrd and IVth Semester
27.	B.Sc. Forensic Science & Cyber Security	IIIrd and IVth Semester
28.	B.Sc. Non-Conventional & Conventional Energy	IIIrd and IVth Semester
29.	B.Sc. Clinical Laboratory Science	IIIrd and IVth Semester
30.	Bachelor of Computer Application	IIIrd and IVth Semester

This is effective from the Academic Year 2025-26 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
-431 004.
Ref.No. SU/Sci./2025/827-29
Date:- 26/05/2025

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Deputy Registrar,
Syllabus Section.

Copy forwarded and necessary action to :-

1] **The Principal of all Affiliated Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

JD*26052025/-

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Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar- 431001

B.A./B.Sc. Second Year (Third & Fourth Semester)

(Three Year / Four Years (Hons) /Four Years (Hons with Research)

Course Structure & Curriculum

(AS PER NEP-2020)

Subject (Major): Mathematics

Effective from 2025-2026

Dr-J.A-Nanaware

Course Structure & Curriculum

BA/ BSc Second Year: 3rd Semester

Students will have to select / declare choice of **one major subject** and **one minor subject** from three major options M1, M2 and M3 (which were opted in the first year)

Course Type	Course Code	Examination Code (To be given by respective BoS)	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	MAT/DSC/T/200	SAC00052003T	**Number Theory**	2		2		2+2+2+2 = 08
	MAT /DSC/T/201	SAC00052013T	**Partial Differential Equations**	2		2		
	MAT /DSC/P/226	SAC00052263P	**Practical based on MAT /DSC/T/200**		4		2	
	MAT /DSC/P/227	SAC00052273P	**Practical based on MAT /DSC/T/201**		4		2	
Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty**	MAT /Mn/T/200	SCC00052003T	To be chosen from other discipline	2		2		2+2 = 04
	MAT /Mn/T/201	SCC00052013T	To be chosen from other discipline	2		2		
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	MAT /GE/OE/T/200	SDC00052003T	To be chosen from faculty other than that of Major	2		2		02
VSC (Vocational Skill Courses) (Choose any one from SUB/VSC/T/200 and SUB/VSC/T/201) and corresponding Practicals	MAT /VSC/T/200	SEC00052003T	**Numerical Methods-I**	1		1		1+1 =02
	MAT /VSC/T/201	SEC00052013T	**Introduction to R and Basic Statistics using R-I**	1		1		
	MAT /VSC/P/226	SEC00052263P	**Practicals based on MAT /VSC/T/200**		2		1	
	MAT /VSC/P/227	SEC00052273P	**Practicals based on MAT /VSC/T/201**		2		1	
AEC, VEC, IKS	SUB/AEC/T/200		**English** (Common for all the faculty)	2		2		2 + 2 = 04
	SUB/VEC/T/201		Environmental Studies	2		2		
OJT/ FP/CEP/CC/RP	SUB/CC/P/226		Cultural Activity / NSS,NCC (Common for all the faculty)		4		2	02
				15	**14**	**15**	**07**	**22**

Minor Courses for other Discipline

MAT /Mn/T/ 200: **Logic and Sets** (This is a 2 credit theory course to be designed for other discipline)

MAT /Mn/T/ 201: **Vector Algebra** (This is a 2 credit theory course to be designed for other discipline)

Generic /Open Elective Courses for other faculty

MAT /GE/OE/T/200: **Mathematics for Competitive Examinations-I** (This is a 2 credit theory course to be designed for other faculty)

BA/BSc Second Year: 4th Semester

Course Type	Course Code	Examination Code (To be given by respective BoS)	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	MAT /DSC/T/250	SAC000525 04T	**Algebra**	2		2		2+2+2+2 = 08
	MAT /DSC/T/ 251	SAC000525 14T	**Integral Transforms**	2		2		
	MAT /DSC/P/ 276	SAC000527 64P	**Practical based on MAT /DSC/T/250**		4		2	
	MAT /DSC/P/ 277	SAC000527 74P	**Practical based on MAT /DSC/T/ 251**		4		2	
Minor (Choose any two from pool of courses) **It is from different discipline of the same faculty**	MAT /Mn/T/250	SCC000525 04T	To be chosen from other discipline	2		2		2+2 = 04
	MAT /Mn/T/ 251	SCC000525 14T	To be chosen from other discipline	2		2		
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	MAT /GE/OE/T/250	SDC000525 04T	To be chosen from faculty other than that of Major	2		2		02
SEC (Skill Enhancement Courses) (Choose any one from SUB/SEC/T/250and SUB/SEC/T/ 251) and corresponding Practicals	MAT /SEC/T/250	SEC000525 04T	**Numerical Methods-II**	1		1		1+1 =02
	MAT /SEC/T/ 251	SEC000525 14T	**Introduction to R and Basic Statistics using R-II**	1		1		
	MAT /SEC/P/ 276	SEC000527 64P	**Practical based on MAT /SEC/T/250**		2		1	
	MAT /SEC/P/ 277	SEC000527 74P	**Practical based on MAT /SEC/T/ 251**		2		1	
AEC, VEC, IKS	SUB/AEC/T /250		Modern Indian Language (MIL-2) (Choose any one from pool of language courses)	2		2		02
OJT/ FP/CEP/CC/RP	MAT/FP/P/ 276	SKC000527 64P	**Field Project**		4		2	2+2= 04
	SUB/CC/P/ 277		(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	
				13	**18**	**13**	**09**	**22**
Exit Option : Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course (related to major / minor) / Internship during summer vacation OR Continue with Major and Minor								

Minor Courses for other Discipline

MAT /Mn/T/250:**Discrete Mathematics** (This is a 2 credit theory course to be designed for other discipline)

MAT /Mn/T/251:**Vector Calculus** (This is a 2 credit theory course to be designed for other discipline)

Generic /Open Elective Courses for other faculty

MAT /GE/OE/T/250: **Mathematics for Competitive Examinations-II** (This is a 2 credit theory course to be designed for other faculty)

Detailed Illustration of Courses included in 3rd and 4th semester:

1) **Major** (Core) subject are mandatory.

MAT /DSC/T/200: This is a 2 credit theory course corresponding to Major (core) subject

MAT /DSC/T/201: This is a 2 credit theory course corresponding to Major (core) subject

MAT /DSC/P/226: This is a 2 credit practical course based on MAT /DSC/T/200

MAT /DSC/P/227: This is a 2 credit practical course based on MAT /DSC/T/201

MAT /DSC/T/250: This is a 2 credit theory course corresponding to Major (core) subject

MAT /DSC/T/251: This is a 2 credit theory course corresponding to Major (core) subject

MAT /DSC/P/276: This is a 2 credit practical course based on MAT /DSC/T/250

MAT /DSC/P/277: This is a 2 credit practical course based on MAT /DSC/T/251

2) **Minor : It is from different discipline of the same faculty**

MAT /Mn/T/200 : This is a 2 credit theory from different discipline of the same faculty

MAT /Mn/T/201 : This is a 2 credit theory from different discipline of the same faculty

MAT /Mn/T/250 : This is a 2 credit theory from different discipline of the same faculty

MAT /Mn/T/251 : This is a 2 credit theory from different discipline of the same faculty

3) **Generic / Open Elective (GE/OE)** : (Needs to be chosen (any one) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

MAT /GE/OE/T/200 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

MAT /GE/OE/T/250: This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

4) **VSC** (Vocational Skill Courses) : Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

MAT /VSC/T/200 : This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

MAT /VSC/T/201 : This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

MAT /VSC/P/226 : This is a 1 credit practical course based on **MAT /VSC/T/200**

MAT /VSC/P/227 : This is a 1 credit practical course based on **MAT /VSC/T/201**

5) **SEC** (Skill Enhancement Courses) : Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

MAT /SEC/T/250 : This is a 1 credit theory course to enhance the technical skills of the students in specific area.

MAT /SEC/T/251 : This is a 1 credit theory course to enhance the technical skills of the students in specific area.

MAT /SEC/P/276 : This is a 1 credit practical course based on **MAT /SEC/T/250**

MAT /SEC/P/277 : This is a 1 credit practical course based on **MAT /SEC/T/251**

6) **AEC** (Ability Enhancement courses): The focus of these courses should be based on linguistic and communication skills.

SUB/AEC/T/200 : English

This is a 2 credit theory course based on linguistic proficiency.

SUB/AEC/T/250 : Modern Indian Language MIL-2 (Hindi/ Marathi/ Pali & Buddhism/ Sanskrit/ Urdu)

This is a 2 credit theory course based on linguistic proficiency. Students will have to choose one of the above mentioned languages.

7) **VEC** : Environmental Studies

SUB/VEC/T/201 : Environmental Studies

This is 2-credit theory course based on Environmental Studies.

8) FP-1 : Field Project :

MAT /FP/P/276 : This is a 2 credit course, should be corresponding to Major (core) subject

9) **CC** (Curricular Courses): The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Preforming Arts.

SUB/CC/P/226 : Cultural Activity / NSS, NCC

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

SUB/CC/P/277 : Fine/ Applied/ Visual/ Performing Arts

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

General Instructions:

I) Minimum 5-6 examples shall be solved in each practical for all practical courses.

II) Use of mathematical software is mandatory for all practical courses

Semester-III

MAT/DSC/T/200: Number Theory

Total Credits:02 **Total Contact Hours: 30** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To learn divisibility rules.
ii) To solve linear Diophantine equations.
iii) To explore prime numbers and its distribution.
iv) To learn theory of congruences.
v) To understand the number-theoretic functions and its properties

Course Outcomes (COs):

After completion of the course, students will be able to -

i) Find the gcd & lcm of integers.
ii) Find solution of linear Diophantine equations.
iii) Solve the linear congruences.
iv) Solve the system of linear congruences.
v) Evaluate $\tau, \sigma, \mu, \emptyset$ for a given number

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	The Division Algorithm, The Greatest Common Divisor, The Euclidean Algorithm, The Diophantine Equation $ax+by=c$.	**10 Hrs.**
II	The Fundamental Theorem of Arithmetic, Basic Properties of Congruence, Linear Congruences and the Chinese Remainder Theorem.	**10 Hrs.**
III	Fermat's Little Theorem, Wilson's Theorem, The Sum and Number of Divisors, The Mobius Inversion Formula, Euler's Phi-Function.	**10 Hrs.**

Text Book:

David M Burton: Elementary Number Theory, Sixth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi. 2006.

Scope:

Chapter2: Articles: 2.2 [Theorem 2.1 Statement only], **2.3** [Theorem 2.6 Statement only], **2.4** [Theorem 2.7 Statement only], **2.5** [Theorem 2.9 Statement only]
Chapter 3: Articles: 3.1 [Corollary 1 & 2 Statements only],
Chapter 4: Articles: 4.2, 4.4 [Omit Theorem 4.9]
Chapter 5: Articles: 5.2 [Omit Theorem 5.2 & 5.3], **5.3** [Theorem 5.5 Statement only]
Articles: 6.1 [Theorem 6.1 & Lemma Statements only], **6.2** [Theorem 6.6, 6.7 Statements only]
Chapter 7: Articles: 7.2 [Lemma & Theorem 7.2, 7.3, 7.4 Statements only]

Reference Books:

1. Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery: An Introduction to the Theory of Numbers, Fifth edition, John Wiley & Sons, New Delhi, 1996.
2. S. G. Telang: Number Theory Tata Mc-Graw Hills, New Delhi 1996
3. S. Y. Hsiung: Elementary Theory of Numbers, World Scientific Publishing Co. Pvt. Ltd. 1992
4. S. B. Malik: Basic Number Theory, Second Revised Edition, Vikas Publishing House Pvt Ltd, New Delhi 2008.
5. Hari Kishan: Theory of Numbers, Edition 1, Krishna Prakashan, Meerut, 2014.
6. Ajay Chaudhari: Introduction to Theory of Numbers, New Central Book Agency Ltd, Kolkata,2013
7. S.K.Pundir and R.Pundir: Theory of Numbers, Fifth Edition Pragati Prakashan, Meerut 2017.

MAT/DSC/T/201 : Partial Differential Equations

Total Credits: 02 **Total Contact Hours : 30 Hrs** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To learn Lagrange's linear partial differential equations
ii) To learn Charpit's method and Jacobi method
iii) To learn Monge's method

Course Outcomes (COs):

After completion of the course, students will be able to -

i) Solve Lagrange's equation
ii) Find the solutions such as complete integral, singular integral and general integral.
iii) Determine the solution of partial differential equations using Charpit's Method.
iv) Describe and apply Monge's Method

Module No.	Topics / actual contents of the syllabus	Contact Hrs
I	**Linear Partial Differential Equations of Order One:** Definition of partial differential equations, Derivation of a partial differential equation by the elimination of arbitrary constants, Derivation of a partial differential equation by the of elimination of arbitrary function, Lagrange's linear partial differential equation, Geometrical interpretation of the Lagrange's linear partial differential equation Pp+Qq=R.	**10 Hrs**
II	**Nonlinear Partial Differential Equations of Order One** Complete and particular integrals, General integral, Singular integral, Standard form I, Standard form II, Standard form III, Standard form IV, Charpit's method, Non-linear partial differential equations of order one with three or more independent variables, Jacobi's method.	**10 Hrs**
III	**Linear Partial Differential Equations:** Definitions, Solution of linear partial differential equations, Solution of linear homogeneous and non-homogeneous partial differential equations with constant coefficients, Solution of linear homogeneous linear partial differential equations with constant coefficients, say F(D,D`)z= f(x,y). Shorter method of finding particular integral. **Partial Differential Equations of Second Order:** Equations that can be integrated by inspection, Monge's method to solve the equation Rr+Ss+Tt=V	**10 Hrs**

TextBooks:

1 **P.P. Gupta, G.S.Malik, S.K.Mittal** : Partial Differential Equations (Thirteenth Edition 2014),Pragati Prakashan, Meerut.

2 **I.N.Sneddon**: Elements of Partial Differential Equation , McGraw Hill Company,2006.

Scope:

Unit I: Chapter 10: 10.1, 10.2, 10.3, 10.4, 10.5 [1]

Unit II: Chapter 11: 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.9, 11.10 [1]

Unit III: Chapter 12: 12.1, 12.2 (12.2-1, 12.2-2, 12.2-3), Chapter 13: 13.1,13.2, 13.3 [1]

Reference Books:

1. H.K.Dass: Advanced Engineering Mathematics, S.Chand and Company Ltd.,2005
2. D.A.Murray: Introductory Course in Differential equations, New York Longmans and Green Co. London and Bombay,2002
3. M.D.Raisinghania: Ordinary and Partial Differential Equation, S.Chand and Company Ltd.,2013

MAT/DSC/P/226: Lab Course Based on MAT/DSC/T/200

Total Credits: 02 **Total Contact Hours: 60** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To study practical approach of divisibility rules.
ii) To apply theory of linear Diophantine equations.
iii) To gain proficiency in working with modular arithmetic.
iv) To solve problems using theory of linear congruences.
v) To study practical techniques in number theoretic functions.

Course Outcomes (COs):

After completion of the course, students will be able to -

i) Determine gcd & lcm of integers using Euclidean Algorithm.
ii) Find Solution of Linear Equation using Method of linear Diophantine Equation.
iii) Solve the system of linear Congruences.
iv) Find the remainder using Wilson's theorem.
v) Evaluate sum of divisors and the number of divisors of a given number.

Practical Nos.	Topics / actual contents of the practical
I	To solve problems based on the division algorithm (Problems 2.2)
II	To solve problems based on the greatest common divisor (Problems 2.3)
III	To solve problems based on the Euclidean algorithm (Problems 2.4)
IV	To solve problems based on the linear Diophantine equation $ax+by=0$ (Problems 2.5)
V	To solve problems based on the Fundamental theorem of arithmetic (Problems 3.1)
VI	To solve problems based on basic properties of congruences (Problems 4.2)
VII	To solve problems based on linear congruences and the Chinese remainder theorem (Problems 4.4)
VIII	To solve problems based on Fermat's little theorem (Problems 5.2)
IX	To solve problems based on the Wilson's theorem (Problems 5.3)
X	To solve problems based on the sum and number of divisors (Problems 6.1)
XI	To solve problems based on the Mobius inversion formula (Problems 6.2)
XII	To solve problems based on the Euler's Phi-function (Problems 7.2)

Text Book:

David M Burton: Elementary Number Theory, Sixth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi. 2006.

Reference Books:

1. Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery: An Introduction to the Theory of Numbers, Fifth edition, John Wiley & Sons, New Delhi, 1996.
2. S. G. Telang: Number Theory Tata Mc-Graw Hills, New Delhi 1996
3. S. Y. Hsiung: Elementary Theory of Numbers, World Scientific Publishing Co. Pte. Ltd. 1992
4. S. B. Malik: Basic Number Theory, Second Revised Edition, Vikas Publishing House Pvt Ltd, New Delhi 2008.
5. Hari Kishan: Theory of Numbers, Edition 1, Krishna Prakashan, Meerut, 2014.
6. Ajay Chaudhari: Introduction to Theory of Numbers, New Central Book Agency Ltd, Kolkata, 2013.
7. S.K.Pundir and R. Pundir: Theory of Numbers, Fifth Edition Pragati Prakashan, Meerut 2017.

MAT/DSC/P/227: Lab Course Based on MAT/DSC/T/201

Total Credits: 02 **Total Contact Hours: 60** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To learn Lagrange's linear partial differential equations
ii) To learn Charpit's method and Jacobi method
iii) To learn Monge's method

Course Outcomes (COs):

After completion of the course, students will be able to -

i) Solve Lagrange's equation
ii) Find the solutions such as complete integral, singular integral and general integral.
iii) Determine the solution of partial differential equations using Charpit's Method.
iv) Describe and apply Monge's Method

Practical Nos.	Topics / actual contents of the practical
I	Problems to derive partial differential equations by elimination of arbitrary constants
II	Problems to derive partial differential equations by elimination of arbitrary functions
III	Problems on Lagrange's equation
IV	Problems on Complete integral and general integral
V	Problems on singular integral and standard form I
VI	Problems on standard form II and standard form III , & IV
VII	Problems on Charpit's method
VIII	Problems on Jacobi method
IX	Problems on linear homogeneous PDE
X	Problems on nonlinear homogeneous PDE
XI	Problems on shorter method of finding particular integral
XII	Problems on Monge's method

Text Books:

1.P.P. Gupta, G.S.Malik, S.K.Mittal : Partial Differential Equations (Thirteenth Edition 2014),Pragati Prakashan, Meerut.

2.**I.N.Sneddon**: Elements of Partial Differential Equation , McGraw Hill Company,2006.

ReferenceBooks:

1. H.K.Dass: Advanced Engineering Mathematics, S.Chand and Company Ltd.,2005

2. D.A.Murray: Introductory Course in Differential equations, New York Longmans and Green Co. London and Bombay,2002

3. M.D.Raisinghania: Ordinary and Partial Differential Equation, S.Chand and Company Ltd.,2013.

MAT/Mn/T/200 : Logic and Sets

Total Credits: 02 **Total Contact Hours: 30 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To learn connectives and compound statements.
ii) To learn algebra and equivalence of propositions.
iii) To learn the set operations and their properties.
iv) To learn Cartesian product of two sets.

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Construct the truth tables of given proposition.
ii) Prove equivalence of two given propositions.
iii) Prove the properties of set operations.
iv) Find Cartesian product of two sets.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Mathematical Logic:** Proposition, type of propositions, the propositional calculus, the negation of a proposition, disjunction, conjunction, tautologies and contractions, logical equivalence, the algebra of propositions, conditional propositions, converse, inverse and contrapositive propositions, the negation of a conditional proposition, biconditional propositions.	**10 Hrs.**
II	**Set theory:** Sets, set designation, null sets and unit sets, special sets of numbers, universal set, subsets, proper subsets, equal sets, set operations, set diagrams, union operation, properties of union operation, intersection, properties of intersection operation, distributive properties.	**10 Hrs.**
III	Complementation, relative complement (or difference of sets), properties of complement, properties of difference, symmetric difference, properties of symmetric difference, power set, Cartesian products, properties of Cartesian products.	**10 Hrs.**

Text Book:

B.S. Vatsa and Suchi Vatsa: Discrete Mathematics, New Age International Publishers, Fourth Revised Edition (2009).

Scope:

Chapter 1: Articles 1.1 to 1.13., Chapter 2: Articles 2.1 to 2.19.

Reference Books:

1. G. Shanker Rao: Discrete Mathematical structures, New Age International Publishers, Second Edition 2009.
2. Swapan Kumar Sarkar: A Textbook of Discrete Mathematics, S. Chand, Ninth Edition,2016 (Reprint 2021).
3. Kenneth H. Rosen: Discrete Mathematics and its Applications, McGraw-Hill Book Company, Eighth Edition 2019.

MAT/Mn/T/201 : Vector Algebra

Total Credits: 02 **Total Contact Hours: 30 Hrs.** **Maximum Marks : 50**

Learning Objectives of the Course:

i) To learn the concept of vectors and scalars.
ii) To perform basic vector operations: addition, subtraction, dot product, and cross product.
iii) To learn properties of scalar triple and vector triple product

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Define scalar, vector and angle between two vectors
ii) Find the directional cosine of the line
iii) Find the scalar triple product and vector triple product

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Directed line segment, Vectors and Scalars, Scalar product of two vectors, sign of the scalar product, length of a vector as a scalar product, angle between two vectors, commutativity, distributivity	**10 Hrs**
II	Orthogonal Bases, Distance between points, Direction Cosines of a line, angle between two line, right-handed and left-handed vector triads, vector product, some properties of vector product.	**10 Hrs**
III	Scalar triple product, distributive law, some properties of scalar triple product, vector triple product.	**10 Hrs**

Text Book:

Shanti Narayan and P. K. Mittal: Vector Analysis, S. Chand and Company Ltd, 2007.

Scope:

Chapter 1: Articles 1.1,1.1.1,1.2.1,1.2.2,1.2.3,1.2.4,1.2.5,1.2.6
Chapter 3: Articles 3.1,3.1.1,3.1.2,3.1.3,3.1.4,3.1.5,3.1.10,3.2,3.2.1,3.2.2,3.4,3.5,3.6.
Chapter 5: Articles 5.1, 5.2, 5.2.1, 5.3, 5.3.1 to 5.3.3, 5.3.4, 5.3.5, 5.3.6, 5.3.7, 5.5, 5.5.1, 5.6, 5.7, 5.7.1 to 5.7.3.5.8

Reference Books:

1. C.J.Eliezer: Concise Vector Analysis, Dover Publications,2015
2. Paul C.Matthews: Vector Calculus, Springer, 1998
3. P.Duraipandian, K.Pachaiyappa: Vector Analysis, S. Chand.

MAT/VSC/T/200: Numerical Methods-I

Total Credits: 01 **Total Contact Hours: 15 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To study error analysis in numerical methods
ii) To study interpolation methods for equally spaced points
iii) To study interpolation methods for unequally spaced points

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Analyze the error in numerical methods
ii) Construct interpolating polynomial when the points are equally spaced
iii) Obtain interpolating polynomial when the points are unequally spaced

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Errors in numerical calculations:** Introduction, numbers and their accuracy, mathematical preliminarics, errors and their computation, absolute relative and percentage errors, a general error formula, error in a series approximation	**05 Hrs**
II	**Interpolation:** Introduction, finite differences, forward differences, backward differences, central differences, symbolic relation and separation of symbols, differences of a polynomial, Newton's formulae for interpolation.	**05 Hrs**
III	**Interpolation with unevenly spaced points:** Lagrange's interpolation formula, error in Lagrange's interpolation formula, divided differences, properties of divided difference (1. Divided differences are symmetrical in their arguments. 2. n^{th} divided difference of n^{th} degree polynomial is constant), Newton's general interpolation formula.	**05 Hrs**

Text Book:

S.S. Sastry: Introductory Methods in Numerical Analysis, Third Edition, Prentice Hall of India Private Limited, New Delhi, 2003.

Scope:

Chapter 1: Complete.

Chapter 3: Articles 3.1,3.3, 3.3.1, 3.3.2, 3.3.3, 3.3.4, 3.5, 3.6, 3.9, 3.9.1, 3.9.2, 3.11, 3.11.1

Reference Books:

1. H.C. Saxena: Finite differences and Numerical Analysis, S. Chand and Co. New Delhi, Fourteenth Revised Edition, 1998.
2. E.V. Krishnamurthi, Sen: Numerical Algorithm, Affiliate East West Press Pvt.Ltd., 1986.
3. M.K.Jain, S.R.K.Iyengar and S.K.Jain:Numerical Methods, New Age International Publishers, Sixth Edition,2012.

MAT/VSC/T/201: Introduction to R and Basic Statistics using R-I

Total Credits: 01 **Total Contact Hours: 15 hrs.** **Maximum Marks : 50**

Learning Objectives of the Course:

i) To understand the basics of the R programming language
ii) To learn to import, manipulate, and analyze data in R
iii) To create high-quality visualizations using R
iv) To apply statistical techniques using R

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Write simple R program
ii) Demonstrate how to install and configure Rstudio.
iii) Analyse data and generate reports based on the data.
iv) Perform basic statistical tests, calculate descriptive statistics.
v) Write programs in R for basic concepts in statistics

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Obtaining and installing R from CRAN, Opening R for the first time, Saving work and exiting R, Conventions	**05 Hrs.**
II	R for basic Math, Assigning Objects, Vectors	**05 Hrs.**
III	Describing Raw Data, Summary Statistics	**05 Hrs.**

Text Book:

Tilman R. Davies: The Book of R- A First Course in Programming and Statistics, No Strach Press, San Francisco,2016

Scope :

Chapter -1:1.1, 1.2,1.3,1.4 Chapter – 2:2.1,2.2,2.3, Chapter- 13: 13.1,13.2

Reference Books:

1.Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters:A Beginers Guide to R, Springer, 2009

2.Thulin, M.: *Modern Statistics with R*. Second edition. Chapman & Hall/CRC Pres, 2024

3. Aeden Culhane: Introduction to Programming and Statistical Modelling in R,Harvard School of Public Health. 2013

MAT/VSC/P/226: Lab Course Based on MAT/VSC/T/200

Total Credits: 01 **Total Contact Hours: 30 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To study error analysis in numerical methods
ii) To study interpolation methods for equally spaced points
iii) To study interpolation methods for unequally spaced points
iv) To implement numerical methods using mathematical software

Course Outcomes (COs) :
After completion of the course, students will be able to -

i) Analyze the error in numerical methods
ii) Construct interpolating polynomial when the points are equally spaced
iii) Obtain interpolating polynomial when the points are unequally spaced
iv) Apply numerical methods using mathematical software

Practical No.	Topics / actual contents of the practical
I	Examples/Problems on errors in numerical calculations.
II	Examples/Problems on errors in numerical calculations.
III	Problems on symbolic relations and separation of symbols,
IV	Problems on Newton's forward difference interpolation formula.
V	Problems on Newton's backward difference interpolation formula.
VI	Problems on Lagrange's interpolation formula.
VII	Problems on error in Lagrange's interpolation formula.
VIII	Problems on Newton's general interpolation formula.

Text Book:

S.S. Sastry: Introductory Methods in Numerical Analysis, Third edition, Prentice Hall of India private limited, New Delhi, 2003.

Reference Books:

1 H.C. Saxena: Finite Differences and Numerical Analysis, S. Chand and Co. New Delhi, Fourteenth Revised Edition, 1998.
2.E.V. Krishnamurthi and Sen: Numerical Algorithm, Affiliate East West Press Private Limited, 1986.
3.M.K.Jain, S.R.K.Iyengar and S.K.Jain:Numerical Methods, New Age International Publishers, Sixth edition,2012.

MAT/VSC/P/227: Lab Course Based on MAT/VSC/T/201

Total Credits: 01 Total Contact Hours: 30 Hrs. Maximum Marks: 50

Learning Objectives of the Course:

i) To understand the basics of the R programming language
ii) To learn to import, manipulate, and analyze data in R
iii) To apply statistical techniques using R
iv) To write custom R functions

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Write simple R program
ii) Demonstrate how to install and configure Rstudio
iii) Analyse data and generate reports based on the data
iv) Perform basic statistical tests, calculate descriptive statistics
v) Write programs in R for basic concepts in statistics

Practical No.	Topics / actual contents of the practical
I	Installation, updation and packages in R
II	Coding in R, Arithmetic, Logrithm and exponential and E-notation
III	Assigning objects, creating vector and sequence
IV	Sorting and vector length
V	Problems on exercise 2.3 using R
VI	Problems on exercise 2.5, mean, median, and mode. using R
VII	Problems on percentage, proportions, quartiles and percentiles
VIII	Problems on variance and standard deviation
IX	Problems on covariance and corelation

Text Book:

Tilman R. Davies: The Book of R- A First Course in Programming and Statistics, No Strach Press, San Francisco,2016

Scope :

Chapter -1:1.1, 1.2,1.3,1.4 Chapter – 2:2.1,2.2,2.3, Chapter- 13: 13.1,13.2

Reference Books:

1.Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters:A Beginers Guide to R, Springer, 2009

2.Thulin, M.: *Modern Statistics with R*. Second edition. Chapman & Hall/CRC Pres, 2024

3. Aeden Culhane: Introduction to Programming and Statistical Modelling in R,Harvard School of Public Health, 2013

MAT/GE/OE/T/200: Mathematics for Competitive Examinations-I

Total Credits : 02 **Total Contact Hours: 30 Hrs** **Maximum Marks: 50**

Learning Objectives of the Course:
अभ्यासक्रम शिकण्याची उद्दिष्टे:

i) To improve arithmetical abilities
अंकगणितीय क्षमता सुधारणे

ii) To understand number systems
संख्या प्रणाली समजून घेणे

iii) To develop analytical and critical thinking skills
विश्लेषणात्मक आणि समीक्षात्मक विचार कौशल्ये विकसित करणे

iv) To improve logical reasoning
तार्किक तर्क सुधारणे

v) To enable students to solve problems quickly and effectively with applying appropriate techniques and strategies for competitive examinations
स्पर्धा परीक्षांसाठी योग्य तंत्रे आणि रणनीती लागू करून विद्यार्थ्यांना समस्या जलद आणि प्रभावीपणे सोडवण्यास सक्षम करणे.

Course Outcomes (COs) :
अभ्यासक्रमाचे परिणाम

After completion of the course, students will be able to –
अभ्यासक्रम पूर्ण झाल्यानंतर, विद्यार्थी हे करू शकतील:

i) Understand and apply fundamental mathematical concepts essential for various competitive exams
विविध स्पर्धा परीक्षांसाठी आवश्यक असलेल्या मूलभूत गणितीय संकल्पना समजून घेणे आणि लागू करणे

ii) Apply logical reasoning, analytical thinking, and problem solving techniques to tackle quantitative aptitude questions efficiently
संख्यात्मक अभिरुची प्रश्नांना कार्यक्षमतेने हाताळण्यासाठी तार्किक तर्क, विश्लेषणात्मक विचार आणि समस्या सोडवण्याच्या तंत्रांचा वापर करणे

iii) Improve calculation speed and accuracy
गणना गती आणि अचूकता सुधारणे

iv) Apply problem solving strategies and computational skills to solve problems
समस्या सोडवण्यासाठी समस्या सोडवण्याच्या रणनीती आणि संगणकीय कौशल्ये लागू करणे

v) Demonstrate a strong foundation in mathematical concepts
गणितीय संकल्पनांमध्ये मजबूत पाया प्रदर्शित करणे

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Number System, H.C.F. and L.C.M. of Numbers, Simplification, Square Roots and Cube Roots, Average, Problems on Ages, Percentage, Profit and Loss संख्या पद्धती, संख्यांचा ल.सा.वी. आणि म.सा.वी, सोपे रूप, वर्ग मूळे आणि घन मूळे, सरासरी, वय वरील प्रश्न, टक्केवारी, नफा आणि तोटा	**10 Hrs**

II	Ratio and Proportion, Pipes and Cisterns, Time and Work, Time and Distance, Boats and Streams, Problems on Trains, Simple Interest, Compound Interest, Area गुणो᳤र व ◌माण, पाईपआिण टाकɡ, वेळआिण काय', वेळआिण अंतर, बोट आिा गुणोत्तर व प्रमाण, पाईप आणि टाकी, वेळ आणि कार्य, वेळ आणि अंतर, बोट आणि प्रवाह, ट्रेनवरील गणिती प्रश्न, सरळ व्याज, चक्रवाढ व्याज, क्षेत्रफळ	**10 Hrs**
III	Volume and Surface Areas, Races and Games of Skill, Calendar, Clocks, Stocks and Shares, True Discount, Height and Distance आकारमान आणि पृष्ठभागाचे क्षेत्रफळ, शर्यत आणि कौशल्य पूर्ण खेळ, दिनदर्शिका, घड्याळ, रोखे आणि समभाग, खरी सवलत, उंची आणि अंतर	**10 Hrs**

Text Books:

1.R. S. Aggarwal: Quantitative Aptitude, S. Chand, 2024

2.Quantitative Aptitude (संख्यात्मक अभियोग्यता- मराठी आवृत्ती) . आर. एस. अग्रवाल, एस चाँद प्रकाशन, 2024

3.दीपक अग्रवाल आणि डी. पी. गुप्ता, "रॅपिड क्वांटिटेटिव्ह ॲप्टिट्यूड", दिशा प्रकाशन, 2019

Scope:

Chapter-1, 2, 4, 5, 6, 8, 11, 12, 13, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 32, 34

Reference Books:

1. Arun Sharma:Teach Yourself Quantitative Aptitude, McGraw Hill Education, 2017.
2. Deepak Agarwal , D. P. Gupta, Rapid Quantitative Aptitude, Disha Publication, 2019.

Semester-IV

MAT/DSC/T/250: Algebra

Total Credits: 02 **Total Contact Hours: 30 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To prepare students for mathematical reasoning and logical thinking
ii) To have a good foundation in Groups and Rings.
iii) To enable students to build mathematical thinking and skill.
iv) To achieve student's problem solving skills

Course Outcomes (COs):

After completion of the course, students will be able to -

i) Identify and apply group structure properties
ii) Identify and apply subgroup, normal subgroup and quotient group properties.
iii) Define and construct homomorphism of groups.
iv) Define and construct homomorphism and isomorphism of rings and characterize integral domains

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Group Theory: Definition of a group, Some examples of groups, Some preliminary lemmas, Subgroups, Cosets, Lagrange's theorem	**10 Hrs**
II	A counting principle, Normal subgroups and quotient groups, Group homomorphism, Kernel of group homomorphism, Group isomorphism	**10 Hrs**
III	Ring Theory: Definition and examples of rings, Some special classes of rings, Characteristic of an integral domain, Ring homomorphism, Kernel of ring homomorphism, Ring isomorphism	**10 Hrs**

Text Books:

I. N. Herstein: Topics in Algebra, Wiley Eastern Pvt. Ltd., New Delhi, Second Edition, 2003.

Scope:

Chapter 2: 2.1, 2.2, 2.3, 2.4, 2.5 (Theorem 2.5.1 are without proof), 2.6, 2.7 **(Omit:** Lemma 2.7.4, Theorem 2.7.1, Cauchy's and Sylow's theorem for abelian groups, Lemma 2.7.5 and Theorem 2.7.2**).**

Chapter 3: 3.1, 3.2, 3.3.

Reference Books:

1. A. R. Vasishtha: Modern Algebra, Krishna Prakashan Media Pvt. Ltd. Meerut, 2023.
2. Surjeet Singh and Qazi Zameeruddin: Modern Algebra, Vikas Publishing House Pvt. Ltd. New Delhi, 2021.
3. Goyal J. K. And K. P. Gupta: Advanced Course in Abstract Algebra, Pragati Prakashan, Meerut, 2022.
4. John B Fraleigh: A First course in Abstract Algebra,Pearson Education,2013.
5. David S Dummit and Richard M. Foote: Abstract Algebra, Wiley India Pvt. Ltd,2011.

MAT/DSC/T/251 : Integral Transforms

Total Credits : 02 **Total Contact Hours : 30 Hrs** **Maximum Marks : 50**

Learning Objectives of the Course:

i) To determine Laplace transform for various functions and understand the properties of Laplace transforms

ii) To determine inverse Laplace transform, properties of inverse Laplace Transform, and solve the problems using convolution theorem

iii) To find the solution of differential equations using Laplace transform

iv) To determine Fourier transform and understand the properties of Fourier transform, Fourier sine and cosine transforms.

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Apply the Laplace transform for various functions.
ii) Obtain the inverse Laplace transform.
iii) Find the solution of differential equations by using Laplace transform.
iv) Find the Fourier transform for various functions, Fourier sine and cosine transforms of functions

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Beta Function and Gamma Function, Elementary properties of Gamma function, Relation between Beta and Gamma functions, The Piece- wise or Sectional continuity, Function of exponential order, Function of class A, The transform concept, Laplace Transform, Notation, Some Standard results, Some Theorems, Solved Problems	**10 Hrs**
II	Definition the inverse Laplace Transform, Null function, Uniqueness of inverse Laplace Transform, Some theorems, Partial Fractions, Heaviside's, expansion formula, Solved Problems, Differential Equations, Notations (problems related to first and second ordinary differential equations only)	**10 Hrs**
III	The Infinite Fourier sine transform of F(x), The Infinite Fourier cosine transform of F(x), The Infinite Fourier transform of F(x), Relationship between Fourier transform and Laplace transform, Some Theorems, Problems related to Fourier transform, Problems related to Integral Equations, Problems related to Fourier sine and cosine transform, Finite Fourier sine transform of F(x), Finite Fourier cosine transform of F(x) and Fourier Integral theorem.	**10 Hrs**

Text Books:

1. **J. N. Sharma, A. R.Vasishtha**: Real Analysis, Thirty Third Edition, Krishna Prakashan Media Pvt.Ltd., Meerut, 2004.
2. **J. K. Goyal and K. P. Gupta**: Laplace and Fourier Transforms, Twenty Seven Edition, Pragati Prakashan Meerut, 2013, Reprint 2014.

Scope:

Unit I: Chapter 14- Article 9, 10,13 [1], Chapter 1 Part I: Article 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 6 [2]

Unit II: (Chapter 1) Part II: Article 1.0, 1.1, 1.2, 1.3, 1.4 [2], Part III: Article 1.0, 1.1 [2]

Unit III: (Chapter 2) Part I: Article 2.0, 2.1, 2.2, 2.3 [2], Part II: Article 2.0, 2.1 [2]

References:

1. L. Debnath and D. Bhatta: Integral Transforms and their Applications, Third Edition, Taylor and Francis Group, 2015.
2. Baidyanath Patra: An Introduction to Integral Transforms, Taylor and Francis Group, 2016.
3. Parmanand Gupta: Topics in Laplace and Fourier transforms, First Edition, Laxmi Publications (P) Ltd, 2019.
4. John W.Miles:Integral Transforms In Applied Mathematics, Cambridge University Press,1971

MAT/DSC/P/276: Lab Course based on MAT/DSC/T/250

Total Credits: 02 **Total Contact Hours: 60 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To prepare students for mathematical reasoning and logical thinking
ii) To have a good foundation in Groups and Rings.
iii) To enable students to build mathematical thinking and skill.
iv) To achieve student's problem solving skills

Course Outcomes (COs):
After completion of the course, students will be able to -

i) Identify and apply group structure properties.
ii) Identify and apply subgroup, normal subgroup and quotient group properties.
iii) Define and construct homomorphism of groups.
iv) Define and construct homomorphism and isomorphism of rings and characterize integral domains

Practical Nos.	Topics / actual contents of the practicals
I	Problems on 2.3 - page no. 35 problem No. 1 to 5.
II	Problems on 2.3 - page no. 35 problem No. 7 to 11.
III	Problems on 2.3 - page no. 36 problem No. 20 to 23.
IV	Problems on 2.5 - page no. 46 problem No. 1 & page no. 47 problem No. 4, 5, 9.
V	Problems on 2.5 - page no. 47 problem No. 13 to 16 & page no. 48 problem No. 24.
VI	Problems on 2.6 - page no. 53 problem No.1 to 5.
VII	Problems on 2.6 - page no. 53 problem No. 6 & 9 to 12.
VIII	Problems on 2.7 - page no. 64 problem No. 1 (a) to 1 (e).
IX	Problems on 2.7 - page no. 64 problem No. 2, 3 & page no. 65 problem No. 9, 12.
X	Problems on 3.2 - page no. 130 problem No. 1 to 4.
XI	Problems on 3.2 - page no. 130 problem No. 5, 6, 8, 9.
XII	Problems on 3.2 - page no. 130 problem No. 10, 12 & Problems on 3.3 - page no.135 problem No. 3, page no. 136 problem no. 20.

Text Books:

I. N. Herstein: Topics in Algebra,Wiley Eastern Pvt.Ltd.,New Delhi,Second Edition,2003.

Reference Books:

1. A. R. Vasishtha: Modern Algebra, Krishna Prakashan Media Pvt. Ltd. Meerut, 2023.
2. Surjeet Singh and Qazi Zameeruddin: Modern Algebra, Vikas Publishing House Pvt. Ltd. New Delhi, 2021.
3. Goyal J. K. And K. P. Gupta: Advanced Course in Abstract Algebra, Pragati Prakashan, Meerut, 2022.
4. John B Fraleigh: A First course in Abstract Algebra, Pearson Education,2013.
5. David S Dummit and Richard M. Foote: Abstract Algebra, Wiley India Pvt. Ltd,2011.

MAT/DSC/P/277: Lab Course based on MAT/DSC/T/251

Total Credits: 02 **Total Contact Hours: 60 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To determine Laplace transform for various functions and understand the properties of Laplace transforms

ii) To determine inverse Laplace transform, properties of inverse Laplace Transform, and solve the problems using convolution theorem

iii) To find the solution of differential equations using Laplace transform

iv) To determine Fourier transform and understand the properties of Fourier transform, Fourier sine and cosine transforms.

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Apply the Laplace transform for various functions.

ii) Obtain the inverse Laplace transform.

iii) Find the solution of differential equations by using Laplace transform.

iv) Find the Fourier transform for various functions, Fourier sine and cosine transforms of functions

Practical Nos.	Topics / actual contents of the practicals
I	Problems on beta and gamma function and properties of them
II	Problems on Laplace transform and its properties
III	Problems on Inverse Laplace transform
IV	Problems on partial functions
V	Problems on ordinary differential equations
VI	Problems on system of ordinary differential equations
VII	Problems on infinite Fourier sine and Fourier cosine transform.
VIII	Problems on infinite Fourier transform
IX	Problems on Fourier sine transform and Fourier cosine transform
X	Problems on integral equations
XI	Problems on Finite Fourier transform
XII	Problems on Finite Fourier cosine transform

Text Books:

1. **J. N. Sharma, A. R.Vasishtha**: Real Analysis, Thirty Third Edition, Krishna Prakashan Media Pvt.Ltd., Meerut, 2004.
2. **J. K. Goyal and K. P. Gupta**: Laplace and Fourier Transforms, Twenty Seven Edition, Pragati Prakashan Meerut, 2013, Reprint 2014.

Scope:

Unit I: (Chapter 14) Article 9, 10,13 [I], (Chapter 1) Part I: Article 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 [2]

Unit II: (Chapter 1) Part II: Article 1.0, 1.1, 1.2, 1.3, 1.4 [2], Part III: Article 1.0, 1.1 [2]

Unit III: (Chapter 2) Part I: Article 2.0, 2.1, 2.2, 2.3 [2], Part II: Article 2.0, 2.1 [2]

References:

1. L. Debnath and D. Bhatta: Integral Transforms and their Applications, Third Edition, Taylor and Francis Group, 2015.

2 Baidyanath Patra: An Introduction to Integral Transforms, Taylor and Francis Group, 2016.

3. Parmanand Gupta: Topics in Laplace and Fourier transforms, First Edition, Laxmi Publications (P) Ltd, 2019.

4. John W.Miles:Integral Transforms In Applied Mathematics, Cambridge University Press,1971

MAT/Mn/T/250: Discrete Mathematics

Total Credits: 02 **Total Contact Hours: 30 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course: To learn relation and functions.

i) To learn Boolean algebra and its laws.
ii) To learn different types of logic gates.
iii) To learn application of logic gates to adders, encoder and decoder.

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Identify the types of relation and function.
ii) Prove laws of Boolean algebra.
iii) Apply the laws of Boolean algebra.
iv) Apply logic gates to adder, encoder and decoder.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Relation and Functions:** relation, equivalence relation, partial order relation. Functions, inverse mapping, composition of mappings, binary operations, [1]	**10 Hrs.**
II	**Boolean algebra:** Introduction, definition of Boolean algebra, principle of duality, laws of Boolean algebra, Boolean function.[1]	**10 Hrs.**
III	**Logic gates: I**ntroduction, gates and Boolean algebra, OR-Gate, AND-Gate, NOT-Gate(inverter), NOR-gate, NAND-Gate, exclusive OR-Gate, exclusive NOR-Gate, Applications: Adders (half adder & full adder), encoder and decoder. [2]	**10 Hrs.**

Text Books:

1. **B.S. Vatsa and Suchi Vatsa**: Discrete Mathematics, New Age International Publishers, Fourth Revised Edition (2009).
2. **G. Shanker Rao**: Discrete Mathematical structures, New Age International Publishers, Second Edition 2009.

Scope:

Chapter 3: Articles 3.1, 3.2 (Omit Theorem 3.2.1 & example 3.2.8), 3.4 to 3.8. [1]
Chapter 5: Articles 5.1, 5.2. [1]
Chapter 6: Articles 6.1, 6.2, 6.2.1 to 6.2.7, 6.3, 6.3.1 to 6.3.3. [2]

Reference Books:

1. Swapan Kumar Sarkar: A Textbook of Discrete Mathematics, S. Chand, Ninth Edition 2016 (Reprint 2021).
2. Kenneth H. Rosen: Discrete Mathematics and its Applications, McGraw-Hill Book Company,Eighth Edition 2019.

MAT/Mn/T/251 : Vector Calculus

Total Credits: 02 Total Contact Hours: 30 Hrs. Maximum Marks : 50

Learning Objectives of the Course:

i) To study the gradient, divergence, and curl of vector fields.
ii) To Model and solve problems related to electric fields, fluid flow

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Find the derivatives and partial derivatives of vector-valued functions of three variables.
ii) Define and apply the gradient, divergence and curl operators
iii) Evaluate line and surface integrals.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Point Functions: scalar valued point functions, vector valued point functions, limits and continuity, directional derivatives, cartesian representation of point functions and their directional derivatives, directional derivatives of point functions along co-ordinate axes and along any line.	**10 Hrs**
II	Gradient of a scalar point function, character of gradient as a point function, the operator ∇, operator a.∇, divergence and curl, gradient, divergence and curl of sums and product.	**10 Hrs**
III	Introduction, line integrals, circulation, irrotational vector point functions, surface integrals	**10 Hrs**

Text Book:

Shanti Narayan and P. K. Mittal: Vector Analysis, S. Chand and Company Ltd, 2007.

Scope:

Chapter 10: Articles 10.1, 10.1.1 to 10.1.2, 10.2, 10.2.1,10.2.3, 10.3, 10.3.1 to 10.3.2, 10.4, 10.4.1 to 10.4.2, 10.5, 10.6, 10.7, 10.7.1 to 10.7.2, 10.9, 10.10, 10.11, 10.12, 10.12.1 to 10.12.2, 10.14, 10.15 (results 1 to 6)

Chapter 11: Articles 11, 11.1, 11.1.1 to 11.1.2, 11.2, 11.2.1, 11.3, 11.3.1.

Reference Books:

1.C.J.Eliezer: Concise Vector Analysis, Dover Publications,2015
2. Paul C.Matthews: Vector Calculus,Springer, 1998
3.P.Duraipandian, K.Pachaiyappa: Vector Analysis, S. Chand.

MAT/SEC/T/250: Numerical Methods-II

Total Credit: 01 **Total Contact Hours: 15 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To study numerical integration methods
ii) To study numerical methods of solution of algebraic and transcendental equations.
iii) To study numerical methods of solution of ordinary differential equations

Course Outcomes (COs) :
After completion of the course, students will be able to -

i) Apply numerical methods and find the integration by numerical methods
ii) Derive and apply numerical methods to find the roots of algebraic and transcendental equations
iii) Apply numerical methods to obtain numerical solution of ordinary differential equations

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	**Numerical Integration**: General formula, Trapezoidal rule, Simpson's 1/3-rule, Simpson's 3/8-rule, Boole's and Weddle's rule.	**05 Hrs.**
II	**Solution of Algebraic and Transcendental Equations:** Introduction, the bisection method, the method of false position, Newton –Raphson method, generalized Newton's method.	**05 Hrs.**
III	**Numerical solution of Ordinary Differential Equations:** Introduction, Solution by Taylor's series, Picard's method of successive approximations, Euler's method, modified Euler's method.	**05 Hrs.**

Text Book:

S.S. Sastry: Introductory methods in numerical analysis, Third edition, Prentice Hall of India Private Limited, New Delhi, 2003.

Scope:

Chapter 2: 2.1, 2.2, 2.4, 2.5, 2.5.1.
Chapter 5: Articles 5.4, 5.4.1 to 5.4.4.
Chapter 7: Articles 7.1, 7.2, 7.3, 7.4, 7.4.2.

Reference Books:

1. H.C. Saxena: Finite Differences and Numerical Analysis, S. Chand and Co. New Delhi, Fourteenth Revised edition, 1998.
2. E.V. Krishnamurthi and Sen: Numerical algorithm, Affiliate East West Press Private Limited, 1986.
3. M.K.Jain, S.R.K.Iyengar and S.K.Jain:Numerical Methods, New Age International Publishers, Sixth edition,2012.

MAT/SEC/T/251 : Introduction to R and Basic Statistics using R-II

Total Credits: 01 **Total Contact Hours: 15** **Maximum Marks : 50**

Learning Objectives of the Course:

i) To learn matrix operation using R
ii) To learn multidimensional arrays using R
iii) To learn plotting using R
iv) To learn linear regression using R

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Perform matrix operation using R
ii) Plot various plots using R
iii) Edit plots using R
iv) Determine linear regression using R

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Defining a matrix, Subsetting, Matrix operations and algebra, Multidimensional arrays, Using plot with coordinate vectors	**05 Hrs.**
II	Graphical parameters, Adding points, lines and text to an existing plot, The ggplot2 package	**05 Hrs.**
III	Barplots, Pie charts, Histograms, Box and Whisker plots, Scatter plots, An example of linear relationship, General concepts	**05Hrs.**

Text Book:

Tilman R. Davies: The Book of R- A First Course in Programming and Statistics, No Strach Press, San Francisco,2016

Scope :

Chapter -3: 3.1,3.2,3.3,3.4 Chapter -7: 7.1,7.2,7.3,7.4, Chapter- 14:14.1,14.2,14.3,14.4

Chapter-20: 20.1,20.2

Reference Books:

1.Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters:A Beginers Guide to R, Springer, 2009

2.Thulin, M.: *Modern Statistics with R.* Second edition. Chapman & Hall/CRC Pres, 2024

3. Aeden Culhane: Introduction to Programming and Statistical Modelling in R,Harvard School of Public Health, 2013

MAT/SEC/P/276: Lab Course Based on MAT/SEC/T/250

Total Credits: 01 **Total Contact Hours: 30 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To study numerical integration methods
ii) To study numerical methods of solution of algebraic and transcendental equations.
iii) To study numerical methods of solution of ordinary differential equations
iv) To use mathematical software

Course Outcomes (COs) :
After completion of the course, students will be able to -

i) Apply numerical methods and find the integration by numerical methods
ii) Derive and apply numerical methods to find the roots of algebraic and transcendental equations
iii) Apply numerical methods to obtain numerical solution of ordinary differential equations
iv) Use of mathematical software for numerical methods

Practical No.	Topics / actual contents of the practical
I	Problems on numerical integration.
II	Problems on numerical integration.
III	Problems on the solution of algebraic and transcendental equations by bisection method.
IV	Problems on the solution of algebraic and transcendental equations by the method of false position.
V	Problems on the solution of algebraic and transcendental equations by the Newton – Raphson method.
VI	Problems on solution of ordinary differential equations by Taylor's series.
VII	Problems on solution of ordinary differential equations by Picard's method.
VIII	Problems on solution of ordinary differential equations by Euler's method.

Text Book:

S.S. Sastry: Introductory Methods in Numerical Analysis, Third edition, Prentice Hall of India Private Limited, New Delhi, 2003.

Reference Books:

1. H.C. Saxena: Finite Differences and Numerical Analysis, S. Chand and Co. New Delhi, Fourteenth Revised edition, 1998.
2. E.V. Krishnamurthi and Sen: Numerical algorithm, Affiliate east west press Private Limited, 1986.
3. M.K.Jain, S.R.K.Iyengar and S.K.Jain:Numerical Methods, New Age International Publishers, Sixth Edition,2012.

MAT/SEC/P/277: Lab Course Based on MAT/SEC/T/251

Total Credits: 01 **Total Contact Hours: 30 Hrs.** **Maximum Marks: 50**

Learning Objectives of the Course:

i) To learn probability mass function and probability density function.
ii) To learn mathematical expectation, variance, covariance.
iii) To understand concept of moment generating function and cumulants.
iv) To understand theoretical and continuous distribution.
v) To learn correlation and regression

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Determine distribution function.
ii) Determine mathematical expectation, variance and covariance.
iii) Apply the concept of theoretical and continuous distribution.
iv) Determine correlation coefficient.
v) Use statistical softwares.

Practical No.	Topics / actual contents of the practical
I	Problems on matrix operations using R
II	Problems on multidimensional arrays using R
III	Problems on automatic plots, title and axis labels using R
IV	Problems on adding points, line, text to existing plots using R
V	Problems using ggplot2 package in R
VI	Problems on Bar plot and Pie charts using R
VII	Problems on Histogram and scatter plots using R
VIII	Problems on fitting linear models with Im in R

Text Book:

Tilman R. Davies: The Book of R- A First Course in Programming and Statistics, No Strach Press, San Francisco,2016

Reference Books:

1.Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters:A Beginers Guide to R, Springer, 2009

2.Thulin, M.: *Modern Statistics with R*. Second edition. Chapman & Hall/CRC Pres, 2024

3. Aeden Culhane: Introduction to Programming and Statistical Modelling in R,Harvard School of Public Health, 2013

MAT/GE/OE/T/250: Mathematics for Competitive Examinations-II

Total Credits : 02 **Total Contact Hours: 30 Hrs** **Maximum Marks: 50**

Learning Objectives of the Course:
शिकण्याची उद्दिष्टे:

i) To develop spatial reasoning skills
स्थानिक तर्क कौशल्ये विकसित करणे

ii) To learn and apply various verbal and non verbal reasoning techniques
विविध मौखिक आणि अशाब्दिक तर्क तंत्रे शिकणे आणि लागू करणे

iii)To develop analytical and critical thinking skills
विश्लेषणात्मक आणि टीकात्मक विचार कौशल्ये विकसित करणे

iv)To improve logical reasoning skills
तार्किक तर्क कौशल्ये सुधारणे

v) To enable students to solve problems quickly and effectively with applying appropriate techniques and strategies for competitive examinations
योग्य तंत्रे आणि रणनीती वापरून विद्यार्थ्यांना समस्या जलद आणि प्रभावीपणे सोडवण्यास सक्षम करणे

Course Outcomes (COs) :

After completion of the course, students will be able to –
विद्यार्थी हे करू शकतील:

i) Apply problem solving strategies and computational skills to solve problems
सोडवण्यासाठी समस्या सोडवण्याच्या रणनीती आणि संगणकीय कौशल्ये लागू करणे

ii) Apply various Verbal & Non- Verbal Reasoning techniques
विविध मौखिक आणि गैर-मौखिक तर्क तंत्रे लागू करणे

iii) Improve calculation speed and accuracy
गणनेचा वेग आणि अचूकता सुधारणे

iv)Understand and apply fundamental mathematical concepts essential for various competitive examinations
विविध स्पर्धा परीक्षांसाठी आवश्यक असलेल्या मूलभूत गणितीय संकल्पना समजून घेणे आणि लागू करणे

v) Demonstrate a strong foundation in mathematical concepts
गणितीय संकल्पनांमध्ये मजबूत पाया प्रदर्शित करणे

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Series Completion, Analogy, Classification, Coding-Decoding, Blood Relations, Direction Sense Test, Logical Venn Diagrams श्रेणी पूर्ण करणे, शाब्दिक तर्क, वर्गीकरण, संकेतन: नि:संकेतन, नाते संबंध, दिशा ज्ञान चाचणी, तार्किक वेन आकृती	**10 Hrs**
II	Alphabet Test, Alpha-Numeric Sequence Puzzle, , Number, Ranking and Time Sequence Test, Logical Sequence of Words, Arithmetical Reasoning, Inserting the Missing Character	**10 Hrs**

	वर्णमाला चाचणी, अक्षरी- अंकी क्रमवार गणिते, संख्या, क्रमांकन आणि वेळ क्रमिका चाचणी, शाब्दिक तार्किक क्रम, अंकगणितीय तर्क, गहाळ घटक समाविष्ट करणे	
III	Series, Analogy, Classification, Analytical Reasoning, Mirror Images, Water Images मालिका, सदृश्यता, वर्गीकरण, विश्लेषणात्मक उत्तरे, आरश्यातील प्रतिमा, पाण्यातील प्रतिबिंब	**10 Hrs**

Text Books:

1. R. S. Aggarwal: A Modern Approach to Verbal & Non- Verbal Reasoning, S. Chand Publication, 2021
2. Abhishek Banarjee: Essential Reasoning Verbal, Non-Verbal and Analytical for Competitive Exams, Disha Publication, 2022
3. आर. एस. अग्रवाल, "संपूर्ण बुद्धिमान चाचणी (A Modern Approach to Verbal & Non- Verbal Reasoning- मराठी आवृत्ती)" , 2024
4. सचिन राजाराम ढवळे आणी कोमल दिलीप दरूरे", बुद्धिमत्ता चाचणी आणी तर्कक्षमता", सचिन ढवळेज् पब्लिकेशन्स, 2024

Scope:

Chapter: 1,2,3,4,5,8,9,10,11,12,14,15,16 [Part I- Text Book 1], Chapter: 1-6 [Part II- Text Book 1]

Reference Books:

1. An Advanced Approach to Reasoning Verbal and Non-Verbal for Competitive Examinations, Oswal Publication, 2020
2. सुजीत पवार, "बुद्धिमापन चाचणी", युनिक अकादमी पब्लिकेशन्स, 2018

MAT/FP/P/276: Field Project

Total Credits: 02	Total Contact Hours: 30 Hrs.	Maximum Marks: 50

Instructions:

Field work related to courses taught shall be allotted to each student and evaluation of the same shall be conducted as per the scheme of examination declared by the University.