

Deccan Education Society's

**Kirti M. Doongursee College of Arts,
Science and Commerce
(AUTONOMOUS)**

Dadar (W), Mumbai -28



Affiliated to

UNIVERSITY OF MUMBAI

Title of the program

- A-** U.G. Certificate in Mathematics
- B-** U.G. Diploma in Mathematics
- C-** B.Sc (Mathematics)

Syllabus for

Semester – Sem I & II

Ref: GR dated 20th April, 2023 for Credit Structure of UG

(With effect from the academic year 2026-27 Progressively)

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in Science Program will be able to	
PO1	Disciplinary Knowledge: Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate Programme. Execute strong theoretical and practical understanding generated from the specific graduate Programme in the area of work.
PO2	Critical Thinking and Problem solving: Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	Social competence: Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	Research-related skills and Scientific temper: Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	Trans-disciplinary knowledge: Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	Personal and professional competence: Performing dependently and collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	Effective Citizenship and Ethics: Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	Environment and Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PROGRAM SPECIFIC OUTCOMES

PSO	Description
PSO1	Students will be able to recall and list fundamental concepts, definitions, formulas, and theorems from Calculus, Algebra, Discrete Mathematics, and Statistical Techniques, along with basic commands in Microsoft Word, PowerPoint, and Excel.
PSO 2	Students will be able to explain and interpret mathematical concepts such as limits, derivatives, integrals, algebraic structures, and statistical methods, as well as demonstrate understanding of logical reasoning and document/presentation tools.
PSO 3	Students will be able to apply mathematical and computational techniques to solve problems in Calculus, Algebra, Discrete Mathematics, and Quantitative Aptitude, and effectively use Advanced Excel, Word, and PowerPoint for data analysis, documentation, and presentations.
PSO 4	Students will be able to analyze complex mathematical problems, compare different solution approaches, interpret statistical data, and evaluate logical arguments using concepts from higher-level calculus, discrete mathematics, and statistical techniques.

Sr. No.	Heading	Particulars	
1	Title of program O: _____A	A	U.G. Certificate in Mathematics
	O: _____B	B	U.G. Diploma in Mathematics
	O: _____C	C	B.Sc. (Mathematics)
2	Eligibility O: _____A	A	HSC(Science) OR Passed Equivalent Academic Level 4.0
	O: _____B	B	Under Graduate Certificate in Mathematics OR Passed Equivalent Academic Level 4.5
	O: _____C	C	Under Graduate Diploma in Mathematics OR Passed Equivalent Academic Level 5.0
3	Duration of program R: _____	A	One Year
		B	Two Years
		C	Three Years
4	Intake Capacity R: _____	120	



Deccan Education Society's

Sign of the HOD & Coordinator, DES's Kirti M. Doongursee College
Sign of Principal DES's Kirti M. Doongursee College, Mumbai 28.

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Preamble

1) Introduction : The syllabus for the program is designed in alignment with the academic framework and vision of the **University of Mumbai**, aiming to provide students with a strong foundation in mathematics, computational skills, and analytical reasoning. The curriculum integrates core mathematical areas such as **Calculus, Algebra, Discrete Mathematics, and Statistical Techniques**, ensuring a gradual progression from basic concepts to advanced applications.

It also emphasizes **computational skills, logical reasoning, and**

digital tools such as Word, PowerPoint, and Excel. The curriculum aims to develop analytical thinking, problem-solving ability, and effective communication skills, preparing students for higher studies, research, and employment opportunities.

2) Aims and Objectives:

- To develop fundamental knowledge in mathematical concepts and techniques.
- To enhance logical reasoning and quantitative aptitude skills.
- To provide hands-on experience through practical and computational tools.
- To improve communication and presentation abilities.

3) Learning Outcomes

- Students will understand and apply mathematical concepts to solve problems.
- Students will analyze mathematical problems and interpret results using appropriate mathematical concept.
- Students will demonstrate proficiency in digital tools and presentation skills.
- Students will develop critical thinking and problem-solving abilities.

4)Any other point (if any)

The curriculum focuses on holistic development by integrating theoretical knowledge, practical skills, and employability competencies, preparing students for higher education and professional careers.

Deccan Education Society's
Kirti M. Doongursee College (autonomous)
Proposed Curriculum as per NEP 2020 Year
of implementation- 2026-27

Name of the Department: Mathematics

Semester	Course Code	Course Title	Vertical	Credit
I	26MATMJ111	Calculus –I and Algebra -I	Major	2
	26MATMJP11	Practical : Calculus –I and Algebra -I	Major practical	2
	26MATOE131	Mathematical and Statistical Techniques-I	OE	2
	26MATVSC141	Microsoft word and Power point	VSC practical	2
	26MATSE151	Quantitative Aptitude and Logical reasoning	SEC practical	2
II	26MATMJ211	Calculus – II and Discrete Mathematics	Major	2
	26MATMJP21	Practical : Calculus – II and Discrete Mathematics	Major practical	2
	26MATOE231	Mathematical and Statistical Techniques-II	OE	2
	26MATVSC241	Basic Excel Skills	VSC practical	2
	26MATSE251	Documentation and Presentation skills	SEC practical	2

Semester -I

Course Code	MAJOR SEM – I : Calculus –I and Algebra -I	Credits	Lectures/ Week
26MATMJ111	PAPER I	2	2
Course Objectives(CO): CO1. To introduce the fundamental concepts of bounded sets, infimum and supremum, sequences, divisibility of integers, congruences, functions, and relations. CO2. To develop understanding of real numbers and their properties, convergence of sequences, and the principles of divisibility and congruence modulo n . CO3. To enable students to apply properties, theorems, and algorithms related to sequences, subsequences, divisibility, and congruences in problem-solving. CO4. To enhance analytical skills for examining boundedness, convergence of sequences, and structure of integers through congruence and residue classes.			
Course Outcomes: After successful completion of this course, students would be able to OC1:Define bounded sets, Infimum and supremum, sequences, Divisibility of integers, congruences, functions, relations. OC2:Explain real numbers and its various properties, sequences and its convergence, properties of divisibility , congruence modulo n . OC3:Apply various properties of real numbers, standard theorems of sequences and subsequences, properties of divisibility, congruences by employing suitable algorithms and theorems to solve related problems . OC4:Examine boundedness of a sequence, convergence of sequences, congruence, residue classes in integers.			
Unit	Topics	No of Lectures	

I	Calculus –I a)Real Number System i) Real number system R and order properties of R, absolute value $$ and its properties. ii) AM-GM inequality, Cauchy-Schwartz inequality, Intervals and neighborhoods , Interior points, Limit point, Hausdorff property. iii) Bounded sets, Statements of l.u.b. axiom and its consequences, Supremum and infimum, Maximum and minimum, Archimedean property and its applications, Density of rationals. b)Sequences in R i) Definition of sequence and examples, Convergence of sequences, and its properties. Divergent sequences. ii) Convergence of standard sequences iii) Algebra of convergent sequences, Sandwich theorem, Monotone convergence theorem and consequences of $\left(1+\frac{1}{n}\right)^n$. iv) Definition of subsequence, Subsequence of a convergent sequence, Cauchy sequences, Every convergent sequences is a Cauchy sequence and converse.	15
II	Algebra -I a)Integers & Divisibility i) Statements of well-ordering property of non-negative integers, Divisibility in integers, division algorithm, greatest common divisor (g.c.d.) and least common multiple (l.c.m.) of two non zero integers and properties , Expression of g.c.d. in the form of $ma + nb$ for some $m, n \in \mathbb{Z}$, Euclidean algorithm. ii) Primes, Euclid's lemma, Fundamental Theorem of arithmetic, The set of primes is infinite, there are arbitrarily large gaps between primes, there exists infinitely many primes of the form $4n - 1$ or of the form $6n - 1$. iii) Congruence, definition and elementary properties, Results about linear congruence equations. Examples. b)Functions, Relations and Binary Operations (Prerequisites: Definition of relation and function, domain, co-domain and range of a function, composite functions, injective, surjective, bijective functions, examples) i) Binary operation, properties, examples. Equivalence relation, Equivalence classes and its properties Definition of partition, every partition gives an equivalence relation and vice versa. ii) Congruence is an equivalence relation on $\mathbb{Z}$, Residue classes and partition of $\mathbb{Z}$, Addition and Multiplication modulo n, examples.	15

	Direct image $f(A)$ and inverse image $f^{-1}(B)$ for a function f , Composite of injective, surjective, bijective functions when defined, invertible functions, bijective functions are invertible and conversely, examples of functions including constant, identity, projection, inclusion, Binary operation as a function.	
References: 1. Thomas' Calculus by G.B. Thomas, Pearson Longman 2. R. G. Bartle- D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994. 3. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982. 4. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964. 5. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000. 6. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd. 7. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989 Additional References: 1. T. M. Apostol, Calculus Volume I, Wiley & Sons (Asia) Pte, Ltd. 2. Richard Courant-Fritz John, A Introduction to Calculus and Analysis, Volume I, Springer. 3. Ajit kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014. 4. James Stewart, Calculus, Third Edition, Brooks/ cole Publishing Company, 1994. 5. A Treatise on Differential Equations, MacMillan and Co.,1956 6. I. Niven and S. Zuckerman, Introduction to the theory of numbers, Third Edition, Wiley Eastern, New Delhi, 1972. 7. G. Birkoff and S. MacLane, A Survey of Modern Algebra, Third Edition, Mac Millan, New York, 1965. a. N. S. Gopalkrishnan, University Algebra, Ne Age International Ltd, Reprint 2013.		

Course Code	MAJOR SEM I – PRACTICAL: CALCULUS –I AND ALGEBRA –I	Credits	Lectures/ Week
26MATMJ11	Major Practical	2	4
Course Objectives(CO): CO1. To develop understanding of properties of real numbers, sequences, and subsequences along with their standard theorems. CO2. To introduce and explain the concepts of divisibility and congruences using appropriate algorithms and theorems. CO3. To enable students to solve a variety of problems based on the prescribed syllabus using			

suitable mathematical techniques.

CO4. To highlight the connection between mathematical concepts and their applications in pure and applied sciences.

Course Outcomes:

After successful completion of this course, students would be able to

OC1:Describe various properties of real numbers, standard theorems of sequences and subsequences

OC2:Discuss problems of divisibility, congruences by employing suitable algorithms and theorems .

OC3:Solve the problems based on the syllabus.

OC4:Relate mathematics and its applications in pure and applied sciences.

Sr. No.	Practical's details	No of Lectures/ Hours
1	Algebraic and Order Properties of Real Numbers and Inequalities	60
2	AM-GM inequality, Cauchy-Schwarz inequality, Interior point , Limit point.	
3	Hausdorff Property and LUB Axiom of R, Archimedian Property	
4	Convergence and divergence of sequences, bounded sequences, Divergent sequence.	
5	Algebra of Convergent sequences, Sandwich Theorem.	
6	Cauchy sequences, monotonic sequences, non-monotonic sequences.	
7	Miscellaneous theory questions on unit I	
8	Division Algorithm, Euclidean algorithm in Z, Examples on expressing the gcd. of two non zero integers a&b as $ma + nb$ for some $m, n \in \mathbb{Z}$,	
9	Primes and the Fundamental theorem of Arithmetic, Euclid's lemma, there exists infinitely many primes of the form $4n - 1$ or of the form $6n - 1$	
10	Congruence, linear congruence equations.	
11	Binary Operation, Equivalence Relations, Partition and Equivalence classes	
12	Congruence , Residue classes, partition of Z, Addition modulo n, Multiplication modulo n,	
13	Bijective and Invertible functions, Compositions of functions.	

14	Miscellaneous theory questions on unit II		
References: 1. R. G. Bartle- D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994. 2. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982. 3. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964. 4. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000. 5. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd. 6. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989			
Additional References: 1. T. M. Apostol, Calculus Volume I, Wiley & Sons (Asia) Pte, Ltd. 2. Richard Courant-Fritz John, A Introduction to Calculus and Analysis, Volume I, Springer. 3. Ajit kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014. 4. James Stewart, Calculus, Third Edition, Brooks/ cole Publishing Company, 1994. 5. A Treatise on Differential Equations, MacMillan and Co.,1956			
Course Code	OE SEM I : Mathematical and Statistical Techniques-I	Credits	Lectures/Week
26MATOE131	Open Elective	2	2
Course Objectives(CO): CO1. To introduce the basic terms and concepts related to shares, mutual funds, permutation, combinations, measures of dispersion, and probability. CO2. To develop understanding of fundamental principles and concepts in financial mathematics, combinatorics, and statistical measures. CO3. To enable students to apply appropriate methods and techniques to solve problems related to shares, mutual funds, permutation, combinations, measures of dispersion, and			

probability.

CO4. To develop analytical and evaluative skills for assessing risk and return in financial instruments and solving advanced problems using combinatorial and statistical concepts.

Course Outcomes:

After successful completion of this course, students would be able to

OC1: Define various terms in shares, mutual funds, permutation, combinations, measures of dispersion and probability.

OC2: Explain the fundamental concepts of shares and mutual funds, , permutation, combinations, measures of dispersion and probability.

OC3: Solve simple problems based on shares, mutual funds, permutation, combinations, measures of dispersion and probability.

OC4: Evaluate the risk and return profiles of individual stocks and mutual funds using performance, problems based on permutation, combinations, measures of dispersion and probability.

Unit	Topics	No of Lectures
I	(a) Basics of Shares and Mutual Funds Shares: Concept of share, face value, market value, dividend, equity shares, preferential shares, bonus shares. Simple examples. Mutual Funds: Simple problems on calculation of Net income after considering entry load, dividend, change in Net Asset Value (N.A.V.) and exit load. Averaging of price under the Systematic Investment Plan (S.I.P.) (b) Permutations, Combinations and Linear Programming Problems: Factorial notation, Fundamental principle of counting. Permutations as arrangement simple examples, combinations as selection simple examples. Linear Programming Problem : Sketching of Graphs of a) Linear equations $AX+BY+C=0$ b) Mathematical formulation of Linear Programming Problem up-to 2 variables. Solving Linear Programming Problem by graphical method up-to 2 variables.	15
II	(a) Measures of Central Tendencies: Definition of Average, Types of Averages: Arithmetic Mean, Median, and Mode for grouped as well as ungrouped data, Combined and Weighted mean. Quartiles for grouped data. Measures of Dispersions: Concept and idea of dispersion. Various measures Range, Quartile Deviation, coefficient of quartile deviation, Mean Deviation, coefficient of mean	15

	deviation , Standard Deviation, Variance, Combined Variance, Coefficient of variation. (b)Elementary Probability Theory Concept of random experiment/trial and possible outcomes; Sample Space and Discrete Sample Space; Events their types, Algebra of Events, Mutually Exclusive and Exhaustive Events, Complimentary events. Classical definition of Probability, Addition theorem (without proof), conditional probability. Independence of Events: $P(A \cap B) = P(A) P(B)$. Simple examples.	
References: 1. Mathematical and Statistical Techniques-I, by Sheth Publication . 2. Mathematical and Statistical Techniques-I, by Manan Prakashan . 3. A class textbook of Business Mathematics by Padmalochan Hazarika S.Chand Publications New Delhi. Additional References: 1. Basics of Business Mathematics Schaums Outline Series. 2. Fundamentals of mathematical Statistics , Sultan chand & sons, S.C. Gupta, V.K.Kapoor.		

Course Code	VSC SEM I : MICROSOFT WORD AND POWER POINT	Credits	Lectures/ Week
26MATVSC141	VOCATIONAL SKILL COURSE	2	4
Course Objectives(CO): CO1. To introduce the interface components and basic functions of word processing and presentation software. CO2. To develop understanding of document creation, editing, formatting, saving, and printing using word processing and presentation tools. CO3. To enable students to apply various formatting techniques and presentation styles for effective document and slide design. CO4. To develop skills in organizing professional documents and presentations incorporating text, graphics, animations, and transitions.			
Course Outcomes: After successful completion of this course, students would be able to OC1:Describe the names and functions of the word and power point interface components. OC2:Explain edit, save, print documents format document using word and power point. OC3:Apply formatting techniques and presentation styles. OC4:Organize document and slide presentations that include text, graphics, animation, and transitions.			
Sr. no.	Practical's Details:	No of Lectures / Hours	
1	Microsoft Word: Introduction to text basics, text formatting, and saving documents	60	
2	Working with objects, headers, and footers		
3	Using bullets and numbering; creating and formatting tables		
4	Proofreading documents; sharing and maintaining documents		
5	Power point :Setting Up PowerPoint Environment, Formatting Text		
6	Creating slides and applying themes; working with bullets and numbering		
7	Working with objects in presentations		
8	Inserting Hyperlinks and Action Buttons , Edit Hyperlinks and Action Button		
9	Using SmartArt graphics and tables		
10	Applying animations and slide transitions		

11	Slide show options and creating custom slide shows	
12	Revision Practical	
References: 1. Microsoft Office 365: In Practice, 2021 Edition, By Randy Nordell, Kathleen Stewart, Annette Easton, Pat Graves Mc Grow Hill Publication 2. Microsoft word in easy steps by Scott Basham 3. Microsoft power point guide to success by Kelvin Pitch 4. Microsoft power point best practices , tips and techniques by Chantal Bosse Additional References: 1. Learning Ms. Word and Ms Excel by Rohit Khurana 2. Microsoft power point basics by Angela Rose		

Course Code	SEC SEM -I QUANTITATIVE APTITUDE AND LOGICAL REASONING	Credits	Lectures/ Week
26MATSE151	SKILL ENHANCEMENT COURSE	2	4
Course Objectives(CO): CO1. To introduce fundamental concepts of numbers, factors, multiples, LCM, HCF, and basic rules such as BODMAS along with logical reasoning. CO2. To develop understanding of number systems, divisibility properties, data interpretation, and logical reasoning techniques. CO3. To enable students to apply appropriate methods and algorithms to solve problems involving arithmetic operations, roots, simplification, and reasoning. CO4. To enhance problem-solving skills by developing efficient techniques for faster and accurate mathematical calculations.			
Course Outcomes: After successful completion of this course, students would be able to OC1:Define different types of numbers , factors and multiples of numbers , LCM and GCD of numbers, BODMAS rule, tabulation, logical reasoning . OC2:Describe number system , BODMAS rule, factors and multiples of numbers , LCM and GCD of numbers the numbers , various properties of divisibility, data Interpretation and logical reasoning . OC3:Solve problems of divisibility,square and square roots, cube and cube roots,division and euclidean algorithms , HCF and LCM of numbers , Simplifications using BODMAS , data Interpretation and logical reasoning problems. OC4:Illustrate techniques involved in solving mathematical problems and thereby reducing the time taken for performing related calculation .			

Sr. no.	Practical Detail:	No of Lecture s/ Hours
1	Number System : Number line and classification of numbers, Face value and Place value of a digit in a number	60
2	squares and square roots , cube and cube roots	
3	prime numbers, test for an number to be a prime, Tests of divisibility	
4	Factorial of a number ,Modulus of a number , Greatest integral value, multiplication by short cut methods	
5	Division and Euclidean algorithms.	
6	Simplifications using BODMAS: simple problems	
7	Modulus of a real number, problems by using formulae like $(a+b)^2, (a-b)^2, a^2-b^2, (a+b)^3, (a^3-b^3), (a+b+c)^2$ etc	
8	HCF and LCM of numbers: Factors and Multiples	
9	HCF of two or more than two numbers by factorization method and by division method	
10	LCM by factorization and by short method,product of two numbers in terms of HCF and LCM	
11	Coprime numbers, HCF and LCM of fractions, Decimal fractions and comparison of fraction.	
12	Data Interpretation: Tabulation and bar graphs related problems.	
13	Logical Reasoning: Important concepts in Logical Reasoning simple problems	
14	Logical reasoning based on arrangements, Logical reasoning based on ranking, Quantitative reasoning, Puzzle test, Syllogisms	
References: 1. Quantitative Aptitude for competitive examinations by Dr. R.S.Aggarwal S.Chand Publication 2. Quantitative Aptitude for the CAT by Arun Sharma , TATA McGRAW-HILL's Series.		
Additional References: 1. Quantitative Aptitude for competitive examinations by Abhijit Gupta TATA McGRAW-HILL Publishing company limited, New Delhi. 2. Quantitative Aptitude by P.R. Vittal pearson education Publication.		

Semester -II

Course Code	MAJOR SEM II: CALCULUS – II AND DISCRETE MATHEMATICS	Credits	Lectures/ Week
26MATMJ211	PAPER I	2	2
Course Objectives(CO): CO1. To introduce the fundamental concepts of limits, continuity, series, finite and infinite sets, and basic counting principles. CO2. To develop understanding of convergence and divergence of series, set theory concepts, and combinatorial principles such as permutations, inclusion–exclusion, and derangements. CO3. To enable students to apply appropriate properties, theorems, and counting techniques to solve problems related to sequences, series, and discrete structures. CO4. To enhance analytical skills for examining mathematical concepts such as limits, continuity, types of sets, and counting principles in problem-solving contexts.			
Course Outcomes: After successful completion of this course, students would be able to OC1:Define limit, continuity , convergence and divergence series, Finite and infinite sets,. Pigeonhole principle, Permutation, Principal of inclusion and exclusion principle , derangements and eulers phi function. OC2:Explain limit, continuity , convergence and divergence series, Finite and infinite sets,. Pigeonhole principle, Permutation, Principal of inclusion and exclusion principle , derangements and eulers phi function. OC3:Apply various properties of limits, continuity, convergence and divergence series, Finite and infinite sets,. Pigeonhole principle, Permutation, Principal of inclusion and exclusion principle , derangements and Euler’s -phi- function to solve related problems. OC4:Examine limit , continuity , convergence and divergence series ,countable and uncountable sets, various counting principals and solve related problems.			

Unit	Topics	No of Lectures
I	Calculus – II a)Limits and Continuity {Brief review: Domain and range of a function, injective function, surjective function, bijective function, composite of two functions (when defined), Inverse of a bijective function. Graphs of some standard functions such as x, e^x, $\log x$, ax^2+bx+c, $\frac{1}{x}$, x^n $n \geq 3$, $\sin x$, $\cos x$, $\tan x$, $\sin\left(\frac{1}{x}\right)$, $x^2 \sin\left(\frac{1}{x}\right)$ over suitable intervals of $\mathbb{R}$. No direct questions to be added. } i) $\varepsilon - \delta$ definition of Limit of a function, uniqueness of limit if it exists, algebra of limits, limits of composite function, sandwich theorem, left-hand-limit $\lim_{x \rightarrow a^-} f(x)$, right-hand-limit $\lim_{x \rightarrow a^+} f(x)$, non-existence of limits, $\lim_{x \rightarrow -\infty} f(x)$, $\lim_{x \rightarrow \infty} f(x)$, $\lim_{x \rightarrow a} f(x)$, $\lim_{x \rightarrow a} f(x) = \pm \infty$. ii) Continuous functions: Continuity of a real valued function at a point, on a set and at end points of domain using $\varepsilon - \delta$ definition, examples, f is continuous at a if and only if $\lim_{x \rightarrow a} f(x)$ exists and equals to $f(a)$, Sequential continuity, Algebra of continuous functions, discontinuous functions, examples of removable and essential discontinuity. iii) Intermediate Value theorem(statement only) and its applications, Bolzano-Weierstrass theorem (statement only): A continuous function on a closed and bounded interval is bounded and attains its bounds. b)Infinite Series i). Infinite series in $\mathbb{R}$. Definition of convergence and divergence series. Basic examples including geometric series. Elementary results such as if $\sum_{n=1}^{\infty} a_n$ is convergent, then $a_n \rightarrow 0$ as $n \rightarrow \infty$ but converse is not true. Cauchy Criterion. Algebra of convergent series. ii). Tests for convergence: Comparison Test, Limit Comparison Test, Ratio Test (without proof), Root Test (without proof), Abel Test (without proof) and Dirichlet Test (without proof). Examples. The decimal expansion of real numbers. Convergence of $\sum_{n=1}^{\infty} \frac{1}{n^p}$ ($p > 1$). Divergence of	15

	harmonic series $\sum_{n=1}^{\infty} \frac{1}{n}$. iii) Alternating series. Leibnitz's Test. Examples. Absolute convergence, absolute convergence implies convergence but not conversely. Conditional Convergence.	
II	Discrete Mathematics Preliminary Counting i) Finite and infinite sets, countable and uncountable sets examples such as $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{N} \times \mathbb{N}$, $\mathbb{Q}$, $(0, 1)$, $\mathbb{R}$. ii) Addition and multiplication Principle, counting sets of pairs, two ways counting. iii) Pigeonhole principle simple and strong form and examples, its applications to geometry. Advanced Counting i) Permutation and combination of sets and multi-sets, circular permutations, emphasis on solving problems. ii) Binomial and Multinomial Theorem, Pascal identity, examples of standard identities such as the following with emphasis on combinatorial proofs iii) Non-negative integer solutions of equation $x_1 + x_2 + x_3 + \dots + x_k = n$. iv) Principle of inclusion and exclusion, its applications, derangements, explicit formula for d_n, deriving formula for Euler's function $\phi(n)$.	15

References:

1. Thomas's Calculus by G. B. Thomas, Pearson Longman
2. R. G. Bartle- D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.
3. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964.
4. James Stewart, Calculus, Third Edition, Brooks/ Cole Publishing company, 1994.
5. T. M. Apostol, Calculus, Vol I, Wiley And Sons (Asia) Pte. Ltd
6. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.
7. Norman Biggs, Discrete Mathematics, Oxford University Press.
8. V. Krishnamurthy, Combinatorics-Theory and Applications, Affiliated East West Press.
9. Discrete Mathematics and its Applications by Kenneth Rosen, Tata McGraw Hills.
10. Sharad Sane, Combinatorial Techniques, Springer.

Additional References:

1. Richard Courant and Fritz John, A Introduction to Calculus and Analysis, Volume-I, Springer.
2. Ajit Kumar and S. Kumaresan, A Basic course in Real Analysis, CRC Press, 2014.
3. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.

1. G. B. Thomas, Calculus, 12th Edition 2009
5. Schaum's outline series, Discrete mathematics,
6. Allen Tucker, Applied Combinatorics, John Wiley and Sons.
7. Richard Brualdi, Introductory Combinatorics, John Wiley and sons.

Course Code	MAJOR SEM II – PRACTICAL: Calculus– II and Discrete Mathematics	Credits	Lectures/ Week
26MATMJP21	Major Practical	2	4

Course Objectives(CO):

- CO1. To introduce the fundamental concepts of limits, continuity, differentiability, and implicit differentiation of functions.
- CO2. To develop understanding of properties of series, sets, and combinatorial principles including permutations, inclusion–exclusion, and related concepts.
- CO3. To enable students to apply concepts of limits, continuity, series, set theory, and counting principles to solve mathematical problems.
- CO4. To promote the application of mathematical concepts in solving problems across related disciplines.

Course Outcomes:

After successful completion of this course, students would be able to

- OC1: Define various properties of limits, continuity, differentiability of a function and implicit differentiation of functions to solve related problems.
- OC2: Explain various properties of limits, continuity, convergence and divergence series, Finite and infinite sets, Pigeonhole principle, Permutation, Principal of inclusion and exclusion principle, derangements and Euler's ϕ -function to solve related problems.
- OC3: Use limit, continuity, convergence and divergence series, countable and uncountable sets, various counting principles to solve related problems.
- OC4: Relate and apply concepts of mathematics in related disciplines.

Sr.no.	Practical detail	No of Lectures/ Hours
1	Limit of a function and Sandwich theorem, Algebra of limits.	60
2	Algebra of continuous functions, Intermediate Value theorem, Bolzano Weierstrass theorem. Continuous and discontinuous function.	
3	Properties of differentiable functions, derivatives of inverse functions and implicit functions.	
4	Chain Rule, Higher order derivatives	
5	Leibnitz Rule, Derivative of inverse functions, Implicit differentiation.	
6	Mean value theorems and its applications	
7	Miscellaneous theory questions on unit I	

8	Finite and infinite sets, countable and uncountable sets	
9	Counting principles, Two way counting.	
10	Pigeon hole principle.	
11	Multinomial theorem, identities, permutation and combination of multi-set.	
12	Non-negative integer solutions of equation $x_1 + x_2 + \dots + x_k = n$.	
13	Inclusion-Exclusion principle. Euler phi function.	
14	Miscellaneous theory questions on unit II	

References:

1. R. G. Bartle- D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.
2. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 1964.
3. James Stewart, Calculus, Third Edition, Brooks/ Cole Publishing company, 1994.
4. T. M. Apostol, Calculus, Vol I, Wiley And Sons (Asia) Pte. Ltd
5. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.
6. Norman Biggs, Discrete Mathematics, Oxford University Press.
7. V. Krishnamurthy, Combinatorics-Theory and Applications, Affiliated East West Press.
8. Discrete Mathematics and its Applications, Tata McGraw Hills.
9. Sharad Sane, Combinatorial Techniques, Springer.

Additional References:

1. Richard Courant and Fritz John, A Introduction to Calculus and Analysis, Volume-I, Springer.
2. Ajit Kumar and S. Kumaresan, A Basic course in Real Analysis, CRC Press, 2014.
3. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.
4. G. B. Thomas, Calculus, 12th Edition 2009
5. Schaum's outline series, Discrete mathematics,
6. Allen Tucker, Applied Combinatorics, John Wiley and Sons.
7. Richard Brualdi, Introductory Combinatorics, John Wiley and sons.

Course Code	OE :SEM – II :Mathematical and Statistical Techniques-II	Credits	Lectures/Week
26MATOE231	Open Elective	2	2

Course Objectives(CO):

- CO1. To introduce the fundamental concepts of functions, derivatives, correlation, and regression.
- CO2. To develop understanding of the properties and interpretations of functions, differentiation, and statistical relationships.
- CO3. To enable students to apply appropriate techniques to solve problems related to functions, derivatives, correlation, and regression.
- CO4. To develop computational skills for evaluating functions, finding derivatives, and calculating correlation and regression coefficients.

Course Outcomes:

After successful completion of this course, students would be able to

- OC1:Define functions, derivatives,correlation and regression.
- OC2:Describe functions, derivatives,correlation and regression.
- OC3:Solve simple problems on functions, derivatives,correlation and regression.
- OC4:Calculate values of a function, derivative of a function,correlation and regression coefficients.

Unit	Topics	No of Lectures
I	Functions ,Derivatives of functions and their Applications: (a)Concept of real Functions: Constant function, linear function, $x^n, a^x, \log x$. Demand, supply, total revenue, average revenue, total cost, average cost and profit function. (b)Derivatives of functions: Derivative of $x^n, a^x, e^x \log x$.Rules of derivative,simple problems, Second order derivative. Applications of derivative : Marginal cost,Marginal Revenue, Elasticity of demand, Maxima and Minima of functions.	15
II	Bivariate Linear correlation and regression (a) Correlation Analysis: Meaning, Types of correlation, Determination of correlation, Scatter diagram, Karl Pearson's and Spearmans rank correlation. (b)Regression Analysis: Meaning, Concept of Regression Equations, Slope of regression line and its interpretation, Regression coefficients, Relation ship between coefficient of correlation coefficients and regression coefficients. Finding	15

	the equations of regression lines by method of least squares.	
References: 1. Mathematical and Statistical Techniques-II, by Sheth Publication . 2. Mathematical and Statistical Techniques-II, by Manan Prakashan . 3. A class textbook of Business Mathematics by Padmalochan Hazarika S.Chand Publications New Delhi. Additional References: 1. Fundamental of mathematical Statistics , Sultan chand & sons, S.C. Gupta, V.K.Kapoor. 2. Basics of Business Mathematics Schaums Outline Series		

Course Code	VSC SEM II :BASIC EXCEL SKILLS	Credits	Lectures/ Week
26MATVSC241	VOCATIONAL SKILL COURSE	2	4

Course Objectives(CO):

- CO1. To introduce methods for organizing large datasets and applying basic functions in spreadsheets.
- CO2. To develop understanding of data management tools such as outlining, filtering, and pivot tables.
- CO3. To enable students to apply advanced functions and productivity tools for efficient worksheet development.
- CO4. To enhance analytical skills in examining and using formulas, including built-in functions, for data analysis.

Course Outcomes:

After successful completion of this course, students would be able to

- OC1: List large amount of data and apply various functions on it.
- OC2: Express data list using outline, auto filter, pivot tables etc.
- OC3: Choose advanced functions and productivity tools in developing worksheets.
- OC4: Examine formulas , including the use of built in functions.

Sr. no.	Practical Detail:	No of Lectures / Hours
1	Spreadsheet : (Creating and Navigating worksheets and adding information to worksheets)	

	Types of data, entering different types of data such as texts, numbers, dates, functions.	60
2	Quick way to add data Auto complete, Autocorrect, Auto fill, Auto fit. Undo and Redo Moving data, contiguous and non-contiguous selections, Selecting with keyboard. Cut-Copy, Paste. Adding and moving columns or rows. Inserting columns and rows. Find and replace values. Spell check	
3	Formatting cells, Numbers, Date, Times, Font, Colors, Borders, Fills. Multiple Spreadsheets: Adding, removing, hiding and renaming worksheets	
4	Add headers/Footers to a Workbook. Page breaks, preview. Creating formulas, inserting functions, cell references, Absolute, Relative (within a worksheet, other worksheets and other workbooks).	
5	Functions: Financial functions: FV, PV, PMT, PPMT, IPMT, NPER, RATE, NPV, IRR	
6	Mathematical and statistical functions. ROUND, ROUNDDOWN, ROUNDUP, CEILING, FLOOR, INT, MAX, MIN, MOD, SQRT, ABS, AVERAGE.	
7	Data Analysis: Sorting, Subtotal. Pivot Tables- Building Pivot Tables, Pivot Table regions, Rearranging Pivot Table.	
8	Advanced Spreadsheet :Multiple Spreadsheets Creating and using templates Creating and Linking Multiple Spreadsheets, Using formulas and logical operators.	
9	Creating and using named ranges. Creating formulas that use reference to cells in different worksheets.	
10	Functions: Database Functions LOOKUP, VLOOKUP, HLOOKUP Conditional Logic functions IF, COUNTIF, SUMIF, AVERAGEIF, NESTED IF.	
11	String functions LEFT, RIGHT, MID, LEN, UPPER, LOWER, PROPER, TRIM.	
12	Date functions TODAY, NOW, DATE, TIME, DAY, MONTH, YEAR, WEEKDAY, DAYS360. Statistical Functions COUNTA, COUNTBLANK, CORREL, LARGE, SMALL.	
13	Data Analysis : Filter with customized condition.	
14	The Graphical representation of data Column, Line, Pie and Bar charts.	

References:

1. Computer system and applications by Dr. Faiyaz Gadiwala, Mukesh N. Tekwani, Sheth publishers PVT LTD.
2. Computer system and applications by Dr. Verus D'Sa, Manan Prakashan.

Additional References:

1. Micosoft Office Excel by Torben Lage Frandsen.
2. Excel Fundamentals by St. George's University of London.

Course Code	SEC SEM II :DOCUMENTATION AND PRESENTATION SKILLS	Credits	Lectures /Week
26MATSE251	SKILL ENHANCEMENT COURSE	2	4
Course Objectives(CO):			
CO1. To introduce the interface components and basic functions of word processing and presentation software.			
CO2. To develop understanding of document creation, editing, formatting, saving, and printing			

using word processing and presentation tools.

CO3. To enable students to apply formatting techniques and presentation styles for effective document and slide design.

CO4. To develop skills in organizing well-structured documents and presentations incorporating text, graphics, animations, and transitions.

Course Outcomes:

After successful completion of this course, students would be able to

OC1:Describe the names and functions of the word and power point interface components.

OC2:Explain edit, save, print documents format document using word and power point.

OC3:Apply formatting techniques and presentation styles.

OC4:Organize document and slide presentations that include text, graphics, animation, and transitions.

Sr. no.	Practical's Details:	No of Lectures / Hours
1	Microsoft word :Text Basics, Text Formatting and saving file	60
2	Working with Objects, Header & Footers	
3	Bullets and Numbering, Working with Tables	
4	Proofing the document, Sharing and Maintaining Document	
5	Revision practical on Microsoft word.	
6	Power point :Setting Up PowerPoint Environment, Formatting Text	
7	Creating slides and applying themes, Working with bullets and numbering	
8	Working with Objects	
9	Inserting Hyperlinks and Action Buttons , Edit Hyperlinks and Action Button	
10	Using SmartArt and Tables	
11	Animation and Slide Transition	
12	Slide show option, Creating custom slide show	
13	Proofing and Printing	
14	Revision practical on Power point.	

References:

5. Microsoft Office 365: In Practice, 2021 Edition, By Randy Nordell, Kathleen Stewart, Annette Easton, Pat Graves Mc Grow Hill Publication
6. Microsoft word in easy steps by Scott Basham
7. Microsoft power point guide to success by Kelvin Pitch
8. Microsoft power point best practices , tips and techniques by Chantal Bosse

Additional References:

3. Learning Ms. Word and Ms Excel by Rohit Khurana
4. Microsoft power point basics by Angela Rose

Evaluation Scheme for First Year (UG) under NEP (2 credits)

I. Internal Evaluation for Theory Courses – 20 Marks

Evaluation Scheme for First Year _____ (UG) under NEP 2020 (2 credits)

I. Internal Evaluation for Theory Courses – 20 Marks

1) Continuous Internal Assessment (CIA) Assignment - Tutorial/ Case Study/ Project / Presentations/ Group Discussion / Ind. Visit. – 10 marks

2) Continuous Internal Assessment (CIA) ONLINE / OFFLINE Unit Test – 10 marks - 15 Minutes

II. External Examination for Theory Courses – 30 Marks

Duration: 1 Hour

Theory question paper pattern:

Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

**NOTE: To pass the examination, attendance is compulsory in both
Internal & External Theory Examinations.**

**FYBSC Mathematics Evaluation pattern and
Question paper pattern for Semester End
Practical Examination of Major Course**

Internal Continuous Assessment: 40% (20 Marks)	Semester End Examination: 60% (30 Marks)	Duration for End semester examination
Viva/ assignment/ objective question test /Small experiments (15 Marks), Overall performance (5 Marks) = 20 Marks	As per paper pattern	1 hr 30 mins

**FYBSC Mathematics Evaluation pattern and
Question paper pattern for Semester End Practical
Examination of Vocational Skill Courses and Skill
Enhancement Courses**

Internal Continuous Assessment: 40% (20 Marks)	Semester End Examination: 60% (30 Marks)	Duration for End semester examination
Viva/ assignment/ objective question test /Small experiments (15 Marks), Overall performance (5 Marks) = 20 Marks	As per paper pattern	1 hr 30 mins

Signatures of Team Members

SR.No.	Name	Signature
1.	Mrs. Mamata Patil	
2.	Mrs. Sheetal Dighe	
3.	Mr. Pratik Desai	
4.	Dr. Nanasaheb Phatangare	
5.	Dr. Abhaya Chitre	
6.	Mr. Dinesh Parker	
7.	Mr. Sharad Tiwari	

Letter Grades and Grade Points:

Semester GPA/ Programme CGPA	% of Marks	Alpha-Sign/ Letter Grade	Grading Point
---	-------------------	-------------------------------------	--------------------------

Semester/ Programme		Result	
9.00 - 10.00	90.0 – 100	O (Outstanding)	10
8.00 - < 9.00	80.0 - < 90.0	A+ (Excellent)	9
7.00 - < 8.00	70.0 - < 80.0	A (Very Good)	8
6.00 - < 7.00	60.0 - < 70.0	B+ (Good)	7
5.50 - < 6.00	55.0 - < 60.0	B (Above Average)	6
5.00 - < 5.50	50.0 - < 55.0	C (Average)	5
4.00 - < 5.00	40.0 - < 50.0	P (Pass)	4
Below 4.00	Below 40.0	F (Fail)	0
Ab (Absent)	-	Ab (Absent)	0

Justification for Bachelors in Mathematics

1.	Necessity for starting the course:	.
2.	Whether the UGC has recommended the course:	Yes
3.	Whether all the courses have commenced from the academic year 2023-24.	The course has already commenced in the university and in the academic year 2023-24 it is restructured under NEP 2020
4.	The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?:	This course is aided / self-financed based on the sanction given by University of Mumbai to affiliated colleges time to time.
5.	To give details regarding the duration of the Course and is it possible to compress the course?:	The duration of the program is three years (6 semesters). It is not possible to compress the course.
6.	The intake capacity of each course and no. of admissions given in the current academic year:	120 per division
7.	Opportunities of Employability / Employment available after undertaking these courses:	