Appendix - B
AC
Item No. -

As per NEP 2020

SRDSP Mandal's

SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA (AUTONOMOUS), SAWANTWADI

Affiliated to University of Mumbai

Title of the Program: Science

B.Sc. (Mathematics)

A: U. G. Certificate in **Mathematics: 2026-2027**

B: U. G. Diploma in **Mathematics: 2027-2028**

C: B.Sc. in **Mathematics: 2028-2029**

Syllabus for

Semester I & Semester II

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

Shri Pancham Khemraj Mahavidyalaya (Autonomous), Sawantwadi

(As per NEP 2020

Sr. No.	Heading	Particulars	
1.	**Title of the Program**	A	U.G. Certificate in **Mathematics**
		B	U.G. Diploma in **Mathematics**
		C	B.Sc. in **Mathematics**
2.	**Eligibility**	A	H. Sc. Science **OR** Passed Equivalent Academic Level 4.0
		B	Under Graduate Certificate in Mathematics & Allied Academic Level **OR** Passed Equivalent Academic Level 4.5
		C	Under Graduate Diploma in Mathematics & Allied Academic Level **OR** Passed Equivalent Academic Level 5.0
3.	**Duration of the program**	A	One Year
		B	Two Years
		C	Three Years
4.	**Intake capacity**		120/ division
5.	**Scheme of Examination**		NEP 40% Internal 60% External, Semester End examination, Individual passing in internal and External examination.
6.	**Standard of Passing**		40%

7.	**Credit Structure** **Sem. I** **Sem. II**		Attached herewith
	Sem. III **Sem. IV**		
	Sem. V **Sem. VI**		
8.	**Semesters**	A	Sem I & II
		B	Sem III & IV
		C	Sem V & VI
9.	**Program Academic Level**	A	4.5
		B	5.0
		C	5.5
10.	**Pattern**	Semester	
11.	**Status**	New	
12.	**To be implemented from Academic Year progressively**	From Academic Year: 2026-2027	

Sign of the BOS
Chairman
Dr. V. P. Sonalkar
BOS of Mathematics

Sign of

Sign of

S. R. D. S. P. Mandal's

Shri Pancham Khemraj Mahavidyalaya, Sawantwadi (Autonomous)

Sr. No.	Name of the Faculty	Category	Designation
01	Dr. Vishwas Pandurang Sonalkar	12.5 (1)	HoD/ Chairman
02	Miss. Tanvi Dilip Shinde	12.5 (2)	Member
03	Miss. Gayatri Rajesh Awate		Member
04	Dr. Kishor D. Kucche	12.5 (3)	Member
05	Dr. Jervin Zen Lobo		Member
06	Dr. Shridhar Krishna Pawar	12.5 (4)	Member
07	Asst. Prof. Sagar Balavant Patil	12.5 (5)	Member
08	Miss. Shreya Shripad Bhagwat	12.5 (6)	Member
09	Dr. Subhash Ishwar Unhale	12.5 (7)	Member

Preamble

1. Introduction:

Shri Pancham Khemraj Mahavidyalaya, Sawantwadi (Autonomous) believes in implementing several measures to bringequity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching- learning process, examination and evaluation techniques and ensuring the all-round development oflearners.

The institute has brought into force the revised syllabi as per the Choice Based Credit System (CBCS) for the First year B. Sc. in Mathematics from the academic year 2026-2027. Mathematics has been fundamental to the development of science and technology. In recent decades, the extent of application of Mathematic s to real world problems has increased by leaps and bounds. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects like Physics, Statistics and Computer Sciences, the board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to University of Mumbai and teachers from other University has prepared the syllabus of F.Y.B. Sc. Mathematics. The present syllabi of F. Y. B. Sc. for Semester I and Semester II has been designed as per U. G. C. Model curriculum so that the students learn Mathematics needed for these branches, learn basic concepts of Mathematics and are exposed to rigorous methods gently and slowly. The syllabi of F. Y. B. Sc. Mathematics would consist of two semesters and each semester would comprise of one course. Course I for semester I is 'Algebra I and Calculus I' and for semester II is `Discrete Mathematics and Calculus II'. Calculus is applied and needed in every conceivable branch of science. Course I of semester II, `Discrete Mathematics and Calculus II' develops mathematical reasoning and logical thinking and has applications in science and technology. Course II in both semesters contains practicals based on courses I. It helps to improve problem solving skills of students.

2. Aims and Objectives:

- Give the students a sufficient knowledge of fundamental principles, methods, and a clear perception of in numerous powers of mathematical ideas and tools and

know how to use them by modelling, solving, and interpreting.

- Reacting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.
- Enhancing students' overall development and to equip them with mathematical modelling abilities, problem solving skills, creative talent, and power of communication necessary for various kinds of employment.
- A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.

3. Program Outcome:

After successful completion of this programme learners will be able to

- Equip with skills to analyze problems, formulate hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.
- Prepare them for prominent career in Industry, Banks and for further Academic study.
- Acquire basic practical skills & technical knowledge along with domain knowledge of different subjects in the science stream.
- possess basic subject knowledge required for higher studies, professional and applied courses.

4. Program Specific Outcome:

After successful completion of this programme learners are able to

- Recall basic facts about mathematics.
- Equipped with mathematical modeling ability, problem solving skills, creative talent necessary for various kinds of employment.
- Develop a positive attitude towards mathematics as an interesting and valuable subject of study.
- Use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

Credit Structure for Sem I and Sem II

Semester	Course Code	Title of the Course	Category of Course	Number of Credits
I (Level 4.5)	USMTT 111	Algebra I and Calculus I	**Major**	**2**
	USMTP 112	Practical -101 (Practical based on Algebra I and Calculus - I)	**Major**	**2**
	MTVS 11	Basics in Python Programming	**VSC**	**2**
	MTSE 11	Data Analytics I	**SEC**	**2**
	USIKS 11	Indian Knowledge System (IKS) in Science	**IKS**	**2**
II (Level 4.5)	USMTT 113	Discrete Mathematics and Calculus II	**Major**	**2**
	USMTP 114	Practical- 102 (Practical based on Discrete Mathematics and Calculus II)	**Major**	**2**
	MTVS 12	Computing with Python	**VSC**	**2**
	MTSE 12	Data Analytics – II	**SEC**	**2**
	MTOE 11	Mathematics for Competitive Exams – I	**OE**	**2**

SEM. - I

STRUCTURE OF THE COURSE

Semester	Course Code	Course title	Type	No. of Credits	No. of Lectures (In Hours)
I	USMTT 111 (Major)	Algebra I and Calculus I	Theory	2	30

Course Objectives:

- To give sufficient knowledge of fundamental principles, methods, and a clear perception of numerous powers of mathematical ideas and tools.
- To reflect the broad nature of the subject and develop mathematical tools for continuing further study in various fields of sciences.
- To enhance students' overall development, problem solving skills, creative talent, and power of communication are necessary for various kinds of employment.
- To give adequate exposure to global and local concerns that would help learners explore many aspects of Mathematical Sciences.

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

- Understand the real number system, the integer and rational number system.
- Explain the properties and theorems of polynomials with suitable examples and also explain the concepts of modulus, infimum and supremum.
- Verify the concepts related to sequences, like bounded, convergent, divergent, Cauchy, etc. and also to verify the statements of theorems by applying them in problem-solving.
- Construct counter examples related to bounded sets, bounded sequence, Cauchy sequence and convergent sequence.

MODULE I) RELATIONS, FUNCTIONS, INTEGERS 15 LECTURES
(i) Well ordering Property, Principles of finite Induction (First and second) with examples. Divisibility in integers, trivial divisors, Division Algorithm.

(iii) Greatest common divisor (g. c. d.) & least common multiple (l. c. m.) of two non-zero integers, Properties of g. c. d. such as existence and uniqueness of g. c. d. of two non- zero integers a and b and that the g. c. d. can be expressed as ma + nb for some m, n $\in Z$, Euclidean Algorithm & Applications.

(iv) Euclid's lemma, Primes & results, 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.

(v) Definition of functions and examples, types of functions: injective, surjective and bijective functions. Projection function. Direct image f(A) and inverse image $f^{-1}(B)$ for a function f. Invertible functions and the inverse of a function, properties such as bijective functions are invertible and conversely, Composition of functions and related properties.

(vi) Cartesian product of two sets, definition of Binary relation and examples, reflexive, symmetric and transitive relations. Equivalence relation, Equivalence classes and its properties such as two equivalence classes are either identical or disjoint. Partition, every partition gives an equivalence relation and vice versa.

(vi) Congruence, definition and elementary properties, congruence is an equivalence relation on $\mathbb{Z}$, residue classes and partition of $\mathbb{Z}$, addition and multiplication modulo n, examples. linear congruence equations (solving problems of the type ax congruent to b modulo n). Examples.

MODULE II) REAL NUMBER SYSTEM AND SEQUENCES IN $\mathbb{R}$

15 LECTURES

(i) Introduction to Real number system, $\mathbb{R}$ and order properties of $\mathbb{R}$, absolute value function and its properties.

(ii) AM-GM inequality, Cauchy-Schwartz inequality, Intervals and neighbourhoods, interior point, limit point, Hausdorff property.

(iii) Bounded sets, supremum and infimum, maximum and minimum, statement of lub axiom and its consequences, Archimedean property and its applications, density of rationals.

(iv) Definition of a sequence and examples, convergence of sequences, limit of a convergent sequence and uniqueness of limit, bounded sequence, divergent

sequence.

(v) Some standard examples like: $\left(\frac{1}{1+na}\right)$, $\forall$ a > 0, (b^n), $\forall$ b, 0 < b < 1, $\left(c^{\frac{1}{n}}\right)$ $\forall$ c > 0 and $\left(n^{\frac{1}{n}}\right)$.

(vi) Convergent sequence is bounded but not conversely. Divergent sequence. Algebra of convergent sequences. Sandwich theorem with proof and examples.

(vii) Definition of subsequence, subsequence of a convergent sequence is convergent and converges to the same limit, Cauchy sequence, every convergent sequence is a Cauchy sequence and converse.

Recommended Books:

1. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd.
2. R. G. Bartle-D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.

Reference Books:

1. Niven and S. Zuckerman, Introduction to the theory of numbers, Third Edition, Wiley Eastern, New Delhi, 1972.
2. G. Birkoff and S. Maclane, A Survey of Modern Algebra, Third Edition, Mac Millan, New York, 1965.
3. N. S. Gopalkrishnan, University Algebra, Ne Age International Ltd, Reprint 2013.
4. P. B. Bhattacharya S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra, New Age International, 1994.
5. Kenneth Rosen, Discrete Mathematics and its Applications, McGraw Hill, International Edition, Mathematics Series.
6. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.
7. James Stewart, Calculus, Third Edition, Brooks/ cole Publishing Company, 1994.
8. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.

9. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989.
10. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.

EXAMINATION PATTERN

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Home Assignment / a quiz on one of the modules.	05 Marks
03	Seminar/ group presentation on any one topic related to the syllabus/ Poster/Chart /Model Making.	05 Marks
	Total	**20 Marks**

Paper pattern of the Test (Duration: 30 Minutes):

Q 1: Definitions/MCQ/ Fill in the blanks/True or False with Justification. (04 Marks: 4 x 1).

Q 2: Attempt any 2 from 3 descriptive questions. (06 marks: 2 × 3).

Semester End Examination (SEE): 30 Marks

Duration: 1 Hour		**Marks: 30**
Q. 1 A)	Attempt Any Two: (a) Question on Module I (b) Question on Module I (c) Question on Module I	10 Marks
Q. 2 A)	Attempt Any Two: (a) Question on Module II (b) Question on Module II (c) Question on Module II	10 Marks
Q. 3 A)	Attempt Any Two: (a) Question on Module I or Module II (b) Question on Module I or Module II (c) Question on Module I or Module II	10 Marks
	Total	**30 Marks**

Name of the Course: Practical – 101

(Practical based on Algebra I and Calculus I)

CREDIT STRUCTURE

Semester	Course Code	Title of the Course	Category of Course	Credits
I (Level 4.5)	**USMTP 112**	**Practical – 101 (Practical based on Algebra I and Calculus I)**	**Practical**	**02**

Course Objectives (CO):

- To give sufficient knowledge of fundamental principles, methods, and a clear perception of numerous powers of mathematical ideas and tools and the skills to use them by modelling, solving and interpreting.
- To reflect the broad nature of the subject and develop mathematical tools for continuing further study in various fields of sciences.
- To enhance students' overall development, problem solving skills, creative talent, and power of communication are necessary for various kinds of employment.
- To give adequate exposure to global and local concerns that would help learners explore many aspects of Mathematical Sciences.

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

- Understand and practice the problems based on fundamental concepts.
- Equip with skills to analyze problems and recognize bounded sets, bounded sequence, convergent and divergent sequences, monotone and Cauchy sequences, bijective functions, equivalence classes.
- Apply order completeness axiom, well ordering principle, induction principle.
- Evaluate limits of sequences, GCD, LCM, solutions of congruence.
- Formulate and validate results related to properties of integers / real numbers.

LIST OF PRACTICALS

1.	Examples based on Functions.
2.	Equivalence relations.
3.	Equivalence classes and partition.
4.	Principles of finite induction.
5.	GCD and LCM in $\mathbb{Z}$ using the Division Algorithm and Euclidean Algorithm and prime numbers.
6.	Congruence and its properties.
7.	Linear congruence equations.
8.	Algebraic, order and absolute properties of real numbers.
9.	Inequalities, Archimedean Property.
10.	Hausdorff Property, LUB axiom of $\mathbb{R}$.
11.	Convergent and divergent Sequences.
12.	Bounded Sequence, Monotone Sequence and Sandwich theorem.
13.	Cauchy Sequence, Subsequence.
14.	Applications of properties of real numbers and sequences.
15.	Supremum and infimum, maximum and minimum of a set.

Recommended Books:

1. David M. Burton, Elementary Number Theory, Seventh Edition, McGraw Hill Education (India) Private Ltd.
2. R. G. Bartle-D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.

Reference Books:

1. Niven and S. Zuckerman, Introduction to the theory of numbers, Third Edition, Wiley Eastern, New Delhi, 1972.
2. G. Birkoff and S. Maclane, A Survey of Modern Algebra, Third Edition, Mac Millan, New York, 1965.
3. N. S. Gopalkrishnan, University Algebra, Ne Age International Ltd, Reprint 2013.

4. P. B. Bhattacharya S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra, New Age International, 1994.
5. Kenneth Rosen, Discrete Mathematics and its Applications, McGraw Hill, International Edition, Mathematics Series.
6. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.
7. James Stewart, Calculus, Third Edition, Brooks/ cole Publishing Company, 1994.
8. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.
9. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989.
10. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.

Scheme of Examination:

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Overall performance	05 Marks
03	Viva	05 Marks
	Total	**20 Marks**

Semester End Practical Examination: 30 Marks

Duration: 2 Hours		**Marks: 30**
Q. 1 A)	Multiple choice questions (Attempt any 5 from 8).	10 Marks
Q. 2 A)	Attempt any Three out of Five.	15 Marks
	Total	**25 Marks**

Journal: 5 Marks

SYLLABUS FOR VOCATIONAL SKILL COURSE (VSC)

TITLE OF THE COURSE: BASICS IN PYTHON PROGRAMMING

CREDIT STRUCTURE

Semester	Course Code	Title of the Course	Type	Credits	No. of Lectures (In Hours)
I (Level 4.5)	MTVS 11	Basics in Python Programming	Practical	02	60

Course Objectives (CO):

- To learn and understand algorithms.
- To define the structure and components of algorithm and python program.
- To learn and understand python looping and control statements manipulations.
- To learn about inbuilt input/output operations and compound data types in Python.
- To learn about searching, sorting and recursion with python programming.

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

- Learn the fundamental concepts of algorithm and python.
- Understand the implementation of basic syntax, Input / Output operations, loop controls and decision making with algorithms and Python.
- Apply basic programming techniques for solving problems in mathematics.
- Verify elementary mathematical results using Python.
- Evaluate the solutions of complex mathematical problems using Python.
- Create different algorithms/programs for searching sorting and recursion-based problem.

LIST OF PRACTICALS

1.	Algorithm, characteristics of an algorithm. Elementary algorithmic vocabulary (input or read, output or print), Elementary mathematical operators (+, -, *, /, **, mod, div mod or %).
2.	Running Code in the Interactive Shell, IDLE. Input, Processing, and Output.
3.	Logical operators (or, and, not), Membership operators.
4.	Python data types.
5.	Exchange of values of two variables, using dummy variable.
6.	Exchange of values of two variables, without using dummy variable.
7.	Conditional Structure (if ---- else).
8.	Loop Structure with pre-known number of iterations (for loop).
9.	Loop Structure with pre-unknown number of iterations (while loop).
10.	Conditional Structure (if - elif - else).
11.	Algorithm on accepting a positive integer from the user and obtaining the sum of $1 + 2 + \cdots + n$, $1^2 + 2^2 + \cdots + n^2$, etc.
12.	Math module and the built-in functions and values – I and II.
13.	Convergence of the sequences $\frac{1}{n}$ and $\frac{1}{n^2}$.
14.	Algorithm on Searching and sorting.
15.	Recursion: Algorithm of Tower of Hanoi and Fibonacci sequence.

Recommended Books:

1. Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015.
2. E Balagurusamy, Introduction to Computing and Problem-Solving Using Python, McGraw Hill Education (India) Private Limited.

Reference Books:

1. Barry, P., Head First Python, O Reilly Publishers.
2. Dromy, R. G., How to solve it by Computer, Pearson India.
3. Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India.

4. Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.
5. Sprankle, M., Problem Solving & Programming Concepts, Pearson India.
6. Venit, S. and Drake, E., Prelude to Programming: Concepts & Design, Pearson India.
7. Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.
8. Rajaraman, V., Computer Basics and C Programming, Prentice-Hall India.
9. Downey, A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015.
10. Goel, A., Computer Fundamentals, Pearson Education.

EXAMINATION PATTERN

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Overall performance	05 Marks
03	Viva	05 Marks
	Total	**20 Marks**

Semester End Practical Examination: 30 Marks

Duration: 2 Hours		**Marks: 30**
Q. 1 A)	Multiple choice questions (Attempt any 5 from 8).	10 Marks
Q. 2 A)	Attempt any Three out of Five.	15 Marks
	Total	**25 Marks**

Journal: 5 Marks

SYLLABUS FOR SKILL ENHANCEMENT COURSE (SEC))

COURSE TITLE: DATA ANALYTICS - I

CREDIT STRUCTURE

Semester	Course Code	Title of the Course	Type	No. of Credits	No. of Lectures (In Hours)
I (Level 4.5)	MTSE 11	Data Analytics I	Practical	02	60

Course Objectives:

- To give deep understanding of fundamental statistical concepts and apply this knowledge to real-world scenarios.
- To develop practical skills of analyzing data and graphical representation using softwares, particularly Excel/ R.
- To enhance critical thinking skills by analyzing and interpreting statistical findings.
- To develop effective communication skills and conveying statistical findings through graphical representations and written analysis.
- To learn to apply statistical concepts creatively to solve real-world problems, demonstrating adaptability and innovation in different professional contexts.

Course Outcomes: After completing the Course, student will be able to

- Remember and recall key statistical terminologies and concepts.
- Understand the foundational principles of statistics and data representation.
- Apply statistical concepts and measures to real-world datasets.
- Analyze data patterns, relationships and distributions using statistical tools.
- Evaluate statistical measures for different types of data and scenarios.
- Develop the ability to create various graphical representations for qualitative and quantitative data.

LIST OF PRACTICALS

1.	Introduction to Statistics.
2.	Descriptive statistics and inferential statistics, difference between population and sample.
3.	Qualitative and quantitative variables, types of quantitative variable viz. discrete and continuous.
4.	Cross-Sectional Data and Time Series Data.
5.	Graphical representation of qualitative data: Bar graphs by using Excel/ R.
6.	Graphical representation of qualitative data: Pie charts by using Excel/ R.
7.	Graphical representation of quantitative data: Histogram, frequency polygon, frequency curve by using Excel/ R.
8.	Graphical representation of quantitative data: stem and leaf plot, box and Whisker plot.
9.	Measures of central tendency: Mean for raw data.
10.	Measures of central tendency: Median and Mode for raw data.
11.	Mean of the grouped data for a discrete variable.
12.	Median and Mode of the grouped data for a discrete variable.
13.	Mean for Continuous random variable.
14.	Median and Mode for Continuous random variable.
15.	Measures of dispersion: Range, coefficient of range, variance and standard deviation.

Recommended Books:

1) Gupta S. C., Kapoor V. K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons publisher, 12th Edition, 2020.
2) David R. Anderson, Dennis J. Sweeney and Thomas A. Williams, Statistics for Business and Economics, 11th Edition, Cengage Learning publisher, 2011.

Reference Books:

1) Prem S. Mann, Introductory Statistics, John Wiley & Sons Inc., 8th Edition, 2013.

2) James McClave and Terry Sincich, A First Course in Statistics, Pearson Education Limited, 12th Edition, 2018.
3) Barbara Illowsky, Susan Dean and Laurel Chiappetta, Introductory Statistics, OpenStax, Rice University, Texas, 2018.

EXAMINATION PATTERN

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Overall performance	05 Marks
03	Viva	05 Marks
	Total	**20 Marks**

Semester End Practical Examination: 30 Marks

Duration: 2 Hours		**Marks: 30**
Q. 1 A)	Multiple choice questions (Attempt any 5 from 8).	10 Marks
Q. 2 A)	Attempt any Three out of Five.	15 Marks
	Total	**25 Marks**

Journal: 5 Marks

SYLLABUS FOR INDIAN KNOWLEDGE SYSTEM
COURSE TITLE: INDIAN KNOWLEDGE SYSTEM (IKS) IN SCIENCE

CREDIT STRUCTURE

Semester	Course Code	Course title	Type	No. of Credits	No. of Lectures (In Hours)
I	USIKS 11	Indian Knowledge System (IKS) in science	Theory	2	30

Course Objectives: After completion of the program the students will be able to:

- sensitize about Indian culture and civilization including its Knowledge System and Tradition.
- to understand the knowledge, art and creative practices, skills and values in ancient Indian system.
- to study the enriched scientific Indian heritage.
- to introduce the contribution from Ancient Indian system & tradition to modern science & Technology.
- To understand importance of Ayurveda and its principles.
- To know Ayurveda methods for collection and storage of crude drugs.
- To train students for identification of medicinal plant parts and their description.
- To train students for use of raw materials in Ayurveda formulations and drugs.

Course Outcomes: After completing the Course, student will be able to

- understand and appreciate the rich Indian knowledge tradition
- understand the contribution of Indians in various fields
- experience increase subject-awareness and self-esteem
- develop a comprehensive understanding of how all knowledge is ultimately intertwined

- aware the importance of ayurveda and its principles.
- understand the ayurveda methods for collection and storage of crude drugs.
- understand the medicinal plant parts and their description.
- use raw materials in ayurveda formulations and drugs.

MODULE I) INDIAN KNOWLEDGE SYSTEM 15 LECTURES
• Introduction to IKS (What is knowledge System, Characteristic Features of Indian Knowledge System) • Why IKS? (Macaulay's Education Policy and its impact, Need of revisiting Ancient Indian Traditions) • Scope of IKS (The Universality of IKS (from Micro to Macro), development form Earliest times to 18th Century CE) • Tradition of IKS (Ancient Indian Education System: Home, Gurukul, Pathashala, Universities and ancient educational centres) • Relevant sites in the vicinity of the Institute (Water Management System at Kanheri, Temple Management of Ambarnath, etc.)
MODULE II) INDIAN KNOWLEDGE SYSTEM RELATED TO SCIENCES 15 LECTURES
i) (Botany) AYURVEDA AND INTEGRATED DISCIPLINE ➢ Introduction to department of AYUSH, CCIM, CCRAS, RAV ➢ Study on following dravyas with respect to Sanskrit name, Common name, Botanical name, Family, habit and parts used: Arjuna, Ashoka, Brahmi, Chitraka, Nirgudi, Shatavari and Tulsi. ii) (Zoology) APPLIED ECONOMIC ZOOLOGY & SUSTAINABLE PRACTICES ➢ Traditional Sericulture, Apiculture, & Lac Culture:

Documented traditional methods of gathering silk, honey, and shellac resins in regional contexts.

iii) (Chemistry) CHEMISTRY IN TRADITIONAL MEDICINES

- Rasayana
- ✓ Benefits of Rasayana,
- ✓ Applications of Suvarna bhasma (Gold), Raupya bhasma (Silver), Tamra Bhasma (Copper), Naga bhasma (Lead).

iv) (Mathematics) CONTRIBUTION OF INDIAN MATHEMATICIANS

- Aryabhat-1
- Brahmagupt.
- Ramanujan

v) (Physics)

- Introduction to Indian Knowledge Systems and Physics, Meaning and objectives of Indian Knowledge Systems (IKS), Development of science in ancient India, Sources of knowledge: Vedas, Upanishads, Vedangas Contributions of ancient Indian scholars such as Kanada, Aryabhata, and Varahamihira Relevance of IKS in modern physics education.
- Ancient Indian Concepts Related to Physics. Vaisheshika philosophy and the concept of Anu (Atom). Concepts of matter, motion (Gati), force (Bala), and gravity in ancient texts Panchamahabhuta (Five Elements) and scientific interpretation Comparison of ancient ideas with modern physics concepts.
- Indian Contributions to Astronomy and Modern Science. Contributions of Aryabhata to astronomy and Earth's rotation Surya Siddhanta and Indian astronomical traditions Contributions of C. V. Raman and Satyendra Nath Bose to modern physics. Importance of integrating IKS with contemporary science and research.

Reference Books:

1. Concise history of science in India- D.M. Bose, S.N Sen, B.V. Subbarayappa.
2. Positive sciences of the Ancient Hindus- Brajendranatha seal, Motilal Banrasidas, Delhi 1958.

3. History of Chemistry in Ancient India & Medieval India, P. Ray- Indian Chemicals Society, Calcutta 1956
4. Charaka Samhita- a scientific synopsis, P. Ray & H.N Gupta National Institute of Sciences of India, New Delhi 1965.
5. MacDonnell A.A- History of Sanskrit literature
6. Winternitz M- History of Indian Literature Vol. I, II & III
7. Dasgupta S.N & De S.K- History of Sanskrit literature Vol. I.
8. Ramkrishna Mission- cultural heritage of India Vol. I, II & III.
9. Majumdar R. C & Pushalkar A.D- History & culture of the Indian people, Vol. I, II & III.
10. Keith A.B- History of Sanskrit literature.
11. Varadachari V- History of Sanskrit literature Chaitanya Krishna- A new History of Sanskrit
12. S.K. Jain (Ed.) (1989): Methods and approaches in Ethno-botany. Society of ethnobotanists, Lucknow, India.
13. S.K. Jain, (1990): Contributions of Indian Ethno-botany. Scientific publishers, Jodhpur.
14. S. K. Jain (1995): Manual of Ethno botany, Scientific Publishers, Jodhpur.
15. Colton C.M. (1997): Ethno botany. Principles and applications. John Wiley and Sons, Chichester.
16. Rama Ro, N. and A. N. Henry (1996): The Ethno-botany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
17. Trivedi P. C., (2006): Medicinal Plants: Ethno-botanical Approach, Agrobios, India.
18. Purohit and V., (2008): Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.
19. D. C. Pal. & Jain, S.K., (1998): Tribal Medicine. Naya Prakash Publishers, Calcutta.
20. Raychudhuri, S.P., (1991): (Ed.) Recent advances in Medicinal aromatic and spice crops.Vol.1, Today & Tomorrow's printers and publishers, New Delhi.

SCHEME OF EXAMINATION

A) Internal Assessment:

Sr. No.	Particulars	Marks
1	One assignment/test/Seminar/Presentation	10
2	Class attendance	05
3	Subject based activity	05
	Total Marks	20

B) External Assessment:

Sr. No.	Particulars	Marks
1	EXTERNAL	30

SEM. - II

STRUCTURE OF THE COURSE

Semester	Course Code	Course title	Type	No. of Credits	No. of Lectures (In Hrs.)
II	USMTT 113 (Major)	Discrete Mathematics and Calculus II	Theory	2	30

Course Objectives:

- To give sufficient knowledge of fundamental principles, methods, and a clear perception of numerous powers of mathematical ideas and tools and the skills to use them by modelling, solving and interpreting.
- To reflect the broad nature of the subject and develop mathematical tools for continuing further study in various fields of sciences.
- To enhance students' overall development, problem solving skills, creative talent and power of communication are necessary for various kinds of employment.
- To give adequate exposure to global and local concerns that would help learners explore many aspects of Mathematical Sciences.

Course Outcomes: After the completion of this course, learners will be able to:

- Understand the concepts of limit and continuity of functions and various counting techniques which are used to handle problems on finite sets and apply them in day-to-day life.
- Explain the concept differentiability of a function, addition and multiplication principles, two-way counting, inclusion and exclusion principles.
- Apply the derivatives and obtain maxima/minima of functions and other various applications, also mathematical logic to solve problems.
- Verify existence of limit, continuity and differentiability of a function.
- Find the limits and derivatives and the number of partitions using Sterling numbers.
- Construct counter examples related to continuous and discontinuous functions etc. and design problems based on the pigeonhole principle.

MODULE I) PRELIMINARY AND ADVANCED COUNTING

15 LECTURES

(i) Countable and uncountable sets examples such as $\mathbb{N}$, $\mathbb{Z}$, $\mathbb{N}\times\mathbb{N}$, $\mathbb{Q}$, (0,1), $\mathbb{R}$. Addition and multiplication principles, counting sets of pairs, two ways counting.

(ii) Stirling numbers of the second kind. Simple recursion formulae satisfied by S(n,k) for k = 1, 2, ……, n−1, n. Pigeonhole principle (simple and strong form) and examples, its applications to geometry.

(iii) Recurrence Relations, the definition of homogeneous, non-homogeneous, linear, non-linear recurrence relation, solving homogeneous recurrence relation by using iterative method, solving a homogeneous recurrence relation of second degree using algebraic method.

(iv) Permutation and combination of sets and multi-sets, circular permutations, emphasis on solving problems.

(v) Binomial and Multinomial Theorem (statement only), Pascal identity. Non-negative integer solutions of the equation $x_1 + x_2 + \cdots + x_k = n$.

(vi) Principle of inclusion and exclusion, its applications.

MODULE II) LIMIT, CONTINUITY, DIFFERENTIABI-LITY AND APPLICATIONS OF DERIVATIVES 15 LECTURES

(i) $\epsilon - \delta$ definition of Limit of a function, uniqueness of limit if it exists, left hand-limit, right-hand limit, algebra of limits, sandwich theorem, non-existence of limits, limits at infinity.

(ii) Continuous functions: Continuity of a real valued function at a point and on a set using $\epsilon - \delta$ definition, examples, Continuity of a real valued function at end points, Sequential continuity (without proof), Algebra of continuous functions (without proof), discontinuous functions, examples of removable and essential discontinuity.

(iii) Intermediate Value theorem and its applications, Bolzano-Weierstrass theorem (statement only): A continuous function on a closed and bounded interval is bounded and attains its bounds.

(iv) Differentiation of real valued function of one variable: Definition of differentiability of a function at a point of an open interval, examples of differentiable and non-differentiable functions, differentiable functions are continuous but not conversely, algebra of differentiable functions (without proof). Chain rule (statement only), Higher order derivatives, Leibniz rule (statement only), Derivative of inverse functions, Implicit differentiation (only examples).

(v) Rolle's Theorem, Lagrange's and Cauchy's Mean Value Theorems, applications and examples, Monotone increasing and decreasing functions, examples. L -Hospital's rule (without proof), examples of indeterminate forms, Taylor theorem (without proof) and its applications.

Recommended books:

1. Norman Biggs, Discrete Mathematics, Oxford University Press, England, 2nd Edition, 2003.
2. Richard Brualdi, Introductory Combinatorics, Pearson Education ltd., 5th Edition, 2019.
3. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 2020.

Reference books:

1. V. Krishnamurthy, Combinatorics-Theory and Applications, Affiliated East West Press.
2. Kenneth H. Rosen & Dr. Kamala Krithivasan, Discrete Mathematics and its Applications, Tata McGraw Hills, 8th Edition, 2021.
3. Schaum's outline series, Discrete Mathematics.
4. Allen Tucker, Applied Combinatorics, John Wiley and Sons.
5. Sharad Sane, Combinatorial Techniques, Springer.
6. Richard Courant-Fritz John, A Introduction to Calculus and Analysis, volume I, Springer.
7. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC press, 2014.
8. James Stewart, Calculus, Third Edition, Brooks/ cole Publishing Company, 1994.
9. R. G. Bartle-D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.

10. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.
11. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.

EXAMINATION PATTERN

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Home Assignment / a quiz on one of the modules.	05 Marks
03	Seminar/ group presentation on any one topic related to the syllabus/ Poster/Chart /Model Making.	05 Marks
	Total	**20 Marks**

Paper pattern of the Test (Duration: 30 Minutes):

Q 1: Definitions/MCQ/ Fill in the blanks/True or False with Justification. (04 Marks: 4 x 1).

Q 2: Attempt any 2 from 3 descriptive questions. (06 marks: 2 × 3).

Semester End Examination (SEE): 30 Marks

Duration: 1 Hour		**Marks: 30**
Q. 1 A)	Attempt Any Two: (d) Question on Module I (e) Question on Module I (f) Question on Module I	10 Marks
Q. 2 A)	Attempt Any Two: (d) Question on Module II (e) Question on Module II (f) Question on Module II	10 Marks
Q. 3 A)	Attempt Any Two: (d) Question on Module I or Module II (e) Question on Module I or Module II (f) Question on Module I or Module II	10 Marks
	Total	**30 Marks**

Name of the Course: Practical – 102

(Practical based on Discrete Mathematics and Calculus II)

CREDIT STRUCTURE

Semester	Course Code	Title of the Course	Category of Course	No. of Credits	No. of Lectures (In Hrs.)
II	USMTP 114	Practical – 102 (Practical based on Discrete Mathematics and Calculus II)	Practical	02	60

Course Objectives:

- To give sufficient knowledge of fundamental principles, methods, and a clear perception of numerous powers of mathematical ideas and tools and the skills to use them by modelling, solving and interpreting.
- To reflect the broad nature of the subject and develop mathematical tools for continuing further study in various fields of sciences.
- To enhance students' overall development, problem solving skills, creative talent, and power of communication are necessary for various kinds of employment.
- To give adequate exposure to global and local concerns that would help learners explore many aspects of Mathematical Sciences.

Course Outcomes: After the completion of this course, learners will be able to:

- Understand the concepts of limits and continuity of functions also counting techniques which are used to handle problems on finite sets and apply in day-to day life.
- Explain the concept of differentiability of a function & learn addition and multiplication principles and two ways counting by solving examples.
- apply the derivatives and obtain maxima/minima of functions and apply mathematical logic to solve problems.
- Verify existence of limit, continuity, and differentiability of a function.
- Find the limits and derivatives and evaluate number of partitions using Sterling numbers.

- Construct counter examples related to continuous and discontinuous functions and to design problems based on the pigeonhole principle.

LIST OF PRACTICALS

1.	Countable and Uncountable Sets.
2.	Counting Principles, Two Way Counting.
3.	Stirling numbers of the second kind.
4.	Pigeon hole principle.
5.	Recurrence relation.
6.	Permutations and Combinations of sets and circular permutations.
7.	Multinomial theorem.
8.	Permutation and combination of multi-set.
9.	Limit of function and Sandwich theorem.
10.	Continuous and discontinuous functions, Algebra of limits and continuous functions.
11.	Intermediate value theorem, Bolzano-Weierstrass theorem.
12.	Properties of differentiable functions.
13.	Higher order derivatives and Leibnitz rule.
14.	Indeterminate forms and Taylor's theorem.
15.	Applications of Rolle's and Lagrange's Theorem.

Recommended books:

1. Norman Biggs, Discrete Mathematics, Oxford University Press, England, 2nd Edition, 2003.
2. Richard Brualdi, Introductory Combinatorics, Pearson Education ltd., 5th Edition, 2019.
3. R. R. Goldberg, Methods of Real Analysis, Oxford and IBH, 2020.

Reference books:

1. V. Krishnamurthy, Combinatorics-Theory and Applications, Affiliated East West Press.

2. Kenneth H. Rosen & Dr. Kamala Krithivasan, Discrete Mathematics and its Applications, Tata McGraw Hills, 8th Edition, 2021.
3. Schaum's outline series, Discrete Mathematics.
4. Allen Tucker, Applied Combinatorics, John Wiley and Sons.
5. Sharad Sane, Combinatorial Techniques, Springer.
6. Richard Courant-Fritz John, A Introduction to Calculus and Analysis, volume I, Springer.
7. Ajit Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC press, 2014.
8. James Stewart, Calculus, Third Edition, Brooks/ cole Publishing Company, 1994.
9. R. G. Bartle-D. R. Sherbert, Introduction to Real Analysis, John Wiley & Sons, 1994.
10. Sudhir Ghorpade and Balmohan Limaye, A course in Calculus and Real Analysis, Springer International Ltd, 2000.
11. K. G. Binmore, Mathematical Analysis, Cambridge University Press, 1982.

Scheme of Examination:

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Overall performance	05 Marks
03	Viva	05 Marks
	Total	**20 Marks**

Semester End Practical Examination: 30 Marks

Duration: 2 Hours		**Marks: 30**
Q. 1 A)	Multiple choice questions (Attempt any 5 from 8).	10 Marks
Q. 2 A)	Attempt any Three out of Five.	15 Marks
	Total	**25 Marks**

Journal: 5 Marks

SYLLABUS FOR VOCATIONAL SKILL COURSE (VSC)

TITLE OF THE COURSE: COMPUTING WITH PYTHON

CREDIT STRUCTURE

Semester	Course Code	Title of the Course	Type	No. of Credits	No. of Lectures (In Hrs.)
II	MTVS 12	Computing with Python	Practical	02	60

Course Objectives (CO):

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to use indexing and slicing to access data in Python programs.
- To develop the skill of designing Mathematical user Interfaces with SymPy package in Python
- To develop SymPy code for different areas of mathematical concepts including calculus, plotting graphs, derivatives and solving simultaneous equations.

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

- Learn operations on strings, list, dictionaries and SymPy package.
- Understand how to use functions with arguments in Python.
- Apply basic programming techniques for solving problems in mathematics using SymPy Python.
- Verify implementation of basic mathematical results of calculus and algebra by using SymPy package.
- Evaluate the solutions of complex mathematical problems using Python.
- Create programs that plot graphs of trigonometric functions, linear, multiple and pretty printing with SymPy package in python.

LIST OF PRACTICALS

1.	Concept of String, Assigning value from user, Operators like +, ==, and *.
2.	Subscript operator and its various functions, len function, The immutability of string.
3.	Testing of substring. String methods, such as center, count, endswith, startswith, find, isalpha, isdigit, join, lower, upper, replace, split, strip.
4.	Concept of List, Assigning value from user, Operators like +, == and *, Subscript operator and its various functions, len function, The mutability of list.
5.	List methods, such as append, extend, insert and pop.
6.	Sorting a list in ascending/descending order. Aliasing a list. Tuple.
7.	Concept of Dictionary, Assigning key-value from user.
8.	Basic operations on numbers (integers and fractions), Getting complex numbers, Doing basic operations on complex numbers. Defining new functions.
9.	Symbols and symbolic operations using sympy.
10.	Working with expressions such as factorizing and expanding, substituting in values, pprint (pretty printing) function.
11.	Solving equations of first degree and higher degree, solving simultaneous equations.
12.	Plotting graphs in Python using sympy, Basic commands in plotting a graph, range of x. Plotting graphs of other functions, such as sin, cos, exp, log. Plotting multiple functions.
13.	Doing Calculus with Python using sympy, use of sympy instead of importing math directory, assumptions with sympy, limit of a function
14.	Instantaneous rate of change and derivative using sympy.
15.	Review of applications of derivatives such as maxima/minima, increasing/decreasing functions.

Recommended books:

1. Allen Downey, Jeffrey Elkner, Chris Meyers., How to think like a Computer Scientist: Learning with Python, Green Tea Press Wellesley, Massachusetts, 2nd Edition, 2008.
2. Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, Pvt. Ltd. Delhi, 3rd Edition, 2025.
3. E Balagurusamy, Introduction to Computing and Problem-Solving Using Python, McGraw Hill Education India Private Limited, 1st Edition, 2017.

Reference books:

1. Barry, P., Head First Python, O'Reilly Media Publisher, 3rd Edition, 2023.
2. Dromy, R. G., How to solve it by Computer, Prentice Hall publisher, 1982.
3. Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India.
4. Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.
5. Sprankle, M., Problem Solving & Programming Concepts, Pearson India.
6. Venit, S. and Drake, E., Prelude to Programming: Concepts & Design, Pearson India.
7. Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.
8. Amit Saha, Doing Math with Python, No Starch Press, Inc.
9. Goel, A., Computer Fundamentals, Pearson Education.
10. Rajaraman, V., Computer Basics and C Programming, Prentice-Hall India.

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Overall performance	05 Marks
03	Viva	05 Marks
	Total	**20 Marks**

Semester End Practical Examination: 30 Marks

Duration: 2 Hours		**Marks: 30**
Q. 1 A)	Multiple choice questions (Attempt any 5 from 8).	10 Marks
Q. 2 A)	Attempt any Three out of Five.	15 Marks
	Total	**25 Marks**

Journal: 5 Marks

SYLLABUS FOR SKILL ENHANCEMENT COURSE (SEC))

COURSE TITLE: DATA ANALYTICS II
CREDIT STRUCTURE

Semester	Course Code	Title of the Course	Type	No. of Credits	No. of Lectures (In Hrs.)
II	**MTSE 12**	**DATA ANALYTICS II**	**Practical**	**02**	**60**

Course Objectives:

- To define and explain fundamental statistical concepts, including scatter diagrams, correlation, regression and probability.
- To apply the Method of Least Squares for curve fitting and regression analysis to analyze real-world datasets.
- To interpret the results of correlation coefficients and regression analysis by considering their implications for decision-making.
- To analyze the patterns in scattered data and recognize the need for different curve fitting techniques.
- To evaluate the strengths and limitations of statistical techniques such as correlation, regression and probability and use statistical analysis to make informed decisions and recommendations in various professional settings.

Course Outcomes: After completing the Course, student will be able to

- recall fundamental concepts related to data analysis, including scatter diagrams, correlation and regression and memorize key principles and methods involved in curve fitting and probability theory.
- comprehend the relationship between scattered data and the need for curve fitting and understand the different types of correlation coefficients and their interpretations.
- apply the method of Least Squares to fit curves and regression lines to the given datasets and use regression techniques to obtain meaningful results from real-world data. Also implement probability concepts to analyze and solve practical problems.

- analyze and evaluate the impact of outliers on correlation coefficients and regression lines and also analyze algebraic operations of events and their implications in probability.
- synthesize information to choose appropriate regression models based on data characteristics and evaluate the strengths and limitations of correlation and regression techniques in various scenarios.
- formulate strategies for finding expectation and variance of a given random variable and also create real-world scenarios that demonstrate the relationship between statistical concepts and practical decision-making.

LIST OF PRACTICALS

1.	Understanding the scattered nature of the data, plotting scatter diagram of the data.
2.	Fitting a straight line using the method of least squares, fitting a curve to the data.
3.	Bivariate distribution, Karl Pearson's coefficient of correlation.
4.	Qualitative data and Spearman's Rank correlation coefficient.
5.	Regression lines of both types (y on x and x on y).
6.	Obtaining means and correlation coefficient from regression lines.
7.	Identifying the type (x on y or y on x) regression lines and estimating the values of y for different values of x, and vice-versa.
	(Note: It is expected to perform the Above practicals with the help of Excel or R software.)
8.	Random experiment and identifying its outcomes, sample points and sample space.
9.	Event, Finding union and intersection of events. Identifying mutually exclusive, exhaustive and complementary events.
10.	The three definitions along with their explanation of probability viz. Classical/Mathematical, Empirical, Axiomatic. Probability of an event.
11.	Addition theorem on Probability. Examples.
12.	Multiplication principle in probability, conditional probability.
13.	Independent events, Bayes' theorem, Examples.

14.	Random experiment and Probability Distribution of a random variable.
15.	Expectation and variance of a random variable.

Recommended Books:

1) Fundamentals of Mathematical Statistics, Gupta S. C., Kapoor V. K., Sultan Chand & Sons 12th Edition, 2020.
2) Statistics for Business and Economics, 11th Edition, David R. Anderson, Dennis J. Sweeney and Thomas A. Williams, Cengage Learning, 2011.

Reference Books:

1) Fundamentals of Statistics, Goon A. M., Gupta M. K. and Dasgupta B., The World press Pvt. Ltd. Calcutta, Vol. 1, 6th Revised Edition, 1983.
2) Statistics made it simple: Do it yourself on PC, Sarma, K. V. S. Prentce Hall of India, New Delhi, 2001
3) Statistics using R, Purohit S. G., Gore S. D., Deshmukh S. R., Narosa Publishing House, New Delhi, 2008.
4) Introductory Statistics, 8th Edition, Prem S. Mann, John Wiley & Sons Inc., 2013.
5) A First Course in Statistics, 12th Edition, James McClave and Terry Sincich, Pearson Education Limited, 2018.
6) Introductory Statistics, Barbara Illowsky, Susan Dean and Laurel Chiappetta, OpenStax, 2013.
7) Hands-On Programming with R, Garrett Grolemund, O'Reilly.
8) Programmed Statistics, Agarwal B. L., New Age International Publisher, 2nd Edition, New Delhi, 2003.

EXAMINATION PATTERN

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Overall performance	05 Marks
03	Viva	05 Marks
	Total	**20 Marks**

Semester End Practical Examination: 30 Marks

Duration: 2 Hours		**Marks: 30**
Q. 1 A)	Multiple choice questions (Attempt any 5 from 8).	10 Marks
Q. 2 A)	Attempt any Three out of Five.	15 Marks
	Total	**25 Marks**

Journal: 5 Marks

OPEN ELECTIVE COURSE
(FOR FYBA & FYBCOM CLASSES)
TITLE OF THE COURSE: MATHEMATICS FOR COMPETITIVE EXAMS - I

CREDIT STRUCTURE

Semester	Course Code	Title of the Course	Type	Credits
II	MTOE 11 (OE)	Mathematics for Competitive Exams - I	Theory	02

Course Objectives:

- To understand the Basic concepts in Mathematics.
- To use different tricks to solve the problems of Mathematics in Competitive Examinations.
- To strengthen the ability to draw logical conclusions.

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

- Provide a platform for building the fundamentals of basic mathematics for competitive examinations.
- Establish a framework to help learners acquire knowledge and expertise necessary to secure employment opportunities in the Government sector.

MODULE I) ARITHMETIC	**10 LECTURES**
Percentages, Interest, Profit and Loss. Mixtures and Allegation, Ratio and Proportion, Relation between Fraction and percentage, Time, Speed and Distance. Races and Clocks, Time and Work. Related Examples.	
MODULE II) NUMBER SYSTEM	**10 LECTURES**

Types of Number, Prime number, composite numbers, Factorial, Absolute value of a real number. Laws of Indices, Last digit of a^n, HCF and LCM For two numbers, relatively Prime numbers, related examples.
MODULE III) MEASURES OF CENTRAL TENDENCIES **10 LECTURES**
Definition of Average, Types of Averages: Arithmetic Mean, Median, and Mode for grouped as well as ungrouped data. Using Histogram locate mode and using Ogive locate median.

Recommanded Books:

1) Quantitative Aptitude for Competitive Examinations, Dinesh Khattar, 4th Edition.
2) Fundamentals of Mathematical Statistics, Gupta S. C., Kapoor V. K., Sultan Chand & Sons 12th Edition, 2020.

References Books:

1) Basis Abstract Algebra, P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, second Edition, Cambridge University press, 1995.
2) Text Book of Quickest Mathematics: Quantitative Aptitude and Numerical ability useful for All Competitive Exams, Kiran Prakashan, 5th Revised Edition, 2014.
3) Mathematical Statistical Techniques (F. Y. B. Com.), R. J. Shah, Sheth publishers Pvt. Ltd. Mumbai, 3rd Edition, 2009.
4) Quantitative Methods – I (BBI First year: First Semester), A. V. Deshpande, A. P. Kumtha, Vipul Prakashan, Mumbai, 1st Edition 2016.
5) Quantitative Methods – II (BBI First year: Second Semester), A. P. Kumtha, Vipul Prakashan, Mumbai, 1st Edition 2016.

EXAMINATION PATTERN

Continuous Internal Evaluation (CIE): 20 Marks

Sr. No.	Particulars	Marks
01	One Class Test	10 Marks
02	Home Assignment/ Quiz.	05 Marks
03	Seminar/ group presentation on any one topic related to the syllabus/ Poster/Chart /Model Making/Subject related activity.	05 Marks
	Total	**20 Marks**

Semester End Examination (SEE): 30 Marks

Duration: 1 Hour		**Marks: 30**
Q. 1 A)	Attempt Any Two: (a) Question on Module I (b) Question on Module I (c) Question on Module I	10 Marks
Q. 2 A)	Attempt Any Two: (a) Question on Module II (b) Question on Module II (c) Question on Module II	10 Marks
Q. 3 A)	Attempt Any Two: (a) Question on Module III (b) Question on Module III (c) Question on Module III	10 Marks
	Total	**30 Marks**