INSTITUTE OF SCIENCE NAGPUR

(An Autonomous Institute of Government of Maharashtra)

Department of Mathematics

CREDIT STRUCTURE, EVALUATION SCHEME, AND SYLLABUS OF

FOUR-YEAR BACHELOR OF SCIENCE (HONORS/HONOURS WITH RESEARCH) DEGREE WITH A SEMESTER PATTERN IN MATHEMATICS (FACULTY OF SCIENCE & TECHNOLOGY)

BASED ON

DIRECTION 1 OF 2024 ISSUED BY THE

INSTITUTE OF SCIENCE NAGPUR

AS PER NEP 2020

TO BE IMPLEMENTED FROM ACADEMIC YEAR

2024-2025

MATHEMATICS-MAJOR

Programme Outcomes

At the time of graduation, Students will be able to

PO 1 **Disciplinary Knowledge:** Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computerscience and other allied subjects.

PO 2 **Communication Skills**: Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modelingand solving of real life problems.

PO 3 **Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoningand capability of recognizing and distinguishing the various aspects of real life problems.

PO 4 **Problem Solving:** The Mathematical knowledge gained by the studentsthrough this programme develops an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modeling ability, problem solving skills.

PO 5 **Research related skills:** The completing this programme develops thecapability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.

PO 6 **Information/digital Literacy**: The completion of this programme will enable the learner to use appropriate softwares to solve system of algebraic equation and differential equations.

PO 7 **Self –directed learning**: The student completing this program will develop an ability of working independently and to make an in depth study of various notions of Mathematics.

PO 8 **Moral and ethical awareness/reasoning:** : The student completing this program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and mathematical studies in particular.

PO 9 **Lifelong learning**: This programme provides self-directed learning and lifelong learning skills. This programme helps the learner to think independently and

develop algorithms and computational skills for solving real word problems.

PO 10 Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

Programme Specific Outcomes:

Upon completion of the program, students would be able to

1. Recall basic facts about Mathematics and should be able to display knowledge of conventions suchas notations, and terminology.
2. Get adequate exposure to global and local concerns that explore the many aspects of mathematical sciences.
3. Be equipped with Mathematical modelling ability, problem- solving skills, creative talent, and power of communication necessary for various kinds of employment.
4. Apply their skills and knowledge that is translate information presented verbally into Mathematical form, select and use appropriate Mathematical formulae or techniques to process the information, and draw the relevant conclusion.
5. Develop a positive attitude towards Mathematics as an interesting and valuable subject of study.

The structure of the course for four years, the pattern of examination, and the question papers are asspecified below:

Structure of Four Year-degree Program

Mathematics as Major (Core) Subject and any other subject as Minor

Table 1: B. Sc. Semester I

Sr No	Course Category	Course Code	Name of the course (Title of the Paper)	Level	Total Credit
1	DSC	B-MT111T	Basic Mathematics	4.5	2
		B-MT112P	DSC Lab		1
2	GE	B-MT113T	Elementary Mathematics I		2
		B-MT114T	Elementary Mathematics II		2
3	VSEC	B-MT115P	Programming with C		2
4	IKS	B-MT116T	Indian Knowledge System		2
Total					11

Table 2: B. Sc. Semester II

Sr No	Course Category	Course Code	Name of the course (Title of the Paper)	Level	Total Credit
1	DSC	B-MT121T	Calculus	4.5	2
		B-MT122P	DSC Lab		1
2	GE	B-MT123T	Elementary Mathematics III		2
		B-MT124T	Elementary Mathematics IV		2
3	VSEC	B-MT125P	Programming with Python		2
4	IKS	B-MT126T	Indian Knowledge System		2
Total					11

Table 3: B. Sc. Semester III

Sr No	Course Category	Course Code	Name of the course (Title of the Paper)	Level	Total Credit
1	DSC	B-MT231T		**5.0**	2
		B-MT232T			2
		B-MT233P			2
2	Minor	B-MT234T			2
		B-MT235T			2
		B-MT236P			2
3	GE	B-MT237T			2
4	VSEC	B-MT238P			2
6	FP	B-MT239P			2
Total					18

Table 4: B.Sc. Semester IV

Sr No	Course Category	Course Code	Name of the course (Title of the Paper)	Level	Total Credit
1	DSC	B-MT241T		**5.0**	2
		B-MT242T			2
		B-MT243P			2
2	Minor	B-MT244T			2
		B-MT245T			2
		B-MT246P			2
3	GE	B-MT247T			2
4	VSEC	B-MT248P			2
6	CEP	B-MT249P			2
Total					18

Table 5: B.Sc. Semester V

Sr No	Course Category	Course Code	Name of the course (Title of the Paper)	Level	Total Credit
1	DSC	B-MT351T		**5.5**	3
		B-MT352T			3
		B-MT353P			3
		B-MT354T			2
		B-MT355P			1
2	DSE	B-MT356(1)T			2
		B-MT356(2)T			
		B-MT357(1)P			2
		B-MT357(2)P			
2	Minor	B-MT358T			2
		B-MT359P			2
4	VSEC	B-MT3510P			2
6	CEP	B-MT3511P			2
Total					22

Table 6: B.Sc. Semester VI

Sr No	Course Category	Course Code	Name of the course (Title of the Paper)	Level	Total Credit
1	DSC	B-MT361T		**5.5**	3
		B-MT362T			3
		B-MT363P			3
		B-MT364T			2
		B-MT365P			1

2	DSE	B-MT366(1)T			2
		B-MT366(2)T			
		B-MT367(1)P			2
		B-MT367(2)P			
4	VSEC	B-MT368P			2
5	OJT	B-MT369P			4
Total					22

Table 7: B.Sc. Semester-VII (Honors)

Sr No	Course Category	Course Code	Name of the course(Title of the Paper)	Level	Total Credit
1	DSC	B-STH471T		6.0	4
		B-STH472T			4
2	DSE	B-STH473T			4
		B-STH473(1)T			
3	DSC /DSE	B-STH474P			6
4	RM	B-STH475T			4
Total					22

Table 8: B.Sc. Semester-VIII (Honors)

SrNo	Course Category	Course Code	Name of the course(Title of the Paper)	Level	Total Credit
1	DSC	B-STH481T			4
		B-STH482T			4

2	DSE	B-STH483T		6.0	4
		B-STH483(1)T			
3	DSC /DSE	B-STH484P			6
4	OJT	B-STH485P			4
Total					22

Table 9: B.Sc. Semester VII (Honors with Research)

Sr No	Course Category	Course Code	Name of the course(Title of the Paper)	Level	Total Credit
1	DSC	B-STR471T		6.0	4
		B-STR472T			4
2	DSE	B-STR473T			4
		B-STR473(1)T			
3	DSC /DSE	B-STR474P			2
4	RM	B-STR474T			4
5	RP	B-STR475P			4
Total					22

Table 10: B.Sc. Semester-VIII (Honors with Research)

Sr No	Course Category	Courses Code	Name of the course(Title of the Paper)	Level	Total Credit
		B-STR481T			4

1	DSC	B-STR482T			4
2	DSE	B-STR483T			4
		B-STR483(1)T			
3	DSC /DSE	B-STR484P			2
4	R P	B-STR485P			4
		B-STR486P			4
					22

Total Credits:

1. Three-Year UG Degree Program: 132
2. Four-Year UG Degree Program: 176

Mathematicsas a Minor Subject and any other subject as a Major

S.No.	Year	Semester	Name of the paper (Theory / Practical)	Credits	Theory / Practical Hrs
1	II	III		2	2
2				2	2
3				2	4
4	II	I V		2	2
5				2	2
6				2	4
10	III	V		2	2
11				1	2

Credit Specifications:

a. Theory/Tutorial Courses: One hour/credit/week (a minimum of 15 hours of teaching per credit is required in a semester.

b. Laboratory/Performance-Based Courses: A minimum of 30 hours in laboratory or Performance-based activities is required in a semester. Performance-based activities include Workshop-based activities, Internships, Apprenticeships, Field-based learning, community engagement learning, etc.

c. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.

Assessment

The assessment Plan will consist of Continuous Internal Evaluation (CIE) and End Semester Evaluation (ESE) for each course/subject taken together.

(A) Continuous Internal Evaluation (CIE) will be based.

(a) Attendance of the student during a particular semester.

(b) An assignment (min. two) based on curriculum to be assessed by the teacher concerned

(c) Subject-wise class test (min. two) or activities conducted by the teacher concerned with proper rubrics.

(d) Expected classroom activities shall consist of Group Discussions, Seminars, Power Point Presentations, Elocution, Debate, Role Play, Case Studies, Educational Games, etc. The teacher is expected to undertake a minimum of four of the aforesaid activities.

(e) The CIE marks will be communicated to the examination cell at the end of each semester, but before the semester end examinations / as instructed by the Examination Cell. These marks will be considered for the declaration of the results.

(f) The record of internal marks, evaluation & results should be maintained for a minimum period of three years by the respective department for verification by the competent authority.

(B) End Semester Evaluation (ESE)

Pattern of Theory Question Paper of 30 marks

1. There will be four units in each paper.
2. Maximum marks for each theory paper will be 30.
3. The question paper will consist of five questions, each of 06 marks.
4. Four questions will be on four units with internal choice (One question on each unit).
5. Fifth question will be compulsory with questions from each of the four units having equal weightage and there will be no internal choice.

Standard of Passing

The scope of the course, percentage of passing in Theory and Project, and Internal Assessment will be governed as per the following rules:

(i) To pass the Bachelor of Science (B. Sc.) 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th Semester Examinations, an examinee shall obtain not less than 50% (Grade 5) marks in each theory course/paper, taking CIE & ESE together. Also, for practical/performance-based examinations an examinee shall obtain not less than 50% marks in each practical, taking CIE & ESE together.

(ii) An examinee who is unsuccessful at the examination shall be eligible for admission to the subsequent examinations on payment of a fee prescribed for the examination together withthe conditions of the ordinance in force from time to time.

Abbreviations Used

Continuous Internal Evaluation: (CIE) End Semester Evaluation: (ESE) Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

Semester-wise structure of the

Four-Year (Eight Semesters) Degree Course, as per Revised New Education Policy (NEP)

B. Sc. Semester-I											
Teaching and Evaluation Scheme of Major Courses offered by the Mathematics Department											
Sr. No.	Course Category	Name of the Course	Course Code	Teaching Scheme (Hours)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	Subject (One will be Major and other Minor in Semester III)	Basic Mathematics	B-MT111T	2	--	--	2	2	30	20	25
		Mathematics Lab	B-MT112P	--	--	2	1	4	30	20	25
2	GE	Elementary Mathematics I	B-MT113T	2	--	--	2	2	30	20	25
		Elementary Mathematics II	B-MT114T	2	--	--	2	2	30	20	25
3	VSEC	Refer VSC Basket (related to Mathematics)	B-MT115P	--	--	4	2	4 - 6	60	40	50
6	IKS	Indian Knowledge System	B-MT116T	2	--	--	2	2	30	20	25
Total				6		6	9				

B. Sc. Semester-II											
Teaching and Evaluation Scheme of Major Courses offered by the Mathematics Department											
Sr. No.	Course Category	Name of the Course	Course Code	Teaching Scheme (Hours)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	Subject (Onewill be Major and other Minor in Semester III)	Calculus	B-MT121T	2	--	--	2	2	30	20	25
		Mathematics Lab	B-MT122P	--	--	2	1	4	30	20	25
2	GE	Elementary Mathematics III	B-MT123T	2	--	--	2	2	30	20	25
		Elementary Mathematics IV	B-MT124T	2	--	--	2	2	30	20	25
3	VSEC	Refer VSC Basket (related to Mathematics)	B-MT125P	--	--	4	2	4 - 6	60	40	50
6	IKS	Indian Knowledge System	B-MT126T	2	--	--	2	2	30	20	25
Total				6		6	9				

Syllabus for Semester I and II

B. Sc. Part I Semester I

Subject:- Mathematics **Paper- Basic Mathematics**

Course Code & Title:	(**B-MT111T**) **Basic Mathematics**		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 30 + CIE=20)

Unit	Syllabus	Course out come
I	**Complex Numbers**: De Moivre's Theorem and its application. Roots of complex number, Euler's formula, The n^{th} roots of unity, The elementary functions. **7 Hours.**	By the end of this course, Students will be able to: **1.** Understand the basic concepts of complex numbers. **2.** Use Matrices to solve system of linear equations. **3.** Understand the concept of Eigen values & Eigen vectors and method to find it. **4.** Find roots of polynomial equation in one variable. **5.** Understand the basic concept of Number Theory. **6.** Understand the concept of handling large integers.
II	**Matrices**: Rank of a matrix. Equivalent matrices; Row canonical form, Normal form, Elementary matrices, System of homogeneous and non-homogeneous equations, Characteristic equation and roots, Cayley-Hamilton Theorem. 8 **Hours.**	
III	**Theory of Equations**: Relation between the roots and the coefficients, Descartes' rule of signs, Calculation of f(x+h) by Horner's process, Transformation of equations, Reciprocal equations, Cardan's solution of Cubic equations, Ferrari's and Descartes' solution of Biquadratic equations. **7 Hours.**	
IV	**Number Theory**: Division Algorithm, Greatest Common Divisor, Euclidean Algorithm. The Diophantine equation $ax + by = c$, The Fundamental Theorem of Arithmetic (without proof), Basic Properties of Congruences. 8 **Hours.**	

Reference Books:

1. Theory and problems of Complex variables by Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981) **Scope:** Chapters 1, 2.
2. Theory and problems of Matrices by Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974) **Scope:** Chapters 5, 10, 19, 23.
3. Higher Algebra by Hall & Knight: S. Chand & Co. Ltd, New Delhi (1996) **Scope:** Chapter 35:(Pages:535-549, 564-575, 578- 583).
4. Elementary Number Theory by David M. Burton (Seventh Edition): Tata McGraw-Hill Edition, New Delhi (2012) **Scope:** Chapters 2 (2.2, 2.3, 2.4, 2.5), Chapter 3 (Article 3.1), Chapter 4: (4.2, 4.4).
5. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
6. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi- 2000.
7. Shanti Narayan: A Text Book of Matrices, S. Chand & Co. Ltd., New Delhi.
8. Neville Robinns, *Beginning Number Theory,* 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.

B. Sc. Part I Semester I Mathematics Practical

Course Code & Title:	**B-MT112P** Practical on Basic Mathematics		
Practical Hours:	4 Hours/Week	Credits:	2
Total Practical Hours:	60 hours	Max. Marks:	50 (ESE= 30 + CIE=20)

Practical/Lab Work to be performed

1. On applications of De Moivre's Theorem.
2. On finding the roots of the complex numbers.
3. On finding the n^{th} roots of unity.
4. Finding the rank of a matrix.
5. To reduce the matrix in row canonical form.
6. To reduce the matrix in its normal form.
7. On solutions of system of homogeneous and non-homogeneous equations.
8. On the roots and the coefficients of equation.
9. Calculation of f(x+h) by Horner's process.
10. Transformation of equations.
11. Reciprocal equations.
12. Cardan's solution of Cubic equations.
13. Ferrari's and Descartes' solution of Biquadratic equations.
14. Division Algorithm and Euclidean Algorithm.
15. The Diophantine equation $ax + by = c$.
16. Properties of Congruences.

B. Sc. Part I Semester I Generic Elective Paper

Course Code & Title:	(**B-MT113T**) **Elementary Mathematics I**		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 30 + CIE=20)

Unit	Syllabus	Course out come
I	Mathematical logic: Propositions, Truth values, Logical connectives. 8 **Hours.**	By the end of this course, Students will be able to: **1.** Translate the real word problems into model through appropriate mathematical logic. **2.** Understand the concept of logical equivalence. **3.** Illustrate problems using Venn diagram. **4.** Analyse the problems in commercial world.
II	Truth table, Tautology and Contradiction, 7 **Hours.**	
III	Logical equivalence, negations, converse, inverse and contrapositive of proposition. 8 **Hours.**	
IV	Introduction to set theory, notations for designing sets, subsets, union, intersection, compliments and simple applications of Venn Diagram, relations, functions 7 **Hours.**	

Reference Books:

1. Calculus Volume-I, T. M. Apostol. 2nd Edition, Wiley India Pvt. Ltd. 2011
2. Theory and problems of Logic, 2nd Edition, Schaum's Outlines.
3. Introduction to Mathematical Logic, Elliott Mendelson, 5th Edition, CRC Press.
4. A First Course In Mathematical Logic and Set Theory, Michael l. O'Leary, Willey

Publications.
5. Discrete Mathematical structures with applications to computer science, Tremblay and R. Manohar J.P., McGraw-Hill Book Company, 1997.

B. Sc. Part I Semester I Generic Elective Paper II

Course Code & Title:	(B-MT114T) **Elementary Mathematics II**		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 40 + CIE=10)

Unit	Syllabus	Course out come
I	The field axioms, the order axioms, upper bound of a set, maximum element, least upper bound, the least upper bound axiom. 7 **Hours.**	By the end of this course, Students will be able to: **1.** Find least upper bound of the set. **2.** Find the greatest upper bound of a set. **3.** Understand the basic concepts of Matrices. **4.** Solve the system of linear equations.
II	The Archimedean property of the real number system, fundamental properties of the supremum and infimum. **7 Hours.**	
III	Definition of a matrix; types of matrices; algebra of matrices, properties of determinants; calculations of values of determinants; Adjoint of a matrix, Inverse of a square matrix. **8 Hours.**	
IV	Elementary row and column operations; solution of a system of linear equations. **8 Hours.**	

Reference Books:

1. Calculus Volume-I, T. M. Apostol. 2nd Edition, Wiley India Pvt. Ltd. 2011
2. Theory and problems of Matrices by Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974).
3. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi- 2000.
4. Shanti Narayan: A Text Book of Matrices, S. Chand & Co. Ltd., New Delhi.
5. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
6. Basic Mathematics, Allen R.G.D, Macmillan, NewDelhi, 1962.

B. Sc. Part I Semester I Vocational Skill Enhancement Course (VSEC)

Course Code & Title:	(**B-MT115P**) Programming with C		
Teaching Hours:	4 Hours/Week	Credits:	2
Total Teaching Hours:	60 hours	Max. Marks:	100 (ESE= 60 + CIE=40)

Sr. No.	List of Practical's
1	A program to find simple and compound interest for the rate of interest.
2	A program to find the corresponding temperature in Fahrenheit from a given temperature in Celsius.
3	A program to swap the contents of two variables.
4	A Program to accept the distance between two cities in kilometers and print the distance in meters, feet, inches, and centimeters.

5	A Program to accept the two sides and angle included by these two sides to find the area and third side of a Triangle.
6	A Program to check whether a number is even or odd using a conditional operator.
7	A program for testing leap year.
8	A program to find roots of the Quadratic equation $ax^2 + bx + c$.
9	A Program to generate a menu-driven program using a switch statement. 1. Add 2. Edit. 3. Delete. 4. Exit.
10	A Program to print multiplication Tables of a number.
11	A program to print numbers, squares, and cubes of the first 10 natural numbers.
12	A program to find the factorial of an integer number.
13	A program to generate and print Fibonacci sequences.
14	A program to print the first 5 lines of the following pyramid. a. 1 1 2 1 2 3 1 2 3 4 1 2 3 4 5 b. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
15	A program to print the following design **a.** * * * * * * * * * * * * * * * **b.** * * * * * * * * * * * * * * *
16	A program to find the GCD of two Positive integers by successive division.
17	A Program to find the number of Armstrong numbers between 123 to 425.
18	A program to print all the prime numbers between 10 to 100

Reference Books:

1. E. Balguruswami, "Programming in ANSI C", TMH, 2009, ISBN-978-0-07-06482207/0-0-0-70-0648220-0.
2. Rajaraman, "Computer Programming in C", PHI, 2002, ISBN-81-203-0859-
3. K. R. Venugopal and S. R. Prasad, "Mastering C", TMH, 2008, ISBN-13:978-0-07-061667-7/10:0-07-06-1667-1.
4. Yeshwant. P. KANETKAR, "Let us C", BPB publicatons

B. Sc. Part I Semester I

Indian Knowledge System (IKS)

Course Code & Title:	(**B-MT116T**) Ancient Indian Mathematics: An Overview		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 30 + CIE=20)

Learning objectives:

1. To learn about India's contribution from ancient to modern to the world of science and technology.
2. To learn about the ancient and modern torchbearers in Mathematics.

3. To trace the evolution of Mathematics as a subject in India.
4. To learn about renowned Indian Mathematicians and their works.
5. To understand the working of various Mathematical organizations in India.

Unit	Syllabus For B. Sc. Semester I	Course outcomes
I	History Of Mathematics In India: Vedic Period; Śulba Sūtras, Vyakarana, Pingala (300 BCE – 200 BCE),	By the end of this course, Students will be able to: 1. To acknowledge, appreciate and value the rich heritage offered; by India in areas of science and technology. 2. To gauge the immensity of the contributions made; by Indian scientists to world knowledge. 3. To identify the erstwhile while lesser known applications of Mathematics since ancient times in India. 4. To recognize the significance of contributions of Indian Mathematicians. 5. To identify the role of Mathematical organizations towards the progress and development of India.
II	History Of Mathematics In India: Jain Mathematics (400 BCE – 200 CE), Oral Tradition, Styles Of Memorization, The Sutra Genre, The Written Tradition: Prose Commentary.	
III	The Famous Mathematicians In India: Srinivasa Ramanujan, Satyendra Nath Bose, C. S. Seshadri, P.C. Mahalanobis, C.R. Rao.	
IV	The Famous Mathematicians In India: Harish Chandra, S S Shrikhande, Narendra Karmarkar, D. D. Kosambi, Aryabhata, Brahma Gupta, Jayant Naralikar, P C Vaidya	

Reference Books (Suggested readings / material)

1. History and development of Mathematics in India: Samiksika Series 16; by Ramakalyani V. Sita Sunder Ram | 1 January 2022
2. History of Hindu Mathematics: A Source Book (Part-I-Numeral Notation and Arithmetic); by Avadhesh Narayan Singh Bibhutibhusan Datta | 1 January 2021
3. History of Hindu Mathematics: A Source Book (Part- II- Algebra); by Avadhesh Narayan Singh Bibhutibhusan Datta | 1 January 2021
4. History of Mathematics (Egyptian, Greek, Arabic/Islamic, Chinese, Indian, American Mathematics); by Govind Prasad Singh | 1 January 2020
5. Kerala Mathematics: History and Its Possible Transmission to Europe; by George Gheverghese Joseph | 1 January 2011
6. Mathematical Methods In The Physical Sciences, 3Ed, An Indian Adaptation | New; by Mary L. Boas; Abhinav Pratap Singh; Krishnakanta Mondal; Maheshwary; Sampurn Anand | 23 January 2023
7. Ramanujan: The Man & The Mathematician, (Great Thinkers of India); by S. R. Ranganathan | 30 April 2009

8. Studies In Indian Mathematics and Astronomy: Selected Articles of Kripa Shankar Shukla (Sources And Studies In The History Of Mathematics And Physical Sciences) Part Of: Sources And Studies In The History Of Mathematics And Physical Sciences (57 Books) |; by Aditya Kolachana, K. Mahesh, Et Al

9. The Imperishable Seed: How Hindu Mathematics Changed the World and Why This History Was Erased; by Bhaskar Kamble and Sankrant Sanu | 21 September 2022

10. Vedic Mathematics: Sixteen Simple Mathematical Formulae From The Vedas; by Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaja | 1 January 2015

B. Sc. Part I Semester II

Subject:- Mathematics **Paper- Calculus**

Course Code & Title:	(**B-MT121T**) **Calculus**		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 40 + CIE=10)

Unit	Syllabus	Course out come
I	Leibnitz's theorem, Maclaurin's and Taylor's theorems, Indeterminate forms, L'Hospital's Rule. 7 **Hours.**	By the end of this course, students will be able to: **1.** Understand the concept of indeterminate forms and to find their limits by using L'Hospital Rule. **2.** Understand the successive differentiation and Leibnitz's theorem. **3.** Understand the concept of series expansions (Maclaurin & Taylor Series). **4.** Understand the concept of limit, continuity and differentiability of functions of two variables. **5.** Understand the concept of partial differentiation, Euler's theorem, Jacobians. **6.** To determine the Taylor's series and extreme values for functions of two variables. **7.** Solve integrals using reduction formulae. **8.** Integrate algebraic rational and irrational functions.
II	Limit and continuity of functions of two variables, Partial derivatives, Homogeneous functions, Euler's theorem, Theorems on total differentials, Differentiation of composite functions, Equality of mixed partial derivatives. 8 **Hours.**	
III	Jacobian and its properties, Taylor's series for functions of two variables, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multiplier. 7 **Hours.**	
IV	Reduction formulae, Integration of algebraic rational functions, Integration of trigonometric functions, Integration of irrational functions. 8 **Hours.**	

Reference Books:

1
1. Differential calculus by Shanti Narayan and Dr P. K. Mittal: S. Chand & Co. Ltd, New Delhi

(2014). **Scope:** Chapter 5 (5.5), Chapter 6 (6.1, 6.2), Chapter 10, (10.1, 10.2, 10.3, 10.4, 10.5, 10.6), Chapter 11 (excluding 11.11), Chapter 15 (15.1, 15.2, 15.3, 15.4), Chapter 18 (18.1, 18.2, 18.3, 18.4, 18.7, 18.8)

2. Calculus Volume-I, T. M. Apostol. 2nd Edition, Wiley India Pvt. Ltd. 2011

3. Advanced Engineering Mathematics by H. K. Das, : S. Chand & Co. Ltd, New Delhi (2009) **Scope:** Chapter 1 (1.15, 1.16, 1.19, 1.20, 1.21)

4. Integral Calculus by Shanti Narayan and P. K. Mittal, : S. Chand & Co. Ltd, New Delhi (2005). **Scope:** Chapter 2 (Article 2.8), Chapter 3 (3.1, 3.4, 3.5, 3.6), Chapter 4 (4.3, 4.4, 4.5, 4.6, 4.9, Chapter 5 (5.1, 5.4, 5.5, 5.6, 5.7)

5. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahbad.

6. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahbad.

7. Ayres F. Jr.: Calculus, Schaum's Outline Series, McGraw- Hill, 1981.

B. Sc. Part I Semester II Mathematics Practical

Course Code & Title:	**B-MT122P** Practical on Calculus		
Practical Hours:	4 Hours/Week	Credits:	2
Total Practical Hours:	60 hours	Max. Marks:	50 (ESE= 30 + CIE=20)

Practical/Lab Work to be performed

1. To find n^{th} derivative of product of two functions.
2. To find Maclaurin's series expansion of given functions.
3. To find Taylor's series expansion of given functions.
4. To find the limit of a given functions using L'Hospital's Rule.
5. To check the existence of limit of a function of two variables at a given point.
6. To check the continuity of a function of two variables at a given point.
7. To find the Jacobian.
8. To find the Taylor's series for functions of two variables.
9. Maxima and Minima of functions of two variables using Lagrange's method of undetermined multiplier.
10. To derive the Reduction formulae.
11. To find Integration of algebraic rational functions, trigonometric functions, irrational functions.
12. To verify Euler's theorem.
13. To find the total differentials.

B. Sc. Part I Semester II Generic Elective Paper I

Course Code & Title:	(**B-MT123T**) Elementary Mathematics III		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 40 + CIE=10)

Unit	Syllabus	Course out come
I	Coordinates of a point in a space, distance between two points, and division of the join of two points, tetrahedron, and angle between two lines. 7 **Hours.**	By the end of this course, Students will be able to: 1. Understand the concept of space

II	Direction cosines of a line, relation between direction cosine, projection on a straight line, angle between two lines. 7 **Hours.**	coordinates. 2. Concept of line and plane in space. 3. Concept of direction cosines and relation between them. 4. Form an equation of plane under given conditions. 5. Determine length of the perpendicular from a given point to a given plane.
III	Equation of a plane, Transformation of the equation to the normal form, determination of a plane under given conditions, equation of a plane in terms of its intercept on the axes. 8 **Hours.**	
IV	Equation of the plane through 3 given points, system of equations, two sides of a plane, length of the perpendicular from a given point to a given plane, bisectors of angles between two planes. 8 **Hours.**	

Reference Books:

1. Analytical Solid Geometry, Shanti Narayana, S. Chand & Co. Ltd.
2. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.
3. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.
1. 4. Gorakh Prasad and H. C. Gupta: Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahbad.

B. Sc. Part I Semester II Generic Elective Paper II

Course Code & Title:	(**B-MT124T**) Elementary Mathematics IV		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 40 + CIE=10)

Unit	Syllabus	Course out come
I	Functions of one variable, Algebraic operations on functions, Bounded and unbounded functions, Limit of a function, Algebra of limit, One sided limit, Limit at infinity and infinite limits. 8 **Hours.**	By the end of this course, Students will be able to: 1. Understand the concept of function and its limit. 2. Understand the concept of continuity of function. 3. Determine the derivative of a function at a point. 4. Understand the mean value theorem and its applicability.
II	Continuous functions, dis-continuity of functions, algebra of continuous functions, composite function, continuity of composite functions. 7 **Hours.**	
III	Derivative of function, existence of derivative, algebra of derivative, geometrical meaning of derivative, meaning of the sign of derivative at a point, Darboux's Theorem. 7 **Hours.**	
IV	Rolle's Theorem, geometrical interpretation of Rolle's Theorem, Lagrange's mean value theorem, monotonic functions, some useful deductions from mean value theorem. 8 **Hours.**	

Reference Books:

1. Elements of Real Analysis, Shanti Narayan, M. D. Raisinghania S. Chand and Co. Ltd.
2. Differential Calculus, Shanti Narayan, S. Chand & Company, NewDelhi, 1998.
3. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA:McGraw Hill.,2008.
4. Mathematical Analysis, S.C. Malik, WileyEastern, 1992.
2. 5. Text Book of B. Sc. Mathematics, G.K. Ranganath, S.Chand & Company, 2011.

B. Sc. Part I Semester II Vocational Skill Enhancement Course (VSEC)

Course Code & Title:	(**B-MT125P**) Programming with Python		
Teaching Hours:	4 Hours/Week	Credits:	2
Total Teaching Hours:	60 hours	Max. Marks:	100 (ESE= 60 + CIE=40)

Sr. No.	**List of Practical's**
1	Program to find roots of quadratic equation.
2	Program to add digits of a number.
3	Program to check whether a number is prime or not prime.
4	Program to print given number in reverse order.
5	Program for reversing an array using function.
6	Program to calculate factorial of a given number.
7	Program to print GCD, LCM of two numbers.
8	Program to find the sum of first n natural numbers.
9	Computation of rank of matrix.
10	Solving the system of homogeneous and non-homogeneous linear algebraic equations.
11	Computation of Eigen values and Eigen vectors.
12	Computation of inverse of matrix using Cayley-Hamilton theorems.
13	Finding the angle between the radius vector and tangent and angle between two curves.
14	Finding the radius of curvature of the given curve.
15	Find the Taylor's and Maclaurin's expansion of the given function.

Reference Books:

1. H. Bhasin: Python Basics, MERCURY LEARNING AND INFORMATION Dulles, Virginia Boston, Massachusetts New Delhi .
2. Beginning-Python, Second Edition by Magnus Lie Hetland .
3. The Complete Reference Python by Martin C. Brown .
4. Head First Python by Patrick Barry .
5. Learning Python, O"Reilly by Mark Lutz.
6. Python in a Nutshell, O"Reilly by Alex Martelli.
7. Charles Dierbach, Introduction to Computer Science using Python, Wiley, 2013.
8. James Payne, Beginning Python: Using Python 2.6 and Python 3, Wiley India, 2010.
9. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python Pragmatic Bookshelf, 2/E 2014 2. AdeshPandey, Programming Languages – Principles and Paradigms, Narosa, 2008.

B. Sc. Part I Semester II Indian Knowledge System (IKS)

Course Code & Title:	(**B-MT126T**) Ancient Indian Mathematics: An Overview		
Teaching Hours:	2 Hours/Week	Credits:	2
Total Teaching Hours:	30 hours	Max. Marks:	50 (ESE= 30 + CIE=20)

Learning objectives:

1. To learn about India's contribution from ancient to modern to the world of science and technology.
2. To learn about the ancient and modern torchbearers in Mathematics.
3. To trace the evolution of Mathematics as a subject in India.
4. To learn about renowned Indian Mathematicians and their works.
5. To understand the working of various Mathematical organizations in India.

Unit	Syllabus For B. Sc. I Semester II	Course outcomes
I	History Of Mathematics In India: Numerals And The Decimal Number System; Bakhshali Manuscript.	By the end of this course, Students will be able to: 1. To acknowledge, appreciate and value the rich heritage offered; by India in areas of science and technology. 2. To gauge the immensity of the contributions made; by Indian scientists to world knowledge. 3. To identify the erstwhile while lesser known applications of Mathematics since ancient times in India. 4. To recognize the significance of contributions of Indian Mathematicians. 5. To identify the role of Mathematical organizations towards the progress and development of India.
II	History Of Mathematics In India: Classical Period (400–1600).	
III	The Famous Mathematical Organizations In Indian: The Kerala School Of Astronomy And Mathematics, Indian Mathematical Society, Calcutta Mathematical Society.	
IV	The Famous Mathematical Organizations In Indian: The Association Of Mathematics Teachers Of India (AMTI), Harish-Chandra Research Institute, Chennai Mathematical Institute, The Institute Of Mathematical Sciences Chennai.	

Reference Books (Suggested readings / material)

1. History and development of Mathematics in India: Samiksika Series 16; by Ramakalyani V. Sita Sunder Ram | 1 January 2022
2. History of Hindu Mathematics: A Source Book (Part-I-Numeral Notation and Arithmetic); by Avadhesh Narayan Singh Bibhutibhusan Datta | 1 January 2021
3. History of Hindu Mathematics: A Source Book (Part- II- Algebra); by Avadhesh Narayan Singh Bibhutibhusan Datta | 1 January 2021

4. History of Mathematics (Egyptian, Greek, Arabic/Islamic, Chinese, Indian, American Mathematics); by Govind Prasad Singh | 1 January 2020

5. Kerala Mathematics: History and Its Possible Transmission to Europe; by George Gheverghese Joseph | 1 January 2011

6. Mathematical Methods In The Physical Sciences, 3Ed, An Indian Adaptation | New; by Mary L. Boas; Abhinav Pratap Singh; Krishnakanta Mondal; Maheshwary; Sampurn Anand | 23 January 2023

7. Ramanujan: The Man & The Mathematician, (Great Thinkers of India); by S. R. Ranganathan | 30 April 2009

8. Studies In Indian Mathematics and Astronomy: Selected Articles of Kripa Shankar Shukla (Sources And Studies In The History Of Mathematics And Physical Sciences) Part Of: Sources And Studies In The History Of Mathematics And Physical Sciences (57 Books) |; by Aditya Kolachana, K. Mahesh, Et Al

9. The Imperishable Seed: How Hindu Mathematics Changed the World and Why This History Was Erased; by Bhaskar Kamble and Sankrant Sanu | 21 September 2022

10. Vedic Mathematics: Sixteen Simple Mathematical Formulae From The Vedas; by Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaja | 1 January 2015