1. VISION AND MISSION OF THE UNIVERSITY.

MANONMANIAM SUNDARANARUNIVERSITY, TIRUNELVELI–627012.
UG COURSES– AFFILIATEDCOLLEGES

VISION AND MISSION

Vision:

- "To provide quality education to reach the un-reached"

Mission:

- To conduct research,teaching and outreach programs to improve conditions of human living.
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnerships with industries and government so as to improve the quality of workplace and to serve as catalyst for economic and cultural development.
- To provide quality/inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled.

2.VISION AND MISSION OF THE MATHEMATICSDEPARTMENT

MANONMANIAM SUNDARANARUNIVERSITY,TIRUNELVELI–627012.

UGCOURSES– AFFILIATEDCOLLEGES

Department of Mathematics

Vision and Mission

Vision

- The longterm vision is to be an internationally leading Mathematics Department that will offer innovative educational programs in Mathematical Sciences and their applications in science and technology

Mission

- To create an environment that will identify, nurture and encourage mathematical intelligence.
- To enhance use of mathematical knowledge readily for problem solving, exploring all subjects by proper understanding of the mathematical content with various possible representation.
- To improve the skills of students in Practical Applications and Life Skills by means of a close and continuous monitoring of their progress throughout the course.

3.PREAMBLE

The LOCF (Learningoutcomes based curriculum framework) committee constituted University Grants Commission (UGC) is pleased to submit the report concerning the syllabi of B.Sc with Mathematics as a subject.The committee discussed the framework of syllabi in its meetings and suggests the implementation these syllabi in the Colleges based on following facts.

1. The learning outcomes of each paper are designed so that these may help learners understand the main objectives of studying the course
2. This will enable learners to select elective papers depending on the individual inclinations and contemporary requirements
3. The objectives of the LOCF are to mentally prepare the students to learn mathematics leading graduate degree with mathematics as a subject.
4. These syllabi in mathematics under CBCS are recommended keeping in view of the wide applications of mathematics in science,engineering,social science, business anda host of other areas.
5. The study of the syllabi will enable the students to equip with the state of the art of the subject and will empower them to get jobs in technological and engineering fields as well as business, education and healthcare sectors.
6. The LOCF committee in Mathematics had prepared this draft paying suitable attention objectives and learning outcomes of the papers.These syllabi may be implemented with minimum modifications with appropriate justificationskeeping in view regional,national and international contents and needs.
7. The outcomes of each paper may be modified as per the local requirements.
8. The text books mentioned in references are denotative/demonstrative.The divisions of each paper in units are specified to the context mentioned in course.These units will help the learners to complete the study of concerned paper in certain periods and prepare them for examination.
9. The mathematics is a vast subject with immense diversity. Hence it is difficult for every student to learn each branch of mathematics, even though each paper has its unique importance. Under these circumstances,LOCF in Mathematics suggests a number of elective papers also with compulsory papers.A student can select elective papers as per his needs and interests.
10. The committee expects that the papers may be taught using various Computer Algebraic systems (CAS) softwares such as Mathematica,MATLAB,Maxima and R to strengthen the conceptual understanding and to wide up the horizon of student's self experience.
11. The committee of the LOCF in Mathematics expects that the concern colleges will encourage their faculty members to include necessary topics in addition to courses suggested by LOCF committee .It is hoped that the needs of all around development in the careers of learners will be fulfilled by the recommendations of LOCF in mathematics.

4.PROGRAMME STRUCTURE

MANONMANIAMSUNDARANARUNIVERSITY, TIRUNELVELI–627012.
UGCOURSES– AFFILIATEDCOLLEGES
B.Sc. Mathematics
(ChoiceBased Credit System)
(Witheffectfromtheacademicyear2021- 2022 onwards)

	Part	Sub. No.	Subject Status	SubjectTitle	Hrs/ Week	Credits	Marks				
							Maximum			Passing Minimum	
							Int.	Ext.	Tot.	Ext.	Tot.
I	I	1	Language	Tamil/OtherLanguages	6	4	25	75	100	30	40
	II	2	Language	CommunicativeEnglish-I	6	4	25	75	100	30	40
	III	3	Core-IPaper-I	Calculus and ClassicalAlgebra	6	4	25	75	100	30	40
		4	Addonmajor(Mandatory) Paper-II	ProfessionalEnglishforPhysicalSciences–I	4	4	25	75	100	30	40
		5	Allied-I(ForMaths students)	Statistics-I OR Physicswith Practical /Chemistry withPractical/ ComputerScience**	6 6	3 5	25 25	75 75	100 100	30 30	40 40
			Allied-I (ForScience students)	AlgebraandDifferentialEquations	6	4	25	75	100	30	40
	IV	6	Common	EnvironmentalStudies	2	2	25	75	100	30	40
			Total		**30**	**21/23**					
II	I	7	Language	Tamil/OtherLanguages	6	4	25	75	100	30	40
	II	8	Language	Communicative English-II	6	4	25	75	100	30	40
	III	9	Core-IIPaper-III	Differential Equationsand Analytical GeometryofThree Dimensions	6	4	25	75	100	30	40
		10	Addon major(Mandatory)Paper-IV	ProfessionalEnglishforPhysicalsciences-II	4	4	25	75	100	30	40
		11	Allied-II(ForMathsStudents)	Statistics-II OR Physics with Practical /Chemistry with Practical /ComputerScience**	6 6	3 5	25 25	75 75	100 100	30 30	40 40
			Allied–II(For ScienceStudents)	Vector Calculus &FourierSeries	6	4	25	75	100	30	40
	IV	12	Common	Valuebasededucation	2	2	25	75	100	30	40
			Total		**30**	**21/23**					

**** The Allied Computer Science shall be taken by the Department of Mathematics**

Sem	Part	Sub. No.	Subject Status	Subject Title	Hrs/week	credits	Mark				
							Maximum			Passing minimum	
							Int.	Ext.	Tot.	Ext.	Tot.
III	I	13	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	14	Language	English	6	4	25	75	100	30	40
	III	15	CoreIII Paper-V	SequencesandSeries	6	4	25	75	100	30	40
		16	Allied-II	Statistics-I OR Physics with Practical / Chemistrywith Practical / Computer Science	6 6	3 5	25 25	75 75	100 100	30 30	40 40
		17	Skill Based Core	Vector Calculus	4	4	25	75	100	30	40
	IV	18	Non-Major Elective	Anyoneofthefollowing 1.1) Mathematics forCompetitiveExaminations-I 1.2) Fundamentals of Statistics-I	2	2	25	75	100	30	40
		19	Common	Yoga*	2	2	25	75	100	30	40
			Total		**30**	**25/27**					
IV	I	20	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	21	Language	English	6	4	25	75	100	30	40
	III	22	Core-IV Paper-VI	Abstract Algebra	6	4	25	75	100	30	40
		23	Allied-II	Statistics-II OR Physics with Practical / Chemistry with Practical/ Computer Science	6 6	3 5	25 25	75 75	100 100	30 30	40 40
		24	Skill Based Core	Trigonometry, Laplace Transforms and Fourier Series	4	4	25	75	100	30	40
	IV	25	Non-Major Elective	Anyone of the Following: 2.1) Mathematics for Competitive Examinations-II 2.2) Fundamentals of Statistics-II	2	2	25	75	100	30	40
		26	Common	Computers for Digital Era*	2	2	25	75	100	30	40
	V		Extension activities	NCC/NSS/YRC/YWF/ PE	-	1	-	-	-	-	-
			Total		**30**	**26/28**					
V	III	27	Core-V Paper-VII	LinearAlgebra	5	4	25	75	100	30	40
		28	Core-VI	RealAnalysis	5	4	25	75	100	30	40

			Paper-VIII								
		29	Core-VII Paper-IX	Statics	5	4	25	75	100	30	40
		30	Core-VIII Paper-X	Integral Transforms and Z Transforms	5	4	25	75	100	30	40
		31	Major Elective-I Paper-XI	Anyone of the Following: 1.1) Programming in C 1.2) Discrete Mathematics 1.3) Combinatorial Mathematics	4	4	25	75	100	30	40
		32	Major Elective –II Paper-XII	Anyone of the Following: 2.1) Operations Research-I 2.2) Stochastic Process 2.3) Math Typing using LaTeX	4	4	25	75	100	30	40
	IV	33	Skill Based Common	Personality Development	2	2	25	75	100	30	40
			Total		**30**	**26**					
VI	III	34	Core-IX Paper-XIII	ComplexAnalysis	5	4	25	75	100	30	40
		35	Core-X Paper-XIV	GraphTheory	5	4	25	75	100	30	40
		36	Core-XI Paper-XV	NumberTheory	4	4	25	75	100	30	40
		37	Core-XII Paper-XVI	Dynamics	4	4	25	75	100	30	40
		38	Core-XIII Paper-XVII	NumericalMethods	4	4	25	75	100	30	40
		39	Major Elective-III Paper-XVIII	Any one of the following 3.1) Astronomy 3.2) Fuzzy Mathematics 3.3) Mathematical Modeling	4	4	25	75	100	30	40
		40	Major Elective-IV Paper-XIX	Any one of the following 4.1) Operations Research-II 4.2) Coding Theory 4.3) Programming in C++	4	4	25	75	100	30	40
				Total	**30**	**28**					

5.EVALUATION SCHEME (INTERNAL,EXTERNAL,PASSING MINIMUM)

Evaluation Scheme

Internal Marks	25 Marks
External Marks	75 Marks
Maximum Marks	100 Marks
Passing Minimum	40 Marks

6.MODEL QUESTION PAPER

MODEL QUESTION PAPER- CBCS-PATTERN (UG MATHEMATICS)

MAXIMUM MARKS: 75 TIME: 3 HOURS

Part –A (10×1 = 10 Marks)

Answer all the questions, Choose the correct answer

Question No. 1,2	Unit –I	Question No. 7,8	Unit –IV
Question No. 3,4	Unit -II	Question No. 9,10	Unit –V
Question No. 5,6	Unit –III		

Part –B(5×5 = 25 Marks)

Answer all the questions, Choosing either (a) or (b).

Question No. 11(a) or11 (b)	Unit –I	Question No. 14(a) or14 (b)	Unit –IV
Question No. 12(a) or12 (b)	Unit -II	Question No. 15(a) or15 (b)	Unit –V
Question No. 13(a) or13 (b)	Unit –III		

Part –A (8×5 = 40 Marks)

Answer all the questions, Choosing either (a) or (b).

Question No. 16(a) or16 (b)	Unit –I	Question No. 19(a) or19 (b)	Unit –IV
Question No. 17(a) or17 (b)	Unit –II	Question No. 20(a) or20 (b)	Unit –V
Question No. 18(a) or18 (b)	Unit –III		

MODEL QUESTION PAPER
CALCULUS AND CLASSICAL ALGEBRA
(For those who joined in July 2021 onwards)

Time: Three hours **Maximum: 75 marks.**

Part-A ($10\times 1 = 10$ marks)
Answer All questions

Sl.No	Choose the correct Answer.	Course outcome	Knowledge Level
1.	The curvature of the curve ax+by+c=0 is…….. a) b b) a c) 0 d) none of the above	CO 1	K1, K5
2.	The radius of the curvature of $y = e^x$ at (0,1) is…… a)1 b) 2 c) $2\sqrt{2}$ d) none of the above	CO 1	K1, K5
3.	The value of $\int_1^b \int_1^a \frac{dxdy}{xy}$=…….. a)$log\left(\frac{a}{b}\right)$ b)log(ab) c) logalogb d) none of the above	CO 2	K2, K3
4.	The Jacobian of $u = x + y$ and $v = x - y$ is……. a) 2 b) 1 c)-2 d)none of the above	CO 2	K2, K3
5.	$\int_0^1 x^2(1-x)dx = \cdots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots$ a)2 b)$\frac{1}{12}$ c) $\frac{1}{3}$ d)none of the above	CO 3	K2, K4
6.	$\int_0^{\pi} \int_0^{\pi/2} \int_0^1 r^2 sin\theta \, dr \, d\theta d\varphi$ =…… a) $\frac{\pi}{2}$b)$\frac{\pi}{3}$ c)$\frac{\pi}{4}$ d) none of the above.	CO 3	K4
7.	The least degree of the equation with rational coefficients one of whose roots $\sqrt{2}+\sqrt{3}$ is……. a) 3 b)2 c) 4 d) none of the above	CO 4	K4, K5
8.	If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$ then $\sum \frac{1}{\alpha}$ a) $\frac{-q}{r}$ b)$\frac{q}{r}$ c)$\frac{p}{r}$ d) none of the above	CO 4	K6
9.	The roots of the equation $x^n + 1$=0 (n is even) are a) All imaginary b) (n-1) imaginary c)(n-2) imaginary d) none of the above	CO 5	K3
10.	One of the roots` of the equation $2x^3 + 3x^2 - 3x - 2 = 0$ is -2, the other roots are…….. a)-2,-1 b)$\frac{-1}{2}, 1$ c) $\frac{-1}{2}, -1$ d) none of the above	CO 5	K6

PART B – ($5\times 5 = 25$ marks)

Sl.No	Answer ALL questions,choosing either (a) or (b)	Course outcome	Knowledge Level
11.	a) Find the p-r equation (pedal equation) of the curve $r^2 = a^2 Sin2\theta$ **Or** b) Find the co-ordinates of the center of curvature of the curve $x^3 + y^3 = 3axy$ at $\left(\frac{a}{2}, \frac{a}{2}\right)$.	CO 1 CO 1	K1 K1
12.	a) Find the area of the region common to $y^2 = 4ax$ and $x^2 = 4ay$. **Or** b) If $u = 2xy, u = x^2 - y^2, x = rcos\theta, y = r\,sin\theta$, evaluate $\frac{\partial(u,v)}{\partial(r,\theta)}$ without actual substitution.	CO 2 CO 2	K2, K3 K2, K3
13.	a) Prove that $\lceil\frac{n+1}{2} = \frac{(2n)!\sqrt{\pi}}{4^n\, n!}$ Where n=0,1,2… **Or**	CO 3	K5

	b) Prove that $\int_0^{\pi/4} Sin^p\theta\ Cos^q\theta d\theta = \frac{1}{2}\beta\left(\frac{p+1}{2}, \frac{q+1}{2}\right)$	CO 3	K5
14.	a) Show that the sum of the 6th powers of the roots of $x^7 - x^4 + 1 = 0$ is 3 **Or** b) If α, β, γ are the roots of the equation $x^3 + ax^2 + bx + c = 0$, form the equation whose roots are $\alpha\beta, \alpha\gamma$ and $\beta\gamma$	CO 4 CO 4	K2, K4 K2, K5
15.	a) Transform the equation $x^4 - 4x^3 - 18x^2 - 3x + 2 = 0$ into an equation with the third term absent. Or b) Remove the fractional coefficient from the equation $x^3 + \frac{1}{4}x^2 - \frac{1}{16}x + \frac{1}{72} = 0$	CO 5 CO 5	K6 K6

PART C – (5× 8 = 40marks)

Sl.No	Answer ALL questions,choosing either (a) or (b)	Course outcome	Knowledge Level
16.	a) Find the coordinates of the center of curvature of $y = xlogx$ at the point where $\frac{dy}{dx} = 0$. **Or** b) Find the evolute of the asteroid $x^{2/3} + y^{2/3} = a^{2/3}$	CO 1 CO 1	K1, K6 K1, K6
17.	a) By changing the order of integration, evaluate the integral $\int_0^1 \int_y^{2-y} xy\, dxdy$ **Or** b) By changing into polar coordinates, show that $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}dxdy = \frac{\pi}{4}$. Hence evaluate $\int_0^\infty e^{-t^2}dt$.	CO 2 CO 2	K2, K4 K2, K4
18.	a) Evaluate $\int_0^1 x^m(1-x^n)^p dx$ in terms of gamma functions and hence find $\int_0^1 \frac{dx}{\sqrt{1-x^n}}$. Or b) Using gamma functions evaluate $\iint xy(1-x-y)^{1/2}\, dxdy$ over the area enclosed by the lines $x = 0, y = 0$ and $x + y = 1$ in the positive quadrant.	CO 3 CO 3	K3, K5 K3, K5
19.	a) Solve $6x^3 - 11x^2 + 6x - 1 = 0$ where roots are in harmonic progression **Or** b) If $a + b + c + d = 0$, show that $\frac{a^5+b^5+c^5+d^5}{5} = \frac{a^2+b^2+c^2+d^2}{2} \cdot \frac{a^3+b^3+c^3+d^3}{3}$	CO 4 CO 4	K3 K3
20.	a) Show that the equation $x^4 - 3x^3 - 4x^2 - 2x + 1 = 0$ can be transformed into a reciprocal equation by diminishing the roots by unity. Hence solve the given equation. **Or** b) Solve the equation $6x^6 - 35x^5 + 56x^4 - 56x^2 + 35x - 6 = 0$.	CO 5 CO 5	K1 K1

- K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

7.PROGRAMME OUTCOMES FOR B.Sc MATHEMATICS

PROGRAMME OUTCOMES

1. Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus,geometry,differential equations and several other branches of mathematics.This also leads to study of related areas like computer science and statistics.Thus,this programme helps the learners in building a social foundation for higher studies in mathematics.
2. The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytical reasoning.This can be utilized in modelling and solving real life problems
3. Students undergoing this programme learn to logically questions assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing independent society
4. Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.
5. Completion of this programme will also enable the learners to join teaching profession in primary and secondary schools.
6. This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

8.PROGRAMSPECIFIC OUTCOMES

PROGRAM SPECIFIC OUTCOMES

After the completion of B.Sc. program in mathematics, the students are able to have

PSO 1: A Solid Foundation in Knowledge: B.Sc. degree is the culmination of depth knowledge of my core branches of mathematics such as Calculus, Classical Algebra, Analytical Geometry, Differential Equations, Sequence and Series, Abstract Algebra, Real and Complex Analysis, Number Theory, Mechanics, Operation Research, Statistics, Graph Theory, Discrete Mathematics, Trigonometry, Transforms and their application and C++/Python. Thus, this programme helps students in creating a solid foundation for further higher studies and research in mathematics

PSO 2: A Competency in Skills: The skills and knowledge gained have intrinsic logic which leads to proficiency in analytical reasoning critical understanding, analysis and synthetic in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, it can also be applied in modelling and solving the real-life problems.

PSO 3: A Problem-Solving Techniques: Students undergoing this programme learn to logically understand the question assertions to classify the patterns and to evaluate the difference between the necessities and unnecessities of the problems which helps to analyze the problem clearly and to take correct decision for solving the problems.

PSO 4: Interdisciplinary and Research Skills: Students completing this programme will be able to create and present mathematical concepts clearly and precisely, to describe mathematical ideas from multiple perspectives and to explain fundamental concepts of mathematics to non-mathematics people in a better manner.

PSO 5:A Proficiency in Employments: The programme will help students build up with employability for government jobs, jobs in banking, insurance and investments sectors, data analysis jobs and jobs in various other public and private enterprises.

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

M.Sc. MATHEMATICS (Affiliated Colleges)

LEARNING OUTCOME BASED CURRICULUM

(For those who joined from 2021-2022 onwards)

VISION AND MISSION OF THE UNIVERSITY

VISION

" To provide quality education to reach the unreached "

MISSION

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

VISION AND MISSION OF DEPARTMENT

VISION

To emerge as a department of science, which will provide strong foundations in the areas of Pure and Applied Mathematics in order to develop innovative minds for interdisciplinary research. Excellence in research and leaders as educators in the region.

MISSION

- To develop and implement student centric teaching learning methods.
- To produce fundamentally and conceptually strong academicians and research oriented Mathematicians who will constructively contribute to the overall growth of the society.
- To usher in construction of the thinking of students to Mathematically tackle modern problems and challenges.
- To develop strong communication skills among students.
- To develop strong moral values.
- To develop strong foundations in Mathematics to have sound analytical and critical thinking ability for innovative solutions in practical problems.
- To continuously improve the basic infrastructure in pursuit of providing the necessary environment for academic excellence.
- To develop a nurturing environment for lifelong learning.

PREAMBLE

M.Sc. Mathematics programme has a total of 90 credits spread over four semesters. The programme emphasizes both theory and applications of Mathematics and is structured to provide knowledge and skills in depth necessary for the employability of students in industry, other organizations, as well as in academics. The program has some unique features such as independent projects, number of elective courses, extensive computer training including standard software packages such as PYTHON etc. The independent project work is one of the important components of this program. The syllabus covers most of the core courses and elective courses with computer course PYTHON. The syllabus has been framed to have a good balance of theory, methods and applications of Mathematics. It is possible for the students to study basic courses from other disciplines such as Computer Science and Applied Mathematics in place of electives.

PROGRAMME STRUCTURE

Semester	Class	Paper	Allotted Hours	Credits
I	I M.Sc. Mathematics	Core – 1, Algebra - I	6	4
		Core – 2, Analysis – I	6	4
		Core – 3, Analytic Number Theory	6	4
		Core – 4, Operations Research	6	4
		Core – 5, Ordinary Differential Equations	6	4
II	I M.Sc. Mathematics	Core – 6, Algebra - II	5	4
		Core – 7, Analysis – II	5	4
		Core – 8, Advanced Calculus	5	4
		Core – 9, Differential Geometry	5	4
		Core – 10,Research Methodology and Statistics	5	4
		Elective – 1 (Choose any one) :		
		1.1. Classical Mechanics		
		1.2. Partial Differential Equations	5	4
		1.3. Python Programming-Theory		
III	II M.Sc. Mathematics	Core – 11, Advanced Algebra – I	6	4
		Core – 12, Graph Theory	6	4
		Core – 13, Measure and Integration	6	4
		Core – 14, Topology - I	6	4
		Elective – 2 (Choose any one):		
		2.1. Algebraic Number Theory		
		2 .2. Calculus of Variation and Integral Equations	6	4
		2.3. Python Programming-Practicals		
IV	II M.Sc. Mathematics	Core – 15, Advanced Algebra -II	5	4
		Core – 16, Complex Analysis	5	4
		Core – 17, Functional Analysis	5	4
		Core – 18, Topology - II	5	4
		Core – 19, Project	10	10
		Total	120 hrs.	90

- In Elective- 1, if 1.3. Python Programming-Theory is chosen then in Elective-2, 2.3. Python Programming-Practicals is Compulsory.
- Project credit is increased to create awareness on Research among students.

EVALUATION SCHEME

Theory Papers

Total – 100 Marks Passing Minimum : 50 Marks

INTERNAL : 25 Marks (Passing Minimum : 12 Marks)

Continuous Internal Assessment Tests(Three Tests) : 15 Marks

Seminar : 05 Marks

Assignment : 05 Marks

EXTERNAL : 75 Marks (Passing Minimum : 38 Marks)

Part A - 10 Questions (Objective Type) : $10 \times 1 = 10$ Marks

Part B - 05 Questions (either or) : $05 \times 5 = 25$ Marks

Part C - 05 Questions (either or) : $05 \times 8 = 40$ Marks

Practicals (Python Programming)

Total – 100 Marks Passing Minimum : 50 Marks

INTERNAL **:** 50 Marks

EXTERNAL **:** 50 Marks

Eligibility for admission to the course and examination:

Candidates shall be admitted to the course provided if they have obtained Bachelor's Degree in Mathematics.

Medium of instruction and examination:

The Medium of instruction as well as examination will be English

MODEL QUESTION PAPER

Class : I M.Sc. Mathematics Max Marks 75

Subject : Analysis – I Time : 3 hrs

Answer ALL questions:

PART – A (1×10 = 10 marks)

1. If every point of X is a limit point of E or a point of E, then E is
   (a) open (b) bounded
   (c) perfect (d) dense
2. A metric space is called separable if it contains a _____dense subset.
   (a) countable (b) uncountable
   (c) perfect (d) none of these

3. $[1+\frac{(-1)^n}{n}]$ converges to
   (a) 1 (b) 0
   (c) 2 (d) none of these
4. $\sum_{n=1}^{\infty}\frac{1}{n!} =$ _____
   (a) 1 (b) e
   (c) $\frac{1}{e}$ (d) π
5. $\sum\frac{z^n}{n!}$ has the radius of convergence
   (a) ∞ (b) 0
   (c) e (d) none of these
6. The series
   (a) converges (b) diverges
   (c) oscillates (d) none
7. Monotonic functions have _____discontinuities of the second kind.
   (a) no (b) only one
   (c) many (d) infinite number
8. The function $f(x)=\begin{cases}1, & x\ is\ rational\\ 0, & x\ is\ irrational\end{cases}$, then f is
   (a) continuous (b)discontinuous of first kind
   (c) discontinuous of 2nd kind (d) none
9. The function $f(x)=\begin{cases}x^2\sin\frac{1}{x}, & x\neq 0\\ 0, & x=0\end{cases}$, then f ′(0) is
   (a) 1 (b) 0
   (c) -1 (d) does not exist
10. Let f be defined for all real x and suppose $|f(x)-f(y)|\leq(x-y)^2$ for all real a and y, then f is
   (a) monotonically increasing (b) monotonically decreasing
   (c) constant (d) none

PART – B (5×5 = 25 marks)

11.(a) Prove that closed subsets of compact sets are compact.

(OR)

(b) If *p* is a limit point of a set *E*, then prove that every neighborhood of *E* contains infinitely many points at *E*.

12. (a) Examine the convergence of the product of two convergent sequences.

(OR)

(b) Prove that the sub sequential limits of a sequence $\{p_n\}$ in a metric space *X* form a closed subset of *X*.

13. (a) Show that $\sum\frac{1}{n^p}$ converges if $p > 1$ and diverges if $p \leq 1$.

(OR)

(b) Prove that *e* is irrational.

14. (a) Let *f* be monotonic on (*a,b*). Prove that the set of points of (*a,b*)at which *f* is discontinuous is atmost countable.

(OR)

(b)Prove that a mapping *f* of a metric space *X* into a metric space *Y* is continuous on *X* if and only if $f^{-1}(V)$ is open in *X* for every open set *V* in *Y*.

15. (a) State and prove the chain rule for differentiation.

(OR)

(b) State and prove the generalized mean value theorem

PART – C (8×5 = 40 marks)

16. (a) show that every *k*-cell is compact.

(OR)

(b) State and prove Heine-Borel theorem.

17. (a) Prove that $\lim_{n\to\infty}(1+\frac{1}{n})^n = e$.

(OR)

(b) State and prove Merten's theorem.

18. (a) State and prove Ratio test.

(OR)

(b) State and prove the root test for convergence of a series.

19. (a) If *f* and *g* are real valued continuous functions on a metric space *X*, show that *f+g* and *fg* are also continuous functions.

(OR)

(b) Prove that every continuous function on a compact space is uniformly continuous.

20. (a) State and prove L'Hospital's rule.

(OR)

(b) State and prove Taylor's theorem.

	PART-A	**PART-B**	**PART-C**
Cognitive Level	2,6,7,10	11(a),14(a), 15(a)	16(a), 17(b), 18(a), 19(a)
Understanding Level	1,4,8	11(b). 12(b), 13(a), 14(b), 15(b)	16(b). 18(b), 19(b), 20(a)
Problem solving	3,5,9	12(a), 13(b)	17(a), 20(a)

PROGRAMME OUTCOMES (POs)

The M.Sc. Mathematics programme will enable the students to

PO1	Knowledge	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
PO2	Research Aptitude	Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems. and to draw conclusions from the analysis.
PO3	Communication	Ability to communicate effectively on general and scientific topics with the scientific community and with the society at large
PO4	Problem Solving	Capability of applying knowledge to solve scientific and other problems
PO5	Individual and Team Work	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings.
PO6	Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PO7	Modern Tool usage	Ability to use and learn techniques, skills and modern tools for scientific practices.
PO8	Science and Society	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices
PO9	Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life
PO10	Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects

PROGRAM SPECIFIC OUTCOMES (PSOS)

After successful completion of the programme, a student will be able to:

PSO1	Have deep understanding and knowledge in the core areas of Mathematics.
PSO2	Demonstrate understanding and application of concepts/ theories/ principles/ methods/ techniques in different areas of pure and applied Mathematics.
PSO3	Have capability to read and understand mathematical texts.
PSO4	Demonstrate and communicate mathematical knowledge effectively and unambiguously through oral and/or written expressions.
PSO5	Attain skills of computing /programming /using software tools /formulating models.
PSO6	Attain abilities of critical thinking, logical reasoning, investigating problems, analysis and problem solving.
PSO7	Application of mathematical methods/ techniques, disciplinary knowledge so as to develop skills to solve mathematical problems in other disciplines and/ or in the real world.
PSO8	Development of intellectual capabilities to get into further research in the discipline.
PSO9	Have strong foundation in basic and applied aspects of Mathematics so as to venture into jobs in scientific and various industrial sectors and/or teaching career in Mathematics.
PSO10	Development of strong oral and written communication skills promoting the ability to present ideas and also promote team work spirit.

MSU / 2021-2022 / PG-College / M.Sc. (Mathematics) / Semester - I / Course No. 1/Core-1

Title of the Course : **ALGEBRA - I** (90 Hours)

Course Objective :To inculcate the ideologies of Algebra.

Course Outcomes(COs)

On successful completion of the course, the students will be able to

	Course outcome	Cognitive Level
CO 1	Demonstrate competence with the basic ideas of algebra including the concepts of counting principle and Homomorphisms	K-2
CO 2	Understand the concept of Cayley's theorem and about Solvable group	K-3
CO 3	Able to demonstrate about the permutations and Accounting principle	K-3
CO 4	Appreciate the significance of Sylow's theorem and Galois theory	K-4
CO 5	Acquire the knowledge of direct products, finitely generated abelian groups	K-3

K-1: Remembering; K-2: Understanding; K-3: Applying; K-4: Analyzing; K-5: Evaluating; K-6:Creating.

L	T	C	P
6	0	4	0

Course Description

Unit I: A Counting Principle - Normal Subgroups and Quotient Groups -Homomorphisms.
Sections: 2.5 - 2.7. (19hours)

Unit II: Automorphisms - Cayley's Theorem-Solvable Groups.
Sections: 2.8, 2.9.
Supplementary Problems: 10-17. (19 hours)

Unit III: Permutation Groups - Another Counting Principle.
Sections: 2.10, 2.11. (18 hours)