

**Shri Manibhai Virani and Smt. Navalben Virani Science College
(Autonomous), Rajkot**

Affiliated to Saurashtra University, Rajkot

11th AC held on 20th June, 2023

APPENDIX J.2

Enclosures VI to XII of 12th BoS Mathematics, 22nd May, 2023



**Yogi Divine Society inspired,
Sarvodaya Kelavani Samaj managed**

**Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)**

Affiliated to Saurashtra University, Rajkot

Re-Accredited at 'A' Level by NAAC
STAR college Scheme & Status by MST-DBT
UGC- College with Potential for Excellence (CPE)
UGC-DDU KAUSHAL Kendra
GAAA – Highest Grade A-1 by KCG, Government of Gujarat
GPCB-Government of Gujarat approved Environment Audit Center
UGC-Autonomous College

DEPARTMENT OF MATHEMATICS

Regulations of B.Sc. / B.Sc. (Honours) / B.Sc. (Honours with Research) Mathematics program

(based on the recommendations for 4 year UG program under Curriculum and Credit Framework for Undergraduate Programs - guidelines / framework/ regulations of UGC, Gujarat Government and affiliating Saurashtra University in light of NEP-2020)

(W.E.F June 2023)

**Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)
Affiliated to Saurashtra University, Rajkot**

**Department of Mathematics
Regulations
of
B.Sc. / B.Sc. (Honours) / B.Sc. (Honours with Research)
Mathematics program
Regulations for Students Admitted from A.Y. 2023-2024 & Onwards**

ELIGIBILITY

Candidate who has passed 02 years Higher Secondary Certificate (10+2) examination with Science subjects in respective streams of Gujarat State or any other examination recognized as equivalent thereto with a good academic record, shall be eligible for admission, subject to and based on the recommendations for 4 year UG program under Curriculum and Credit Framework for Undergraduate Programs - guidelines / framework/ regulations of UGC, Gujarat State Government and affiliating Saurashtra University in light of NEP-2020. All admissions are provisional and subject to the approval of Saurashtra University.

DURATION OF THE PROGRAMME

The Programme shall extend over a period of FOUR years(FYUP) comprising of eight semesters with two semesters in one academic year. Each semester normally consists of 90 teaching days.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses based on their interest. Mainly, each course is worth a certain number of credit points, determined by different criteria including learning outcome, contact hours etc.

The following mechanism is adopted for the purpose of computation of credits earned by the students:

- a) 1 hour instruction of Theory = 1 Credit
- b) 1 hour instruction of Tutorial = 1 Credit
- c) 2-3 hours instructions of Practical = 1 Credit

OUTCOME BASED EDUCATION (OBE)

Outcome based education is based on revised Bloom Taxonomy and is a learner-centric teaching and learning methodology in which the course delivery and assessment are planned to achieve stated objectives and outcomes. It focuses on measuring students' performance i.e. outcomes at different levels. OBE method of learning is adopted.

STRUCTURE OF THE PROGRAMME

Each UG programme shall have a curriculum comprising theory and practical courses with a specified syllabus. The curriculum of the programme is a blend of theory courses and practical courses as Core, Discipline Specific Electives (DSE), Minor Stream Core, and Trans Disciplinary Elective (TDE) and Multi-Disciplinary Courses. In addition, project, internship/training and personality development courses as Ability Enhancement Courses (AEC) and Skill Enhancement Courses (SEC) shall be offered.

MEDIUM OF INSTRUCTION AND EXAMINATIONS

The medium of instruction and examinations shall be English except for courses on languages other than English.

EVALUATION

The evaluation shall generally comprise of Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) with percentage weightage as specified below, unless specified otherwise in the Scheme of Instruction and Examinations.

<i>Theory Courses</i>		<i>Practical Courses</i>	
Continuous Internal Evaluation (CIE)	Varies from 30 percent to 100 percent based on the nature of course.	Continuous Internal Evaluation (CIE)	Varies from 30 percent to 100 percent based on the nature of course.
Semester End Examination (SEE)	Varies from 70 percent to 0 percent based on the nature of course.	Semester End Examination (SEE)	Varies from 30 percent to 100 percent based on the nature of course.

ISSUE OF MARK-SHEET AND DEGREE CERTIFICATE

The college shall publish the result after evaluation and with the recommendations of Result Passing Board at the end of each semester. On approval/ratification of the results by the Academic Council, the candidate will be recommended to Saurashtra University for the award of the degree on completion of all the courses and components of the curriculum.

COMPLETION OF PROGRAM TO EARN THE DEGREE CERTIFICATE

The institute shall publish the result after evaluation and with the recommendations of Result Passing Board at the end of each semester. On approval/ratification of the results by the Academic Council, the student will be recommended to parent university for the award of the degree provided that the student have earned all the credits towards mandatory course / components as mentioned in Scheme of Learning and Evaluation.

MINIMUM QUALIFICATION FOR APPOINTMENT OF FACULTY MEMBER

As per norms of UGC and./or other related Regulatory body



**Sarvodaya Kelavani Samaj Managed
Shri Manibhai Virani & Smt. Navalben Virani Science College, Rajkot**
(An autonomous College affiliated to Saurashtra University, Rajkot)

Reaccredited at the “A” Level (CGPA 3.28) by NAAC

“STAR” College Scheme & Status by MST-DBT

A College with Potential for Excellence – CPE (Phase - II) by UGC

Accredited at the G-AAA Highest Grade ‘A-1’ Level by KCG, Govt. of Gujarat

UGC-DDU KAUSHAL Kendra

GPCB-Government of Gujarat approved Environmental Audit Centre

SCHEME OF LEARNING AND EVALUATION

(based on the recommendations for 4 year UG program under Curriculum and Credit Framework for Undergraduate Programs - guidelines / framework/ regulations of UGC, Gujarat Government and affiliating Saurashtra University in light of NEP-2020.)

of

**Bachelor of Science (Hon/Hon with Research (FYUGP)) Mathematics
program**

(w.e.f 2023-24)

Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot

(An Autonomous College affiliated to Saurashtra University, Rajkot)

Department of Mathematics

Bachelor of Science (Hon/Hon with Research (FYUGP)) Mathematics program

Vision of the Department:

To be recognized for excellence in Teaching – Learning adjunct by empowering graduating students to compete in and contribute to the developing needs of the society.

Mission of the Department:

To provide quality teaching-learning, research and service opportunities leading to holistic development of students through collegial exchange of ideas, independent thought, and the highest ethical standards.

Goals:

- a. Provide high quality academic experiences through comprehensive & relevant curriculum at all UG & PG levels.
- b. Foster problem solving ability and research aptitude by extending instructional and infrastructural support and research guidance.
- c. Inculcate the values of multi-disciplinary approach and innovative thinking by facilitating learning experiences in the field of mathematics and its allied fields
- d. Produce graduates with ability to solve real life problems and ability to face the emerging challenges for careers in academia, industry and GOs/NGOs.
- e. Promote ethical and professional environment amongst faculties and students of the department.

GRADUATE ATTRIBUTES

- **Academic excellence:** Ability to identify key questions, research and pursue rigorous evidence-based arguments
- **Critical Thinking and Effective communications:** Analysis and evaluation of information to form a judgment about a subject or idea and ability to effectively communicate the same in a structured form.
- **Global Citizenship:** Mutual understanding with others from diverse cultures, perspectives and backgrounds
- **Life Long Learning:** Open, curious, willing to investigate, and consider new knowledge and ways of thinking

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) FOR B. Sc. MATHEMATICS

Our programme will produce Graduates who will attain following PEOs after few years of graduation

- PEO 1 : Core competency:** will develop the competency to pursue higher education or successful professional career with synergistic combination of the knowledge and skills of mathematics and allied sciences.
- PEO 2 : Breadth of knowledge:** will show capabilities of independently designing, executing and interpreting mathematical problems by integrating the interdisciplinary knowledge of Mathematics and other domains.
- PEO 3 : Preparedness:** will reflect professional behaviour and have the potential to show preparedness to take any task or assignment in the capacity of a leader or team member in their chosen occupations or careers and communities.
- PEO 4 : Professionalism:** will reflect values and responsibilities in the character to make them fit to work in a multidisciplinary team and to become socio-ethically responsible citizen.
- PEO 5 : Learning environment:** will show attitude of self-learning abilities and keep themselves abreast with new development in all spheres of life.

PROGRAM OUTCOMES (POs) FOR B. Sc. MATHEMATICS

After completion of the programme the Graduate will be able to:

- PO 1 : Domain knowledge:** Demonstrate the knowledge of concepts, principles and applications of Mathematics in various fields.
- PO 2 : Problem analysis:** Acquire critical thinking skills to understand and solve contemporary problems with knowledge and skills.
- PO 3 : Design/development of solutions:** Make decisions to develop solutions to given situations/questions, formulate strategies to identify, define and solve problems including, as necessary, global perspectives.
- PO 4 : Conduct investigations of complex problems:** Gain ability to design, conduct experiments, analyse and interpret data for investigating problems in Mathematics and allied sectors
- PO 5 : Modern tool usage:** The ability to acquire, develop, employ and integrate a range of technical, practical and professional skills, in appropriate and ethical ways within a professional context, autonomously and collaboratively and across a range of disciplinary and professional areas.
- PO 6 : The Mathematics Professional and society:** An awareness of the role of science within a global culture and willingness to contribute to the shaping of

community views on complex issues where the methods and findings of science are relevant.

- PO 7 : Environment and sustainability:** Understand complex environmental issues and their interrelationships and requirement of interdisciplinary domains for sustainable development
- PO 8 : Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and norms.
- PO 9 : Individual and team work:** Able to function effectively as individual and as a member in multidisciplinary settings.
- PO 10 : Communication:** Communicate effectively using different modes (viz. written, verbal and digital) not only with scientific community but also with the society at large.
- PO 11 : Project management and finance:** Understand the principles of management of finance and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 12 : Life-long learning:** Able to recognize the need to undertake life-long learning and acquire the capacity to do so.

PROGRAMME SPECIFIC OUTCOME (PSOs) FOR B. Sc. MATHEMATICS PROGRAMME

After completion of the programme the Graduate will:

- PSO 1 :** Understand the advanced concepts of mathematics and demonstrate the ability to apply the knowledge of mathematics at an advanced level.
- PSO 2 :** Collect, organize and adapt contemporary knowledge effectively and utilize appropriate computational tools independently and analyse and perform a broad variety of mathematical experiments using mathematical software and internet.
- PSO 3 :** Develop and apply new theories of mathematics to solve a broad variety of problems involving mathematics.
- PSO 4 :** Apply critical thinking skills for the sustainable development and develop the knowledge and skills to secure employment.
- PSO 5 :** Exhibit the capacity to identify, formulate, and solve problems pertaining to mathematics through research and critically evaluate the theoretical results and recognize the need for, and an ability to engage in life-long learning.

Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot

(An Autonomous College affiliated to Saurashtra University, Rajkot)

Department of Mathematics

Bachelor of Science (Hon/Hon with Research (FYUGP))

SCHEME OF LEARNING AND EVALUATION

For the students admitted from A.Y. 2023-2024 & onwards

NCrF- Level 4.5: First Year FYUGP: Semester I & II (UG Certificate in Sciences)

Semester I									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-I Ability Enhancement Courses (Language)									
		T	Tu	P					
	English - I	2	-	-	3	-	50	50	2
	Part-I Total	2	0	0		-	50	50	2
Part-II Discipline Specific Core Course									
Major Core / DSC / ID Major									
	Core 1: Mathematics - I	4	-	-	3	30	70	100	4
	Core 2: Physics - I	4	-	-	3	30	70	100	4
	Core Practical 1: Practical on Mathematics - I	-	-	4	3	15	35	50	2
	Core Practical 2: Physics-I	-	-	4	3	15	35	50	2
Minor Stream Core Courses / DMi / IDMi									
	DMi Core 1: Chemistry – I	4	-	-	3	30	70	100	4
	DMi Core Practical : Chemistry – I	-	-	4	3	15	35	50	2
Multi-Disciplinary Courses: (MDC)									
	MDC 1:	2	-	-	3	50	-	50	2
Skill Enhancement Courses (SEC Major & Minor)									
	Practical: Introduction to Mathematical Software.	1	-	-	3	50	-	50	1
	Part – II Total	15	0	12		235	315	550	21
Part-III Common Value Added Course (CVAC)									
	Jeevan Vidya	1	-	-	-	50	-	50	1
		18	0	12					
	Part-I+II+III Total	30				285	365	650	24

Multi-disciplinary course offered by the Department to Sem – I students of other Departments.

Multi-disciplinary course (MDC)									
	Introduction to Statistics	2	-	-	2	50	-	50	2

SCHEME OF LEARNING AND EVALUATION
For the students admitted from A.Y. 2023-2024& onwards

Semester II									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-I Ability Enhancement Courses (Language)									
		T	Tu	P					
	English - II	2	-	-	3	-	50	50	2
	Part-I Total	2	0	0		-	50	50	2
Part-II Discipline Specific Core Courses									
Major Core / DSC / ID Major									
	Core - 3	4	-	-	3	30	70	100	4
	Core - 4	4	-	-	3	30	70	100	4
	Core Practical 3:	-		4	3	15	35	50	2
	Core Practical 4:	-		4	3	15	35	50	2
Minor Stream Core Courses / DMi / IDMi									
	DMi Core 2:	4	-	-	3	30	70	100	4
	DMi Core Practical 2	-	-	4	3	15	35	50	2
Multi-Disciplinary Courses: (MDC)									
	MDC 2:	2	-	-	3	50	-	50	2
Skill Enhancement Courses (SEC Major & Minor)									
	SEC 2(Major):	1	-	-		50	-	50	1
	Part-II Total	15	0	12		235	-	550	21
Part-III Common Value Added Course (CVAC)									
	CVAC – 2	1	-	-		50	-	50	1
		18	0	12					
	Part-I+II+III Total	30				285	365	650	24

Multi-disciplinary course offered by the Department to Semester – II students of other Departments.

Multi-disciplinary course (MDC)									
	MDC 2:	2	-	-	2	50	-	50	2

SCHEME OF LEARNING AND EVALUATION

For the students admitted from A.Y. 2023-2024 & onwards

NCrF- Level 5: Second Year FYUGP: Semester III & IV (UG Diploma in Sciences)

Semester III									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-I Ability Enhancement Courses (Language)									
		T	Tu	P					
	English - III	2	-	-	3	-	50	50	2
	Part-I Total	2	0	0		-	50	50	2
Part-II Discipline Specific Core Courses									
Major Core / DSC / ID Major									
	Core - 5	4	-	-	3	30	70	100	4
	Core - 6	4	-	-	3	30	70	100	4
	Core Practical 5:	-		4	3	15	35	50	2
	Core Practical 6:	-		4	3	15	35	50	2
Minor Stream Core Courses / DMi / IDMi									
	DMi Core 3:	4	-	-	3	30	70	100	4
	DMi Core Practical 3	-	-	4	3	15	35	50	2
Multi-Disciplinary Courses: (MDC)									
	MDC 3:	2	-	-	3	50	-	50	2
Skill Enhancement Courses (SEC Major & Minor)									
	SEC 3: (Major):	1	-	-		50	-	50	1
	Part-II Total	15	-	12		285	315	550	21
Part-III Common Value Added Course (CVAC)									
	CVAC - 3	1	-	-		50	-	50	1
		18	0	12					
	Part-I+II+III Total	30				285	365	650	24

Multi-disciplinary course offered by the Department to Semester – III students of other Departments.

Multi-disciplinary course (MDC)									
	MDC 3:	2	-	-	2	50	-	50	2

SCHEME OF LEARNING AND EVALUATION
For the students admitted from A.Y. 2023-2024& onwards

Semester IV									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-I Ability Enhancement Courses (Language)									
		T	Tu	P					
	English - IV	2	-	-	3	-	50	50	2
	Part-I Total	2	0	0		-	50	50	2
Part-II Discipline Specific Core Courses									
Major Core / DSC / ID Major									
	Core - 7	4	-	-	3	30	70	100	4
	Core - 8	4	-	-	3	30	70	100	4
	Core Practical 7:	-		4	3	15	35	50	2
	Core Practical 8:	-		4	3	15	35	50	2
Minor Stream Core Courses / DMi / IDMi									
	DMi Core 4:	4	-	-	3	30	70	100	4
	DMi Core Practical 4	-	-	4	3	15	35	50	2
Multi-Disciplinary Courses: (MDC)									
	MDC 4: TDE 1	1	-	-	3	50	-	50	1
Skill Enhancement Courses (SEC Major & Minor)									
	SEC 4: CoC	2	-	-		50	-	50	2
	Part-II Total	15	0	12		235	315	550	21
Part-III Common Value Added Course (CVAC)									
	CVAC - 4	1	-	-		50	-	50	1
		18	0	12					
	Part-I+II+III Total	30				285	365	650	24

Multi-disciplinary course offered by the Department to Semester – IV students of other Departments.

Multi-disciplinary course (MDC)									
	MDC 4: TDE 1	2	-	-	2	50	-	50	2

SCHEME OF LEARNING AND EVALUATION
For the students admitted from A.Y. 2023-2024& onwards
NCrF- Level 5.5: Third Year FYUGP: Semester V & VI (B.Sc. in Mathematics)

Semester V									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-I: Ability Enhancement Courses (Language)									
		T	Tu	P					
	MIL Hindi*	2	-	-	3	2 Assi	50	50	2*
	Part-I Total	2	0	0		-	50	50	2*
Part-II Discipline Specific Core Courses									
Major Core / DSC / ID Major									
	Core - 9	4	-	-	3	30	70	100	4
	Core - 10	4	-	-	3	30	70	100	4
	Core - 11	4	-	-	3	30	70	100	4
	Core Practical 9:	-		4	3	15	35	50	2
	Core Practical 10:	-		4	3	15	35	50	2
	Core Practical 11:	-		4	3	15	35	50	2
Core Elective:									
	Core Elective 1:	3	-	-	3	30	70	100	3
Research Project Dissertation:									
	Minor Research Project (of Major)/ Industrial Visit / Training	-	-	-	-	Evaluation in the 6 th Semester			-
Skill Enhancement Courses (SEC Major & Minor)									
	SEC 5: Internship (Major)	-	-	4	-	50	-	50	2
	Part-II Total	15	0	16		215	385	600	23
Part-III Common Value Added Course (CVAC)									
	CVAC – 5	1	-	-	-	50	-	50	1
		16/18	0	16					
	Part-I+II+III Total	32/34				265	435	650	24

*Extra Credit Course

SCHEME OF LEARNING AND EVALUATION
For the students admitted from A.Y. 2023-2024& onwards

Semester VI									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-I: Ability Enhancement Courses (Language)									
		T	Tu	P					
	MIL Hindi*	2	-	-	3	2 Assg	50	50	2
	Part-I Total	2	0	0		-	50	50	2*
Part-II Discipline Specific Core Courses									
Major Core / DSC/ID Major									
	Core – 12	4	-	-	3	30	70	100	4
	Core – 13	4	-	-	3	30	70	100	4
	Core - 14	4	-	-	3	30	70	100	4
	Core Practical 12:	-		4	3	15	35	50	2
	Core Practical 13:	-		4	3	15	35	50	2
	Core Practical 14:	-		4	3	15	35	50	2
Core Elective:									
	Core Elective 2:	3	-	-	3	30	70	100	3
Multi-Disciplinary Courses: (MDC)									
	MDC 5: TDE 2	1	-	-	3	50	-	50	1
Research Project Dissertation:									
	Minor Research Project (of Major)/ Industrial Visit / Training**	-	-	-	3	-	-	-	-
Skill Enhancement Courses (SEC Major & Minor)									
	SEC 6: Self-Study Course* + CRT(NCC)**	1	-	-	3	50	-	50	1+0
	Part-II Total	17	0	16		265	435	650	23
Part-III Common Value Added Course (CVAC)									
	CVAC - 6	1	-	-	-	50	-	50	1
		18/20	0	12					
	Part-I+II+III Total	33/35				315	435	750	24

*Extra Credit Course

**Non Credit Compulsory Course - NCC

SCHEME OF LEARNING AND EVALUATION
For the students admitted from A.Y. 2023-2024 & onwards
NCrF- Level 6: Fourth Year FYUGP: Semester VII & VIII
(B.Sc. Honours or B.Sc. Honours with Research)

Semester VII (B.Sc. Honours)									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-II: Discipline Specific Core Courses									
Major Core / DSC / ID Major									
	Core 15:	4	-	-	3	30	70	100	4
	Core 16:	4	-	-	3	30	70	100	4
	Core 17:	4	-	-	3	30	70	100	4
	Core Practical-15:	-	-	4	4*	15	35	50	2
	Core Practical -16:	-	-	4	4*	15	35	50	2
	Core Practical -16:	-	-	4	4*	15	35	50	2
Core Elective									
	Core Elective 3:	4	-	-	3	30	70	100	4
	Core Elective 3 Practical:	-	-	4	4*	15	35	50	2
Part-II Total		16	0	16		180	420	600	24
Part-I+II+III Total		32				180	420	600	24

SCHEME OF LEARNING AND EVALUATION
For the students admitted from A.Y. 2023-2024 & onwards

Semester VIII (B.Sc. Honours)									
Course Code	Course	Contact Hrs. / week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-II: Discipline Specific Core Courses									
Major Core / DSC / ID Major									
	Core 18:	4	-	-	3	30	70	100	4
	Core 19:	4	-	-	3	30	70	100	4
	Core 20:	4	-	-	3	30	70	100	4
	Core Practical-18:	-	-	4	4*	15	35	50	2
	Core Practical -19:	-	-	4	4*	15	35	50	2
	Core Practical -20:	-	-	4	4*	15	35	50	2
Core Elective									
	Core Elective 4:	4	-	-	3	30	70	100	4
	Core Elective 4 Practical:	-	-	4	4*	15	35	50	2
Part-II Total		16	0	16		180	420	600	24
Part-I+II+III Total		32				180	420	600	24

SCHEME OF LEARNING AND EVALUATION
For the students admitted from A.Y. 2023-2024 & onwards
NCrF- Level 6: Fourth Year FYUGP: Semester VII & VIII
(B.Sc. Honours or B.Sc. Honours with Research)

Semester VII (B.Sc. Honours with Research)									
Course Code	Course	Contact Hrs/ week			SEE Duration (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-II Discipline Specific Core Courses									
Major Core / DSC/ID Major									
	Core – 15	4	-	-	3	30	70	100	4
	Core – 16	4	-	-	3	30	70	100	4
	Core - 17	4	-	-	3	30	70	100	4
	Core Practical 15:	-	-	4	3	15	35	50	2
	Core Practical 16:	-	-	4	3	15	35	50	2
	Core Practical 17:	-	-	4	3	15	35	50	2
Core Elective:									
	Core Elective 3:	4	-	-	3	30	70	100	4
	Core Elective Practical 3:	-	-	4	3	15	35	50	2
	Part-II Total	16	0	16		180	420	600	24
	Part-I+II+III Total	32				180	420	600	24

*Extra Credit Course

Semester VIII (B.Sc. Honours with Research)									
Course Code	Course	Contact Hrs/ week			SEE Dur (Hours)	Maximum Marks			Credits
						CIA	SEE	Total	
Part-II Discipline Specific Core Courses									
Major Core / DSC/ID Major									
	Core – 16 including MOOC	4	-	-	3	30	70	100	4
	Core – 17 including MOOC	4	-	-	3	30	70	100	4
Research Project:									
	Major Research Project	16	-	-		120	280	400	16
	Part-II Total	12	0	24		180	420	600	24
	Part-I+II+III Total	36				180	420	600	24

**TOTAL MARKS & CREDIT DISTRIBUTION TO EARN THE DEGREE Semester I
and II**

S.No	PART	Total Marks	Total Credits
1.	PART I: Language Course	200	8
2.	PART II: <ul style="list-style-type: none"> • Major Core / DSC / ID Major • Minor Stream/ DMi/IDMi • SEC Major & Minor • MDC Elective 	4650	176
3.	PART III <ul style="list-style-type: none"> • Value Added Course (VAC) 	300	06
TOTAL		5150	192

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)**

Affiliated to Saurashtra University, Rajkot

B.Sc. / B.Sc. (Honours) / B.Sc. (Honours with Research) Mathematics program.

Core Course (Theory)		
For the students admitted from A.Y. 2023-2024& onwards		
Offering Department: Mathematics		Offered to: B.Sc. Mathematics
Semester – I		
Course Code	Course Title	Course Credit and Hours
	Core 1: Mathematics - I(F)	4 Credits - 4 hrs/wk (4 Theory)

Course Description:

"**Mathematics - I**" is a course in the B.Sc. (FYUGP) program, focusing on key concepts and techniques in differential calculus. Topics include successive differentiation, Leibnitz's theorem and its applications, mean value theorems, Taylor's theorem, increasing and decreasing functions, expansions of functions using Taylor's and Maclaurin's series, and methods of expansion for implicit functions. The course also covers indeterminate forms and L'Hospital's rule for solving them. Through this course, students will develop a strong foundation in differential calculus and its practical applications.

In the "**Mathematics - I**" part of the course covers the fundamental concepts and techniques of matrix algebra. The course includes topics such as revision of matrices, matrix rank and determinant, linear dependence and independence of row and column matrices, row reduced echelon form, matrix inversion, properties of determinants, Cayley-Hamilton theorem, eigenvalues, eigenvectors, and the characteristic equation of a matrix. Students will gain a solid understanding of matrix operations, determinants, and their applications in solving linear systems and eigenvalue problems.

Course Purpose:

The purpose of the course "**Mathematics - I**" for a B.Sc. (FYUGP) program majoring in Mathematics is to provide students with a solid foundation in the fundamental concepts and techniques of differential calculus. The course aims to develop students' understanding of successive differentiation, Leibnitz's theorem, mean value theorems, Taylor's theorem, and the geometrical interpretations of these theorems. Students will also learn about increasing and decreasing functions, the expansion of functions using Taylor and Maclaurin series, and the method of expansion for implicit functions. Additionally, the course covers indeterminate forms and L'Hôpital's rule for solving such forms. The course provides students with a comprehensive understanding of matrix algebra and its applications. Through this course, students will gain proficiency in the fundamental concepts of matrices, including rank, determinant, linear dependence and independence, and matrix inversion. They will also explore advanced topics such as Cayley-Hamilton theorem, eigenvalues, eigenvectors, and the characteristic equation of a matrix. The course aims to develop students' analytical and

problem-solving skills in the context of matrix algebra, preparing them for further studies in mathematics and related fields.

Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	Blooms taxonomy Level (K₁ to K₆)
CO ₁	Identify the formulas and definitions related to successive differentiation, Leibnitz's theorem, mean value theorems, Taylor's theorem, increasing and decreasing functions, Taylor series, Maclaurin series, and L'Hopital's rule.	K1
CO ₂	Explain the concepts of successive differentiation, Leibnitz's theorem, mean value theorems, Taylor's theorem, and their geometric interpretations.	K2
CO ₃	Solve problems involving the application of Leibnitz's theorem, mean value theorems, and Taylor's theorem to find derivatives, evaluate limits, and approximate functions.	K3
CO ₄	Analyze the behavior of functions using the concepts of increasing and decreasing functions, Taylor series, and Maclaurin series.	K4
CO ₅	Identify the rank and determinant of a given matrix.	K1
CO ₆	Determine linear dependence and independence of row and column matrices.	K2
CO ₇	Analyze the row rank, column rank, and overall rank of a matrix.	K3
CO ₈	Evaluate the row reduced echelon form of a matrix and use it for matrix inversion.	K4
CO ₉	Calculate the rank and determinant of matrices and identify linear dependence and independence of row and column matrices.	K1
CO ₁₀	Solve problems involving the row reduced echelon form of matrices and matrix inversion.	K4
CO ₁₁	Apply the Cayley-Hamilton theorem to find eigenvalues, eigenvectors, and the characteristic equation of matrices and utilize it for finding the inverse of matrices.	K5

Course Contents	Hours
Unit-I: Successive Differentiation	9
<ul style="list-style-type: none"> • Successive differentiation • Leibnitz's theorem and its applications 	
Unit-II: Mean value theorems.	10
<ul style="list-style-type: none"> • Introduction. • Bounded set and bounded function. • Rolle's Mean value theorems and examples. • Lagrange's Mean value theorems and examples. • Cauchy's Mean value theorems and examples. • Geometrical interpretation of Rolle's, Lagrange's and Cauchy's Mean value theorems. 	

Unit- III: Taylor's theorem and Indeterminate Forms	10
<ul style="list-style-type: none"> • Introduction, • Expansion of functions using Taylor's Series and Maclaurin's series. • Power series expansion of $e^x, \sin x, \cos x, (1+x)^m, \log(1+x)$. • Indeterminate Forms including $\frac{0}{0}, \frac{\infty}{\infty}, 0 \times \infty, \infty - \infty, 0^0, \infty^0, 1^\infty$ • L' Hospitals Rules for above indeterminate forms. 	
Unit- IV: Concept of a matrix and Rank and determinant of a matrix	10
<ul style="list-style-type: none"> • Introduction to matrices. • Theorems on matrices • Hermitian and skew - Hermitian matrices. • Linear dependence and independence of row and column matrices. • Row rank, column rank and rank of a matrix. • Row Reduced Echelon form of a matrix and matrix inversion using it • Determinant of a matrix and rank using it. 	
Unit- V: Cayley-Hamilton theorem and Diagonalization of a matrix	9
<ul style="list-style-type: none"> • Eigen values, Eigen vectors and the characteristic equation of a matrix. • Cayley-Hamilton theorem and its use in finding inverse of a matrix • Similar matrices- Definition and properties. • Diagonalizable matrix. • To find power of a matrix by using Diagonalization. • To find power of a matrix by using Cayley-Hamilton Theorem. 	

Pedagogic Tools:

- Chalk and board (Lecture Method)
- Power point presentation
- Seminars
- Classroom discussions and debates
- Online resources

TEXT BOOKS: -

1. George B. Thomas, Joel Hass, Christopher Heil, Maurice D. Weir, (May 2018) *Thomas' Calculus* 14th Edition Pearson Education.
2. Howard Anton (January 2015), *Calculus*, 10ed, Wiley India Pvt. Ltd.
3. David C. Lay, (2017), *Linear Algebra and its Applications*, 4th Edition, Pearson Education Asia, Indian Reprint.
4. Howard Anton and Chris Rorres, (2014), *Elementary Linear Algebra*, 11th Edition, Wiley.

REFERENCE BOOKS:-

1. James Stewart, (2018), *Calculus*, 9th Edition, Brooks Cole.
2. M. J. Strauss, G. L. Bradley and K. J. Smith, (2007), *Calculus* (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

3. S. C. Arora and Ramesh Kumar, (2016), *A Text book of Calculus*, Pitamber Publishing Company Ltd. Delhi.
4. Seymour Lipschutz and Marc Lars Lipson, (2018), *Linear Algebra (Schaum's Outline Series)*, 9th Edition, Mc Graw Hill Education.
5. V. Krishnamurthy, V. P. Mainra and J. L. Arora, (2005), *Introduction to Linear Algebra*, Affiliated East-West Press Pvt. Ltd.-New Delhi.

Suggested reading / E-resources:

- NPTEL (National Programme on Technology Enhanced Learning)
Differential Calculus and Matrix Algebra
<https://nptel.ac.in/>
- Khan Academy - Differential Calculus:
<https://www.khanacademy.org/math/calculus-home/differential-calculus>
- MIT OpenCourseWare - Single Variable Calculus:
<https://ocw.mit.edu/courses/mathematics/18-01-single-variable-calculus-fall-2006/>
- Paul's Online Math Notes - Calculus I:
<http://tutorial.math.lamar.edu/Classes/CalcI/CalcI.aspx>
- MathisFun - Differential Calculus:
<https://www.mathsisfun.com/calculus/index.html>
- MathisFun - Matrix Algebra:
<https://www.mathsisfun.com/algebra/matrix-introduction.html>
- Khan Academy - Linear Algebra:
<https://www.khanacademy.org/math/linear-algebra>
- MathsGee - Matrix Algebra:
<https://mathsgee.com/matrix-algebra/>
- MIT OpenCourseWare - Linear Algebra:
<https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/>

Suggested MOOCs:

- NPTEL (National Programme on Technology Enhanced Learning)
<https://nptel.ac.in/courses/111/106/111106054/>
- Coursera - "Calculus: Single Variable" by University of Pennsylvania
<https://www.coursera.org/learn/single-variable-calculus>
- edX - "Introduction to Calculus" by Massachusetts Institute of Technology (MIT)
<https://www.edx.org/course/introduction-to-calculus>
- Udemy - "Calculus 1 - The Complete Guide to Differential Calculus" by Infinite Skills
<https://www.udemy.com/course/calculus-1-the-complete-guide-to-differential-calculus/>
- Coursera - Matrix Algebra for Engineers:
<https://www.coursera.org/learn/matrix-algebra-engineers>
- edX - Linear Algebra - Foundations to Frontiers:
<https://www.edx.org/course/linear-algebra-foundations-to-frontiers>
- Udemy - Matrix Algebra:
<https://www.udemy.com/course/matrix-algebra/>
- FutureLearn - Linear Algebra: Foundations to Frontiers:
<https://www.futurelearn.com/courses/linear-algebra-foundations-frontiers>

Methods of Assessment & Tools:

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration	Marks	Sub Total
A	Test 1	1 st and 2 nd units	1 $\frac{1}{2}$ hours	5 (Set for 30)	20
	Test 2	Remaining 3 units	2 hours	15 (Set for 70)	
B	Assignment			04	10
C	Class activity			06	
Grand Total					30
Assignment	<ul style="list-style-type: none">• Problem formulation and its analysis.• Problem Solving• Notes written by the learner on the different topics in the syllabus.• Book Review.• Chapter review				
Class activity	<ul style="list-style-type: none">• Quiz / Surprise Quiz• Seminar• Situation based question etc.				

Note: Any other assessment tools or methods can be adopted as per requirement of the course

Shri Manibhai Virani & Smt. Navalben Virani Science College (Autonomous)
Department of Mathematics

B.Sc. / B.Sc. (Honours) / B.Sc. (Honours with Research) Mathematics program.

Core Practical 1		
For the students admitted from A.Y. 2023-2024& onwards		
Offering Department: Mathematics	Offered to: B.Sc. Mathematics	
Semester – I		
Course Code	Course Title	Course Credit and Hours
	Core Practical 1: Practical on Mathematics - I	2 Credits/ 4 hrs/wk

Course Description:

"Practical on Mathematics - I" is a course designed for B.Sc. (FYUGP) program in Mathematics, focusing on hands-on practical applications of mathematical concepts. The course covers topics such as successive differentiation, Leibnitz's theorem, mean value theorems, Taylor's theorem, indeterminate forms, matrices, rank and determinant, row reduced echelon form, Cayley-Hamilton theorem, diagonalization of matrices, and more. Students will engage in practical experiments and problem-solving exercises to reinforce their understanding of these mathematical concepts and their applications. By the end of the course, students will have gained proficiency in applying these concepts to real-world mathematical problems and developing analytical and problem-solving skills.

Course Purpose:

The course "Practical on Mathematics - I" for B.Sc. (FYUGP) program in Mathematics aims to provide students with practical exposure to various mathematical concepts and their applications. The course content covers topics such as successive differentiation, Leibnitz's theorem, mean value theorems, Taylor's theorem, indeterminate forms, matrices, rank and determinant, row reduced echelon form, Cayley-Hamilton theorem, and diagonalization of matrices. Through experimental practical sessions and problem-solving exercises, students will develop their analytical and problem-solving skills. The course intends to enhance students' understanding of mathematical principles, their ability to apply them to real-world problems, and their proficiency in performing calculations, manipulations, and interpretations related to these mathematical concepts.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy Level (K ₁ to K ₆)
CO ₁	Recall the definitions and principles related to successive differentiation, Leibnitz's theorem, mean value theorems, Taylor's theorem, and indeterminate forms. Problems	S1, S2
CO ₂	Apply basic formulas and rules for finding successive differentiation, and solve the problems based on Leibnitz's theorem,	S1, S2
CO ₃	Analyze and interpret problems based on L'Hospital's rule, Taylor's and Maclaurin's series, and mean value theorem, Problems	S3, S4
CO ₄	Formulate solutions to problems involving row reduced echelon form, rank, Cayley	S3, S4

CO ₅	Hamilton theorem, eigenvalues, eigenvectors, and diagonalization of matrices. Problems	S3, S4
	Evaluate and synthesize complex problems related to successive differentiation, Leibnitz's theorem, Taylor's theorem, and indeterminate forms. Problems	S5, S6
	Construct and design experiments to verify mathematical theorems and concepts. Problems	S5, S6
	Analyze and critically assess the use of different methods, techniques, and algorithms in solving problems involving matrices, determinants, rank, eigenvalues, and eigenvectors. Problems	S5, S6

List of Practical		
Sr.	Experiments	Hrs
1	Problems Based on Successive differentiation.	4
2	Problems Based on Leibnitz's theorem.	4
3	Problems based on L'Hospital rule.	4
4	Problems based on expansions of functions using Taylor's formula.	4
5	Problems based on expansions of functions using McLaurin's formula.	4
6	Problems based on mean value theorem.	4
7	Problems to find Row Reduced Echelon form.	4
8	Problems to find rank of a Matrix.	4
9	Problems to verify the Cayley-Hamilton theorem.	4
10	Problems to evaluate Eigen value and Eigen vector of a Matrix.	4
11	Problems to evaluate inverse of a Matrix by using Cayley-Hamilton theorem.	4
12	Problems based on Diagonalization of a matrix.	4

Pedagogic tools:

- Chalk and Board
- Power point presentation
- Handouts
- Computer
- Videos / Online Resources

Text books:

1. George B. Thomas, Joel Hass, Christopher Heil, Maurice D. Weir, (May 2018) Thomas' Calculus 14th Edition Pearson Education.
2. Howard Anton (January 2015), Calculus, 10ed, Wiley India Pvt. Ltd
3. David C. Lay, (2017), Linear Algebra and its Applications, 4rd Edition, Pearson Education Asia, Indian Reprint.
4. Howard Anton and Chris Rorres, (2014), Elementary Linear Algebra, 11th Edition, Wiley.

Reference books:

1. James Stewart, (2018), Calculus, 9th Edition, Brooks Cole.
2. M. J. Strauss, G. L. Bradley and K. J. Smith, (2007), Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
3. S. C. Arora and Ramesh Kumar, (2016), A Text book of Calculus, Pitamber
4. Publishing Company Ltd. Delhi.

5. Seymour Lipschutz and Marc Lars Lipson, (2018), Linear Algebra (Schaum's Outline Series), 9th Edition, Mc Graw Hill Education.
6. V. Krishnamurthy, V. P. Mainra and J. L. Arora, (2005), Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd.-New Delhi.

Suggested reading / E-resources:

1. NPTEL (National Programme on Technology Enhanced Learning) Differential Calculus and Matrix Algebra
<https://nptel.ac.in>
2. MathWorld: <http://mathworld.wolfram.com/>
3. Khan Academy <https://www.khanacademy.org/>
4. Wolfram Alpha <https://www.wolframalpha.com/>
5. MIT OpenCourseWare <https://ocw.mit.edu/courses/mathematics/>
6. Mathplanet <https://www.mathplanet.com/>
7. Brilliant <https://brilliant.org/>

Suggested MOOCs:

1. NPTEL (National Programme on Technology Enhanced Learning)
<https://nptel.ac.in/courses/111/106/111106054/>
2. Coursera - Mathematics for Machine Learning Specialization
<https://www.coursera.org/specializations/mathematics-machine-learning>
3. edX - Introduction to Calculus
<https://www.edx.org/professional-certificate/calculus>
4. MIT OpenCourseWare - Multivariable Calculus
<https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/>
5. Udemy - Linear Algebra for Beginners: Open Doors to Great Careers
<https://www.udemy.com/course/linear-algebra-for-beginners-open-doors-to-great-careers/>
6. edX - Linear Algebra - Foundations to Frontiers
<https://www.edx.org/course/linear-algebra-foundations-to-frontiers>

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)**

Affiliated to Saurashtra University, Rajkot

MDC - Multidisciplinary Course		
For the students admitted from A.Y. 2023-2024 & onwards		
Offering Department: Mathematics	Offered to: B.Sc. All Programs	
Semester – I		
Course Code	Course Title	Course Credit and Hours
23U.....	Introduction to Statistics	2 Credits - 2 hrs/wk (2 Theory)

Course Description:

The course “**Introduction to Statistics**” is a multidisciplinary course offered as part of the B.Sc. (UG) program. This course provides students with a comprehensive introduction to the fundamental concepts and techniques of statistics. Students will explore the process of data representation through diagrammatic and graphical presentation methods, including frequency distribution tables, histograms, bar graphs, pie charts, and line graphs. The course covers measure of central tendency and variability, including arithmetic mean, weighted mean, median, mode, geometric mean, harmonic mean, range, mean deviation, variance, standard deviation, coefficient of variation, and skewness. Additionally, students will delve into correlation analysis, regression analysis, and the theoretical distributions of normal, binomial, and Poisson distributions. Practical applications of theoretical distributions will also be explored. Through this course, students will develop a strong foundation in statistical concepts and techniques, enabling them to apply statistical reasoning in various multidisciplinary contexts.

Course Purpose:

Course Purpose: The course “**Introduction to Statistics**” is designed to provide B.Sc. (UG) students with a multidisciplinary understanding of statistical concepts and techniques. The purpose of this course is to equip students with the fundamental knowledge and skills required to analyze and interpret data effectively. By exploring various topics such as diagrammatic and graphical presentation, measures of average, measures of dispersion, correlation analysis, regression analysis, and theoretical distribution, students will develop a solid foundation in statistical reasoning and problem-solving. This course aims to cultivate students' ability to critically evaluate data, make informed decisions, and apply statistical techniques in various real-world contexts. Ultimately, the course intends to empower students with statistical literacy, enabling them to contribute meaningfully in their respective disciplines.

Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	Blooms taxonomy Level (K₁ to K₆)
CO ₁	Identify and define key statistical terms and concepts, such as statistical data, frequency distribution tables, histograms, bar graphs, pie charts, and line graphs.	K1
CO ₂	Compute and calculate basic measures of central tendency and dispersion, including arithmetic mean, weighted mean, median, mode, range, mean deviation, variance, standard deviation, coefficient of variation, and skewness.	K2
CO ₃	Recognize and interpret scatter plots and correlation coefficients, such as Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.	K2
CO ₄	Apply statistical techniques to analyze and interpret data, including constructing and interpreting simple linear regression models and performing residual analysis.	K3
CO ₅	Evaluate the appropriateness of different graphical representations for various types of data and effectively communicate statistical information through diagrams and graphs.	K4
CO ₆	Analyze and synthesize statistical information to make informed decisions and draw meaningful conclusions, considering real-world applications and limitations.	K5

Course Contents	Hours
Unit-I: Diagrammatic and Graphical Presentation	6
<ul style="list-style-type: none"> • Introduction to statistical data • Frequency distribution tables • Histograms • Bar graphs • Pie charts • Line graphs 	
Unit-II: Measures of Average.	6
<ul style="list-style-type: none"> • Arithmetic mean • Weighted • Mean, Median, Mode • Geometric mean • Harmonic mean 	

Unit- III: Measures of Dispersion	6
<ul style="list-style-type: none"> • Range • Mean deviation • Variance, Standard deviation • Coefficient of variation • Skewness 	
Unit- IV: Correlation Analysis.	6
<ul style="list-style-type: none"> • Introduction to correlation • Scatter plots • Karl Pearson's correlation coefficient • Spearman's rank correlation coefficient • Interpretation of correlation coefficient. 	
Unit- V: Regression Analysis and Theoretical Distribution.	6
<ul style="list-style-type: none"> • Simple linear regression • Multiple regression 	

Pedagogic Tools:

- Chalk and board (Lecture Method)
- Power point presentation
- Seminars
- Classroom discussions and debates
- Online resources

TEXT BOOKS: -

1. Gupta S. C., Kapoor V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi, 2020.
2. B.L. Agarwal, *Basic Statistics*, New Age International Publishers, New Delhi.

REFERENCE BOOKS: -

1. Barbara Illowsky, Susan Dean, *Introductory Statistics*, Samurai Media Limited, 2017.
2. Tenko Raykov, Marcoulides G. A., *Basic Statistics*, New Age Revised Fourth Edition, New York.

Suggested reading / E-resources:

- NPTEL (National Programme on Technology Enhanced Learning)
<https://nptel.ac.in/>
- Statistics how to
<https://www.statisticshowto.com/>
- Khan Academy
<https://www.khanacademy.org/>
- UCLA Institute for Digital Research and Education: Statistical Consulting Resources
<https://stats.idre.ucla.edu/>
- MIT OpenCourseWare: Introduction to Probability and Statistics
<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-041-probabilistic-systems-analysis-and-applied-probability-fall-2010/>

Suggested MOOCs:

- NPTEL (National Programme on Technology Enhanced Learning)
<https://nptel.ac.in/>
- Coursera: Introduction to Statistics by University of Amsterdam
<https://www.coursera.org/learn/basic-statistics>
- edX: Statistics and R by Harvard University
<https://www.edx.org/professional-certificate/statistics-and-r>
- Udacity: Intro to Descriptive Statistics
<https://www.udacity.com/course/intro-to-descriptive-statistics--ud827>

Note: Any other assessment tools or methods can be adopted as per requirement of the course

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)**

Affiliated to Saurashtra University, Rajkot

B.Sc. / B.Sc. (Honours) / B.Sc. (Honours with Research) Mathematics program.

Value Added courses / Skill Enhancement course (Practical)		
For the students admitted from A.Y. 2023-2024 & onwards		
Offering Department: Mathematics	Offered to: B.Sc. Mathematics	
Semester – I		
Course Code	Course Title	Course Credit and Hours
	Practical: Introduction to Mathematical Software	1 Credits -2 hrs/wk (1 Practical)

Course Description:

"Introduction to Mathematical Software - GeoGebra"

This course offers a practical introduction to GeoGebra, a powerful mathematical software widely used for dynamic geometry, algebra, and calculus. Designed as a value-added course for B.Sc. (UG) programs, it enhances students' skills in utilizing GeoGebra for mathematical exploration and problem-solving. The course covers the fundamentals of the GeoGebra interface and provides hands-on experience in drawing geometric shapes, analyzing functions, graphing curves, and constructing complex figures. Students will also learn about important geometric properties, such as centers of triangles, and gain proficiency in using tools for measurement, transformation, and construction.

Course Purpose:

"Introduction to Mathematical Software - GeoGebra", This course aims to provide students in B.Sc. (UG) programs with valuable skills in utilizing GeoGebra, a mathematical software, as a value-added course for skill enhancement. Through practical hands-on sessions, students will learn to navigate the GeoGebra interface and effectively use its tools to draw various geometric shapes, graph functions, and analyze mathematical properties. The course emphasizes the construction of triangles, exploring important centers, and applying circle and compass tools. Students will also develop proficiency in measuring shapes and applying transformation tools like reflection, rotation, and translation. Overall, this course equips students with practical software skills for mathematical exploration and problem-solving.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Blooms taxonomy Level (K₁ to K₆)
CO ₁	Demonstrate proficiency in using GeoGebra's interface and toolbars to draw geometric shapes such as lines line segments triangles and polygons.	(K2)
CO ₂	Utilize GeoGebra's drawing and measuring tools to accurately construct and measure geometric shapes including angles distances and areas.	(K2)

CO ₃	Apply basic graphing skills to plot functions and curves using Cartesian equations and inputting equations given.	(K3)
CO ₄	Analyze functions and curves by utilizing GeoGebra's function inspector tool identifying properties such as maximum and minimum values.	(K3)
CO ₅	Explore the properties of various types of triangles including equilateral isosceles right-angled acute and obtuse triangles and identify their important centers such as centroid in-center circumcenter and orthocenter.	(K4)
CO ₆	Employ advanced construction techniques using circle and compass tools in GeoGebra to create complex geometric shapes including triangles polygons squares and rectangles.	(K5)
CO ₇	Apply transformational operations such as reflection rotation and translation by vector tools to manipulate geometric objects and visualize their transformations.	(K5)

Experiments		
1.	Introduction to the interface of GeoGebra.	Hours
2.	Use of tool bars to draw various Geometric Shapes including lines, line segments, triangles, polygons.	2
3.	Use of tool bars to draw various Geometric Shapes including circles and conics.	1
4.	Drawing of graphs of any function of one variable for Cartesian equation using menu bar and to analyze the function using function inspector tool from tool menu and find its properties like maximum and minimum values.	1
5.	Drawing of graph of curves using input bar, when equation of the curves are given.	1
6.	Drawing of various types of triangles including equilateral triangles, isosceles triangles, right angle triangles, acute triangle, obtuse triangle, and finding its various important centers including centroid, in-center, circum - center and ortho-center.	2
7.	Introduction of various circle and compass tools and practice of drawing construction of various geometric shapes including triangles, polygons, squares, rectangle... etc.	2
8.	Drawing and measuring various geometric shape using angle, distance, area and slop tools from tool bar.	2
9.	Introduction and usage of reflect, rotate and translate by a vector tools.	1

Pedagogic Tools:

- Chalk and board (Lecture Method)
- Power point presentation
- Seminars
- Classroom discussions and debates
- Online resources

TEXT BOOKS: -

1. Judith Hohenwarter and Markus Hohenwarter, Introduction to GeoGebra
2. "Discovering Geometry with GeoGebra" by Michael Serra
3. "GeoGebra for Beginners" by José Antonio Cuadrado
4. "Exploring Analytic Geometry with GeoGebra" by Ronald J. Shifrin and Michelle T. Shifrin

REFERENCE BOOKS:-

1. Judith Hohenwarter and Markus Hohenwarter, The official manual of GeoGebra.
2. "GeoGebra in Action: How to Learn and Teach Mathematics" by Judith Hohenwarter and Markus Hohenwarter
3. "GeoGebra for Advanced Mathematics: An Interactive Guide" by Tom Button
4. "GeoGebra Tutorial Series" by GeoGebra Institute of Singapore
5. "GeoGebra Essentials" by Alfred S. Posamentier and Daniel Jaye
6. "GeoGebra: Math Apps and Online Tools" by Markus Hohenwarter.

Suggested reading / E-resources:

- Judith Hohenwarter and Markus Hohenwarter, Introduction to GeoGebra
- Judith Hohenwarter and Markus Hohenwarter, The official manual of GeoGebra.
- <https://www.geogebra.org/> (The official website of GeoGebra)
- <https://www.geogebra.org/?lang=en> (To download window setup)
- <https://en.wikipedia.org/wiki/GeoGebra>.
- NPTEL - <https://nptel.ac.in/courses/111/101/111101087/>
- Khan Academy: <https://www.khanacademy.org/>
- Math Warehouse: <https://www.mathwarehouse.com/>

Suggested MOOCs:

- NPTEL: <https://nptel.ac.in/>
- Coursera - "Mathematical Visualization with GeoGebra"
<https://www.coursera.org/>
- edX - "Introduction to GeoGebra: Dynamic Mathematics Software for Everyone"
<https://www.edx.org/>
- Udemy - "GeoGebra: Learn and Teach Mathematics the Easy Way"
<https://www.udemy.com/>
- Alison - "GeoGebra: An Introduction for Beginners" <https://alison.com/>

Methods of Assessment & Tools:

Components of CIA: 50 marks

Note: Any other assessment tools or methods can be adopted as per requirement of the course

**Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)**

**Affiliated to Saurashtra University, Rajkot
Department of Mathematics**

**Question paper Pattern for Semester – I (Theory)
For the students admitted from A.Y. 2023-2024 & onwards
Question Paper Pattern for Semester End Examination
UG Programs**

Duration of Examination: **3 Hrs.**
70

Max. Marks:

Part A (10 Questions x 1 Mark = 10 Marks)

Answer **ALL** questions (2 questions from each unit)

1.



10.

Part B (5 Questions x 5 Marks = 25 Marks)

Answer **ALL** questions (1 question with internal choice from each unit)

11a.

OR

11b.



15a.

OR

15b.

Part C (5 Questions x 7 Marks = 35 Marks)

Answer **ALL** questions (1 question with internal choice from each unit)

16a.

OR

16b.



20a.

OR

20b.

Shri Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)
Affiliated to Saurashtra University, Rajkot
Department of Mathematics
Question paper Pattern for Semester – I Theory
For the students admitted from A.Y. 2021-2022 & onwards
Question Paper Blueprint

UG Programs

A. SEE Fundamental Paper – 70 Mark

Sr No	Types of Question (K level)	Short Question (1 Marks)	Value Question Answer (5 Marks)	Descriptive Question (7 Marks)	Total Marks	% Weigh tage
1	Remembering-Knowledge based (Define, Arrange, Describe, Identify, List, Match, order, select, Name, Tell, Show, Label, Collect, Recall, Examine, Repeat, Tabulate, Quote, Duplicate, Relate, Memorize, Recognize, Reproduce, or State)	4	2	2	28	40
2	Understanding-Comprehension (Interpret, defend, Explain, Summarize, Convert, Distinguish, Estimate, Generalize, give examples, identify, Rewrite, Contrast, Predict, paraphrase, Associate, recognize, review, Discuss, Review, Differentiate, Extend, Classify, Express, Indicate, Locate, Report, Restate, Select or Translate)	4	2	2	28	40
3	Application (Apply, Change, Compute, discover, Employ, Demonstrate, Operate, Show, Use, Solve, Calculate, Complete, Illustrate, Examine, Modify, manipulate, predict, prepare, produce, Relate, Change, Classify, Experiment, Dramatize, Illustrate, Interpret, Operate, use, Practice, Schedule, Sketch or Write,)	2	1	1	14	20
4	Analysis (Identify Parts, Distinguish, Diagrams, appraise, experiment, Outline, select, illustrate, model, point out, Relate or Associate, calculate, Breakdown, criticize, Subdivide, Analyze, Separate, Order, Explain, Classify, Arrange, Divide, Select, Explain, Infer,	-	-	-		

Sr No	Types of Question (K level)	Short Question (1 Marks)	Value Question Answer (5 Marks)	Descriptive Question (7 Marks)	Total Marks	% Weigh tage
	Calculate, Categorize, Compare, Contrast, Differentiate, Discriminate, Examine, Question, or Test) Synthesis (Arrange, assemble, categorize, collect, combine, comply, compose, construct, create, design, develop, devise, design, explain, formulate, generate, integrate, manage, modify, organize, plan, prepare, propose, rearrange, reconstruct, relate, reorganize, revise, rewrite, set up, summarize, synthesise, tell, write)					
5	Evaluation (Appraise, Criticize, Compare and Contrast, Support, Conclude, Infer, Deduce, Assess, Decide, Rank, Grade, Test, Measure, attach, choose, describe, discriminate, Recommend, explain, justify, interpret, relate, Convince, Select, Support, summarize, Argue, Defend, Estimate, Judge, Predict, Rate, Value or Evaluate)	-	-	-		
	Total	1X10=10	5X5=25	7X5=35	70	100
% Weightage can vary up to ±10% for each K level and accordingly number of questions can be varied.						