Gandhinagar Institute of Science

Academic Regulation& Curriculum

for

Proposed Program BSc

in

Mathematics

BSc PROGRAMME

***w.e.f.* 2023-24**

Preamble

The Department of Mathematics at Gandhinagar University is dedicated to imparting high-quality education, fostering analytical and logical reasoning, and promoting research-oriented learning in the field of mathematical sciences. The department endeavours to cultivate strong conceptual foundations, advanced problem-solving capabilities, and computational proficiency among students, thereby equipping them to meet the academic, and research-oriented challenges of the modern era.

With effect from the Academic Year 2022–23, Gandhinagar University has been recognized by the University Grants Commission (UGC). Furthermore, in consonance with the vision and directives of the National Education Policy 2020 (NEP-2020), the University implemented the NEP-2020 framework from the Academic Year 2023–24. In alignment with these reforms, the Mathematics Department has adopted a flexible, multidisciplinary, and learner-centric curriculum structure emphasizing holistic education, skill development, research aptitude, innovation, and outcome-based learning.

Mathematics Department continually strives to achieve academic excellence through the adoption of innovative pedagogical practices, organization of seminars, workshops, expert lectures, research projects, and interdisciplinary academic activities. It remains committed to nurturing intellectual growth and preparing students for higher education, competitive examinations, research pursuits, and professional careers in mathematics and allied disciplines.

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1. Institutional Vision & Mission

1.1 Vision:

Gandhinagar Institute of Science aims to strengthen quality science education and research by fostering innovation, ethical values, and scientific temperament for societal and sustainable development.

1.2 Mission:

- To provide quality education supported by modern infrastructure and an industry- oriented curriculum, while emphasizing ethics and critical thinking.
- To promote an innovative and research-oriented environment that fosters effective problem-solving skills and entrepreneurial development.
- To encourage innovation, entrepreneurship, and scientific ethics for developing responsible and skilled graduates.
- To foster interdisciplinary learning, sustainability, and community engagement for national development.

2. Departmental Vision & Mission

2.1 Vision:

The mathematics develops calculating, computing, critical thinking, reasoning, problem solving and formulating the skills for the upcoming mathematicians, The discipline theory and techniques taught in mathematics courses are especially important in today's society. The faculty of the department recognizes this and strives to ensure that the student learner obtain this knowledge. Develop the student's ability to intelligently communicate mathematical results in both written and oral because the mathematical background to succeed discipline both academically and professionally.

2.2 Mission:

- To develop areas related to mathematical aspects of scientific computing in all its

manifestations.

- To formulate the strategies for solving problems and acknowledge the importance of being intellectually curious throughout students adult lives.
- To develop young mathematician knowledge and discipline.
- To obtain abilities to critically assess the mathematical information.

3. Program Objectives

The program aims to:

1. To provide strong fundamental knowledge in applied mathematics.
2. To develop analytical thinking and logical problem-solving skills among students
3. To enable students to apply mathematical concepts in science, technology, research, and real-life situations.
4. To enhance computational and numerical abilities using modern mathematical tools and techniques.
5. To develop students' ability in mathematical modeling, data interpretation, and critical reasoning.
6. To provide practical exposure through projects, seminars, and problem-based learning approaches.
7. To develop students' ability in mathematical modeling, data interpretation, and critical reasoning.

4. Program Educational Objectives (PEOs)

PEO-1: To equip graduates with strong mathematical knowledge, professional competence, and entrepreneurial skills to excel as academicians, researchers, professionals, and innovators.

PEO-2: To prepare students for higher education, advanced research, and lifelong learning in the field of Mathematics and related interdisciplinary areas.

PEO-3: To develop a strong foundation in mathematical concepts, analytical thinking, logical reasoning, and problem-solving abilities among students.

PEO-4: To enhance students' teaching aptitude, communication skills, and subject expertise to enable successful careers in education, industry, information technology, and allied sectors.

PEO-5: To foster ethical values, leadership qualities, teamwork, and adaptability so that graduates can contribute effectively to society and professional environments.

5. Program Details

5.1 Program Structure & Duration

- Duration & Intake : 4 Years & 60 Seats
- Semesters: 8
- Mode: Full Time
- Credit Structure: As per NEP/University norms
- Medium of Instruction: English

5.2 Eligibility Criteria for Admission

Candidates who have cleared 10 + 2 (Higher Secondary) examination with a minimum of 45%–50% aggregate marks from a recognized school board, along with Physics, Chemistry and Mathematics (PCM) as compulsory subjects, shall be eligible for admission to the program.

5.3 Admission Procedure

- Students can apply offline on merit directly. Candidates may also visit the campus, attend an interaction session, and receive approval from the Admission Committee.
- Admission using GCAS Portal (Online mode):
  1. Quick Registration and login ID generation using Mobile number, Email ID and Aadhar details.
  2. Payment of Registration fees via online mode.
  3. Fill the profile details and upload the required documents.
  4. Select the preferences of universities and their affiliated colleges in best priority order.
  5. Final Submission of details.
  6. Merit List and Admission offers from the priority list of universities and their affiliated colleges.
  7. Acceptance of admission offer and confirmation by paying the whole semester fees after verification of documents.
  8. Student can further follow the same procedure for other admission rounds till he/she will not get proper admission offer.

The University reserves the right to revise admission procedures.

5.4 Credit Summary for BSc Course in Mathematics with effect from 2023-2024

Course Type-wise Distribution for B.Sc. Mathematics

Sr. No.	Course Type	Abbreviation	Description
1	Major Course	MJ	Core Mathematics subjects related to the discipline
2	Minor Course	MIN	Supporting interdisciplinary subjects
3	Multi / Interdisciplinary Course	MDC	Courses from allied or other disciplines
4	Ability Enhancement Course	AEC	Language, communication, and personality development courses
5	Skill Enhancement Course	SEC	Skill-oriented practical and employability courses
6	Value Added Course	VAC	Ethics, wellness, Indian knowledge system, and value-based education
7	Internship / Research Project / OJT	INT/RP/OJT	Hands-on industrial training and research exposure

Definition of Credit (as per NEP):

Teaching Component	Credit Definition
1 Hour of Theory (Lecture) per week	1 Credit
2 Hours of Practical/Laboratory Work per week	1 Credit
2 Hours of Field Work/Internship per week	1 Credit=30 hours (4 credit=120 hrs)
2 Hours of Skill/Project Work per week	1 Credit

Range of Credits (as per NEP):

Qualification	Minimum Credits Required
UG Certificate (1 Year)	48 Credits (44+4 credit of

	Internship)
UG Diploma (2 Years)	92 Credits (88+4 credit of Internship)
UG Degree (3 Years)	132 Credits
UG Honours / Honours with Research (4 Years)	176 Credits

Semester-wise Credit Structure (B.Sc. Mathematics)

Semester	**Total Credits**
Semester I	22
Semester II	22
Semester III	22
Semester IV	22
Semester V	22
Semester VI	22
Semester VII	22
Semester VIII	22
Grand Total	**176 Credits**

Proposed Abbreviation Table for Mathematics Curriculum

Sr. No.	**Category**	**Suggested Code**
1	Major	MJ
2	Minor	MIN
3	Multi / Interdisciplinary	MDC
4	Ability Enhancement Course	AEC
5	Skill Enhancement Course	SEC
6	Value Added Course	VAC
7	Indian Knowledge System	IKS
8	Internship / OJT / Research Project	INT / RP / OJT

6. Curriculum Structure

First Year 1st Semester:

Sr.No.	Category	Course Code	Course Name	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	Major	10160102	Calculus-I	3	-	2	5	4
2	Major	10160103	Matrices and Coordinate Geometry	3	-	2	5	4
3	Minor	10150101	Fundamental Physics-I	3	-	2	5	4
4	Multi / Interdisciplinary	10170105	Astrology-I	4	-	-	4	4
5	Ability Enhancement Course	AEC016	Practical English	2	-	-	2	2
6	Skill Enhancement Course	SEC006	Data Analysis Using Spreadsheet	2	-	-	2	2
7	alue Added Course	VAC004	Basic Life Support	2	-	-	2	2
Total				19	0	06	25	22

First Year 2nd Semester:

Sr.No.	Category	Course Code	Course Name	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	Major	10160202	Calculus-II	3	-	2	5	4
2	Major	10160203	Linear Algebra	3	-	2	5	4
3	Minor	10150201	Fundamental Physics-III	3	-	2	5	4
4	Multi / Interdisciplinary	10170205	Agriculture Business Management	4	-	-	4	4
5	Ability Enhancement Course	AEC015	Personality Development for Effective Leadership	2	-	-	2	2

6	Skill Enhancement Course	SEC019	Social Media Management	2	-	-	2	2
7	IKS	IKS0201	Indian Ancient History and Cultural Heritage	2	-	-	2	2
Total				19	0	06	25	22

NCrF Credit Level	**Semester**	**Major (core)**	**Minor (Elective)**	**Multi/Inter-disciplinary**	**AEC**	**SEC/ Internship**	**VAC/ IKS**	**RP/ OJT**	**Total Credit per sem.**	**Qualification/ Certificate**
First Year	**I**	**8**	**4**	**4**	**2**	**2 (SEC)**	**2 (VAC)**	**-**	**22**	**UG Certificate 44**
	II	**8**	**4**	**4**	**2**	**2 (SEC)**	**2 (IKS)**	**-**	**22**	
1st Year Total Credits		**16**	**8**	**8**	**4**	**4**	**4**	**-**	**44**	
Exit 1: Award of UG certificate in Major course with 44 credits with additional 4 credits of summer Internship in core specific NSQF defined course or continue with major and minor course for next NCrF credit level										

Second Year 3rd Semester:

Sr.No.	Category	Course Code	Course Name	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	Major	10160301	Ordinary Differential Equations	3	-	2	5	4
2	Major	10160302	Group Theory-I	3	-	2	5	4
3	Major	10160303	Numerical Method-I	3	-	2	5	4
4	Multi / Interdisciplinary	10170308	Astrology-II	4	-	-	4	4
5	Ability Enhancement Course	AEC010	Functional Grammer and Composition	2	-	-	2	2
6	Skill Enhancement Course	SEC021	Visual Arts	-	-	4	4	2

7	Value Added Course	VAC014	Yoga and Meditation for Wellness	2	-	-	2	2
Total				17	0	10	27	22

Second Year 4th Semester:

Sr.No.	Category	Course Code	Course Name	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	Major	10160401	Number Theory-I	3	-	2	5	4
2	Major	10160402	Group Theory-II	3	-	2	5	4
3	Major	10160403	Numerical Method -II	3	-	2	5	4
4	Minor	10150401	Advance Physics IV	3	-	2	5	4
5	Ability Enhancement Course	AEC008	Freelancing and Content Writing	2	-	-	2	2
6	Skill Enhancement Course	SEC023	Organic Farming	2	-	-	2	2
7	IKS	IKS0401	Indian Ancient Science and Philosophy	2	-	-	2	2
Total				18	0	8	26	22

NCrF Credit Level	Semester	Major (core)	Minor (Elective)	Multi/Inter-disciplinary	AEC	SEC/ Internship	VAC/ IKS	RP/ OJT	Total Credit per sem.	Qualification/ Certificate
Second Year	III	12	-	4	2	2 (SEC)	2 (VAC)	-	22	UG Diploma
	IV	12	4	-	2	2 (SEC)	2 (VAC)	-	22	
2nd Year Total Credits		40	12	12	8	8	8	-	88	
Exit 2: Award of UG diploma in Major course with 88 credits with additional 4 credits of summer Internship in core specific NSQF defined course or continue with major and minor course for next NCrF credit level										

Third Year 5th Semester:

Sr.No.	Category	Course Code	Course Name	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	Major	10160501	Mathematical Analysis - I	3	-	2	5	4
2	Major	10160502	Complex Variables and Fourier Series	3	-	2	5	4
3	Major	10160503	Linear Programming	3	-	2	5	4
4	Minor	10160504	Discrete Mathematics	3	-	2	5	4
5	Minor	10160505	Computational Power of Vedic Sutras	4	-	-	4	4
6	Skill Enhancement Course	SEC022	Public Speaking	-	-	4	4	2
Total				16	0	12	28	22

Third Year 6th Semester:

Sr.No.	**Category**	**Course Code**	**Course Name**	**Contact Hours/Week**				**Credit Points**
				L	T	P	Total	
1	Major	10160601	Mathematical Analysis - II	3	-	2	5	4
2	Major	10160602	Mathematical Analysis - III	3	-	2	5	4
3	Major	10160603	Graph Theory	3	-	2	5	4
4	Minor	10160604	Operation Research	3	-	2	5	4
5	Ability Enhancement Course	AEC021	Digital Privacy: Understanding and Operational Framework	2	-	-	2	2
6	Internship	20140605	Internship in Major specific course	-	-	-	4	4
Total				14	0	16	26	22

NCrF Credit Level	Semester	Major (core)	Minor (Elective)	Multi/Inter-disciplinary	AEC	SEC/ Internship	VAC/ IKS	RP/ OJT	Total Credit per sem.	Qualification/ Certificate
Third Year	V	12	8	-	-	2 (SEC)	-	-	22	UG Degree
	VI	12	4	-	2	4 (Internship)	-	-	22	
3rd Year Total Credits		64	24	12	10	14	8	-	132	
Award of UG degree in Major course with 132 credits and Internship in core discipline or continue with major and minor course for next NCrF credit level.										

Fourth Year 7th Semester:

Sr.No.	Category	Course Code	Course Name	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	Major	10160701	Advanced Ordinary Differential Equations	4	-	-	4	4
2	Major	10160702	Numerical Analysis and Complex Analysis	4	-	-	4	4
3	Major	10160703	Advanced Linear Algebra	4	-	-	4	4
4	Minor	10160704	Programming using MATLAB	-	-	8	4	4
5	Research Project/On-the-Job Training	10160705	On the Job Training (OJT) (For UG Honors Degree) / Research Project (For UG Honors with Research Degree)	-	-	-	12	6
Total				12	0	8	32	22

Fourth Year 8th Semester:

Sr.No.	Category	Course Code	Course Name	Contact Hours/Week				Credit Points
				L	T	P	Total	
1	Major	10160801	Partial Differential Equations	3	-	2	5	4
2	Major	10160802	Applied Analysis	3	-	2	5	4

3	Major	10160803	Advanced Abstract Algebra	3	-	2	5	4
4	Minor	10160804	Programming using Python	3	-	2	5	4
5	Research Project/On-the-Job Training	10160805	On the Job Training (OJT) (For UG Honors Degree) / Research Project (For UG Honors with Research Degree)	-	-	-	12	6
Total				12	0	20	32	22

NCrF Credit Level	Semester	Major (core)	Minor (Elective)	Multi/Inter-disciplinary	AEC	SEC/ Internship	VAC/ IKS	RP/ OJT	Total Credit per sem.	Qualification/ Certificate
Fourth Year	**VII**	**12**	**4**	**-**	**-**	**-**	**-**	**6 (OJT)**	**22**	**UG Honours Degree**
	VIII	**12**	**4**	**-**	**-**	**-**	**-**	**6 (OJT)**	**22**	
4th Year Total Credits		**88**	**32**	**12**	**10**	**14**	**8**	**12**	**172**	
Award of UG Honours degree in Major course with total 172 credits										

NCrF Credit Level	Semester	Major (core)	Minor (Elective)	Multi/Inter-disciplinary	AEC	SEC/ Internship	VAC/ IKS	RP/ OJT	Total Credit per sem.	Qualification/ Certificate
Fourth Year	**VII**	**12**	**4**	**-**	**-**	**-**	**-**	**6 (RP)**	**22**	**UG Honours with Research Degree**
	VIII	**12**	**4**	**-**	**-**	**-**	**-**	**6 (RP)**	**22**	
4th Year Total Credits		**88**	**32**	**12**	**10**	**14**	**8**	**12**	**176**	
Award of UG Honours with Research Degree in Major Course with total 176 credits.										

7. Teaching, Learning & Evaluation

7.1 Teaching Methodology

The program shall adopt:

- Classroom Teaching
- Workshops
- GIS/Software Training
- Research Projects
- Internships
- AI-based Learning Tools
- Blended and Digital Learning

7.2 Attendance Rules

- Minimum 75% attendance shall be mandatory in each course.
- Students below prescribed attendance may not be permitted to appear in examination.
- Additional attendance requirements may apply for practicals, internships, and field work.

7.3 Examination and Evaluation System

7.3.1 Evaluation Components

- The evaluation may consist of Continuous Internal Evaluation (CIE) and End Semester Examination (ESE)
- Continuous Internal Evaluation (CIE) may include:
- Mid-Semester Examination
- Assignments
- Presentations
- Class Test
- AI Quiz & Viva Voce
- Dissertation
- Project work
- Internship

7.4 Suggested Weightage

- Continuous Internal Evaluation: 50%
- End Semester Examination: 50%

7.5 Passing Standards

- Minimum 40% marks in each component where applicable.
- Minimum 40% aggregate for passing the course/program.
- Separate passing may be required in theory and practical examinations.

7.6 Grading System

The program shall follow Gandhinagar University grading norms.

7.6.1 Grade Table

Grade	Grade Points	From Marks	To Marks
AA	10	80	100
AB	9	75	79
BB	8	70	76
BC	7	65	69
CC	6	60	64
CD	5	55	59
DD	4	50	54
DF	0	0	49

7.7 Internship

Students shall undertake Research Project OR Industry-Based Dissertation.

Requirements may include:

- Proposal Presentation
- Periodic Review
- Final Report Submission
- Viva Voce Examination

The dissertation shall be evaluated by internal and external examiners.

8. Rules and Regulations

8.1 Rules for Promotion

A student shall be promoted to the next semester as per Gandhinagar University rules subject to fulfilment of academic requirements, minimum attendance and Completion of required credits.

8.2 Maximum Duration for Completion

The maximum duration for completing the program shall be 4 years from the date of admission (or as prescribed by the University.)

8.3 Internship Guidelines

8.3.1 Students shall undergo mandatory internship/field training in:

- Educational Institutions and Coaching Centers
- Research and Development Organizations
- Data Science, Analytics and Statistical Consulting Organizations
- Banking and Financial Institutions
- Industries involving Mathematical Modeling, Operation Research and Quality Control

8.3.2 Students must submit:

- Internship Report
- Work Diary/Logbook
- Completion Certificate
- Presentation

8.4 Discipline Rules

Students shall maintain discipline, professional ethics, and proper conduct within the institution, during internships, project works, examinations, and all academic activities. Students are expected to attend classes regularly, follow institutional rules and regulations, respect faculty members, staff, fellow students, and institutional property, and maintain academic integrity in assignments, projects, and examinations. Any form of misconduct, ragging, indiscipline, use of unfair means in examinations, damage to institutional property, harassment, or behavior affecting the academic environment shall be treated seriously and may result in disciplinary action including warning, suspension, cancellation of examination, withholding of results, or expulsion from the program as per University rules and UGC regulations. Students shall also comply with all safety, ethical, and professional standards prescribed by the institution from time to time.

8.5 Anti-Ragging Policy

The program shall strictly follow:

- UGC Anti-Ragging Regulations
- Anti-Ragging Affidavit requirements
- Institutional disciplinary procedures
- Ragging in any form is strictly prohibited.

8.6 Ethical use of Technology and AI Tools

Students are encouraged to use:

- Various Software and AI Tools
- Data Analytics Tools
- AI-based Learning Platforms
- Computational Mathematics Tools

Use of AI tools shall be ethical and academic integrity must be maintained.

9. Student Support

9.1 Industry Collaboration

The department shall actively promote collaboration with Research Institutions, Information Technology Companies, Educational Organizations and Professional Bodies to enhance practical exposure of the program. Such collaborations may include internships, field training, projects, expert lectures, workshops, skill development programs, and placement support.

9.2 Research

The department shall encourage faculty members and students to actively engage in research, innovation, and applied studies in areas such as applied mathematics, data analytics, mathematical modelling, and Computational mathematics. Students may undertake research projects, data analysis studies, optimization studies and problem solving activities as part of their academic and professional training. Participation in seminars, conferences, workshops, funded projects, and collaborative research activities shall be encouraged to promote academic excellence, innovation, and industry- oriented learning.

9.3 Library and Laboratory Facilities

Adequate library, laboratory, and digital learning facilities shall be made available to support effective teaching, practical training, research, and skill development under the program. The department shall facilitate access to relevant books, journals, research publications, e-resources, and digital learning platforms related to applied mathematics. Necessary computing facilities, software, data analytics tools, internet access, and other technical resources required for practical and project-based learning shall also be provided to enhance industry-oriented education, research capability, and professional

competency among students.

9.4 Student Support and Mentoring

A structured system for student support, academic mentoring, and professional guidance shall be implemented for students enrolled in the program. The department shall facilitate academic counselling, mentoring, career guidance, research support, and skill development activities to assist students in their academic progression and professional growth. Students may also be provided opportunities for interaction with field experts, participation in workshops, seminars, training programs, and extracurricular activities aimed at enhancing employability, leadership qualities, communication skills, and overall personality development. Necessary support mechanisms for addressing academic and personal concerns shall also be made available as per institutional policies.

9.5 Placement and Career Development

The department shall promote placement assistance and career development activities for students through professional networking, training programs, internships, and campus engagement initiatives.. Career development activities such as aptitude training, resume preparation, soft skill development, entrepreneurship guidance, certification programs, expert sessions, and placement-oriented workshops may also be organized to enhance professional competency and employability of students.

10. Program Credibility

The Department of Mathematics is committed to achieving excellence in teaching, research, and academic development by providing a strong foundation in mathematical sciences. The department focuses on developing analytical thinking, logical reasoning, problem-solving abilities, and computational skills among students.

With qualified and experienced faculty members, the department ensures quality education through innovative teaching methodologies, practical applications, seminars, workshops, and research-oriented learning. The curriculum is designed in accordance with modern academic and industry requirements, enabling students to pursue higher studies, research, competitive examinations, and professional careers in education, IT, finance, data science, and related fields.

The department also encourages students to participate in academic activities, projects, interdisciplinary learning, and skill development programs to enhance their overall personality and professional competence. Through continuous academic improvement and student-centered learning, the Department of Mathematics strives to maintain credibility, integrity, and excellence in higher

education.

10.1 Scope and Career Opportunities

Graduates of the program may work in:

- Consultant Companies
- Information Technology (IT) Companies
- Banks and Financial Institutions
- Insurance Companies
- Research and Development Organizations
- Government Departments and Public Sector Undertakings
- Educational Institutions and Academic Organizations
- Entrepreneurship and Start-up Ventures

10.2 Potential Job Roles

- Mathematics Teacher/ Tutor
- Research Assistant
- Business Analyst
- Banking and Insurance Professional
- Academic and Research Professional

10.3 Higher Study & Professional Opportunities

Students may pursue:

- Master of Science in Mathematics (Pure /Applied Mathematics), Statistics, Data Science or related disciplines
- Master of Computer Applications
- Mater of Business Administrations
- Integrated Ph.D. and Ph.D. in Mathematics and related disciplines
- National and International Professional Certifications in Mathematics, Data Analytics, and Computational Sciences
- Competitive Examination Preparation for Government, Banking, Insurance, and Research

11 Collaborative Field Work / Experimental Work

The B.Sc. Mathematics program shall encourage students to participate in collaborative field work, experimental activities, and project-based learning to strengthen their analytical, computational, and problem-solving skills. Such activities may include:

- Statistical data collection and analysis projects
- Mathematical modeling of real-world problems
- Computational mathematics and programming exercises
- Data analytics and visualization projects
- Operations research and optimization case studies
- Financial and actuarial mathematics applications
- Interdisciplinary projects involving mathematics and technology
- Collaborative research projects with academic institutions and industries
- Participation in mathematics laboratories, workshops, and innovation activities
- Experimental work using mathematical software, statistical tools, and computational platforms

These activities shall provide practical exposure to the application of mathematical concepts, enhance research aptitude, promote teamwork, and prepare students for higher studies and professional careers in mathematics and allied disciplines.

12 Review and Revision of Regulation

The University reserves the right to interpret, modify, revise, amend, or update any provision, rule, regulation, curriculum structure, evaluation pattern, academic requirement, or operational guideline related to the program from time to time in accordance with University regulations, statutory requirements, industry developments, and academic needs.

In case of any ambiguity or dispute regarding interpretation of any provision of this manual, the decision of the University/Competent Authority shall be final and binding on all stakeholders. Any amendments, additions, or revisions approved by the appropriate academic or statutory bodies of the University shall automatically become applicable to the program.

Annexure I: Detailed Syllabus

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 1

Subject Code: 10160102	**Subject Title:** Calculus – I
Pre-requisite: To study this course, a student must have subject Mathematics in class XII.	

Course Objective:

(1) To gain proficiency in calculus computations and analyze the behavior of functions.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Indeterminate forms:** Various types of Indeterminate forms and L'Hospital's Rules. **Infinite sequence and series**: Monotonic increasing and Monotonic decreasing sequences, Telescoping series, Geometric series, Alternating series, Convergence and divergence of sequence and series, Divergent test, Comparison test, Integral test, Ratio test, Root test, Leibnitz's test, Test of convergent for power series, Test of Absolutely convergent and Conditional convergent.	15	34%
2	**Successive Derivatives**: Standard for n^{th} derivative, Leibniz's Theorem, Rolle's Theorem, Lagrange's and Cauchy's Mean Value Theorem (MVT) Taylor's and Maclaurin's Theorems, Series expansions of trigonometric functions, exponential functions, inverse trigonometric functions.	15	33%
3	**Integrals**: Fundamental theorem of integral calculus, Mean value theorems of integral calculus, Differentiation under the sign of Integration, Improper integrals, Classification and Convergence of Improper Integrals, Comparison test, p-test, Reduction Formulae	15	33%

Course Outcome: After completion of this course, student will be able to

- Develop proficiency in handling indeterminate forms, mastering convergence tests, and applying mathematical techniques to rigorously assess the behavior of functions, sequences, and series, fostering analytical thinking and problem-solving skills.
- Master successive derivatives and their applications.
- Gain proficiency in handling diverse integrals and understanding their convergence properties.

List of References:

1. G. B. Thomas and R. L. Finney, Calculus, Pearson Education, 2010.
2. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus, Pearson Education, Delhi.

3. Shanti Narayan, Differential Calculus, S. Chand & Co. Ltd,1996 .
4. Shanti Narayan, Integral Calculus, S. Chand & Co. Ltd, 1999.
5. T. M. Apostol, Calculus Vol.-I, John Wiley & Sons Inc., 1974.
6. T. M. Apostol, Calculus Vol.-II, John Wiley & Sons Inc., 1974.
7. B. S. Grewal, Higher Engineering Mathematics, Thirty-fifth edition, Khanna Publ.
8. Louis Leithod, The Calculus with Analytic Geometry, Harper-Collins Pub.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses/122104017)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Indeterminate forms and L'Hospital's rule.
2. Test of Convergent and Divergent: Divergent test, Comparison test, Integral test, Ratio test, Root test, Leibnitz's test.
3. Test of Convergent and Divergent: Test of convergent for power series, Test of Absolutely convergent and Conditional convergent.
4. Successive Derivatives, Standard for n^{th} derivative, Leibniz's Theorem.
5. Rolle's Theorem, Lagrange's and Cauchy's Mean Value Theorem.
6. Concavity and Convexity, Maxima and Minima, Taylor's theorem and Maclaurin's theorem.
7. Riemann's integrals, Fundamental theorem of integral calculus, Mean Value Theorems of integral calculus.
8. Improper Integrals, Convergence of Improper Integrals.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE

SEMESTER- 1

Subject Code: 10160103	**Subject Title:** Matrices and Co-ordinate Geometry
Pre-requisite: To study this course, a student must have knowledge of basic concepts of curves and algebra.	

Course Objective:

- To understand the concepts of Matrices and principles and concepts of co-ordinate geometry.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Matrices:** Introduction of Matrices and types of matrices, Different types of operations on matrices, Elementary operations on matrices, Row and column reduction to Echelon form, Linear dependence and independence of row and column matrices, Inverse matrix by determinant and Row echelon form method, Rank of a matrix; Determinant method, Rank of a matrix by reducing to row reduced Echelon form, Normal form	15	33%
2	**Simultaneous Systems**: Solutions of Homogeneous and Non-homogeneous linear equations, Application of matrices in solving a system of simultaneous linear equations, Cramer's rule, Condition of consistency and nature of the general solution of a system of linear non-homogeneous equations, Eigen values, Eigen vectors and their properties, Cayley-Hamilton theorem (With Proof), Inverse of matrices by Cayley- Hamilton theorem, Diagonalization of Matrices	15	33%
3	**2-D and 3-D Geometry:** Polar Equation of Straight line, Polar equation of a conic, Directrix, Chords, Tangent and Normal to a conic, General equation of second degree equation, Tangent plane, Angle between a plane and a line, Coplanar lines, The shortest distance between two lines, Definition of sphere, cone and cylinder, the length of the tangent from the point to the sphere, Intersection of spheres at a point, Equation of the tangent plane to the sphere at a point, Envelope cone of sphere, Enveloping cylinder.	15	34%

Course Outcome: After completion of this course, student will be able to

- Gain proficiency in elementary operations on matrices and the process of reducing matrices to echelon forms, enhancing their ability to analyze and manipulate matrix structures.
- Gain a deep understanding of the fundamental concepts of linear algebra, including solving systems of linear equations, eigenvalues, eigenvectors, and matrix operations.
- Acquire skills in matrix analysis, including Cramer's Rule, Cayley-Hamilton theorem, and matrix diagonalization.
- Gain a strong foundation for solving real-world problems in physics, engineering, computer science, and data analysis.
- Expertly handle polar equations, symmetrical straight lines, conic sections, and geometric relationships, demonstrating a profound grasp of advanced mathematical concepts.
- Showcase proficiency in solving problems related to spheres, cones, cylinders, and their intersections.

List of References:

1. Serge Lang, Introduction to Linear Algebra, Springer (India).
2. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley 1995.
3. Shanti Narayan, P.K. Mittal, A Textbook of Matrices, S Chand & Company, 2010.
4. Fuzhen Zhang, Matrix Theory- Basic Results and Techniques, Springer, 1999.
5. P.R. Vittal, Analytical Geometry 2d & 3D, Pearson, 2013.
6. S.L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London. 2018.
7. Shanti Narayan, Analytical Solid Geometry, S.Chand.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses/122104017)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Row and Column reduction to Echelon form.
2. Inverse matrix by determinant and Row reduction to echelon form.
3. Rank of matrix by determinant method, Reduction to row echelon form and Normal form.
4. Solutions of a system of Homogeneous and Nonhomogeneous linear equations.
5. Eigne values and Eigen vectors, Cayley- Hamilton theorem and Inverse of a matrix by Cayley-Hamilton theorem.
6. Polar equations of a straight line: Joining two lines, Normal form, Line parallel and perpendicular to the initial line, General equation.
7. Polar equations of a circle: Centre – Radius form, Centre at the pole, Passing through the pole and touching the polar axis at the pole, Passing through the pole and the diameter through pole making an angle α with initial line.
8. Applications of sphere, cone and cylinder.

Gandhinagar Institute of Science
Bachelor of Science- Physics
Semester-1

Subject Code: 10150101	**Subject Title: Fundamental Physics-I**
Pre-requisite: Students must comprehend the fundamental ideas of essential topics such as Physics, and Mathematics up to higher secondary level.	

Course Objective:

(1) To develop young Physics and Electronics scholars with a healthy mix of academic, emotional, and cultural development.

(2) Our first goal will be instilling a value system and cultivating sensitivity and tolerance for human being and society.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	**-**	**02**	**04**	**50**	**50**	**25**	**25**	**150**

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
Unit-1	**Fundamentals of Classical Mechanics** Classical mechanics, Newton's first law, mass, Weight, Force, Newton's second law, Newton's third law, Weight and mass, Applications of Newton's laws in one dimension, Motion in three dimensions with constant acceleration, Newton's laws in three dimensional vector form, Projectile motion, Drag forces and motion of projectile, Uniform circular motion, Relative motion, Collisions, Linear momentum, Impulse and momentum, Conservation of momentum, Two particle and many particle systems, System of variable mass, Rotational motion, The rotational variables, Rotational quantities as vectors, Relationships between linear and angular variables	15	34
Unit-2	**Basic Mathematical Physics** •Introduction, Applications of Vector Multiplication, Triple Scalar Product, Triple Vector Product, Differentiation of Vectors, Fields, Directional Derivative; Gradient, some other expressions involving del, Green's Theorem	15	33

	in the plane, The Divergence and the Divergence theorem. Gauss's law, The curl and Stoke's theorem.		
Unit-3	**OPTICS** Fermat's principle and its applications: Fermat's principle of least time, Laws at reflection and laws of refraction from Fermat's principle. Refraction at a single spherical surface, Reflection by a single spherical surface, Thin lens, the principle foci and the focal length of lens, Newton's formula and rings, Lateral magnification, Aplanatic points of a sphere, **Matrices and Matrix methods in Optics:** Matrix equations, Multiplication of a Matrix by a number, Multiplication of Matrices, Zero matrix, Identity Matrix or Unit Matrix, Applications of matrix Multiplication, Inverse of a Matrix, Rotation of Matrices. The Matrix method, Unit planes, Nodal planes, A system of two thin lenses, Huygens' theory, Rectilinear propagation, Superposition of two sinusoidal waves, Coherence and interference of light waves, Interference pattern, Intensity distribution	15	33

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
List of Experiments			100
1	**Newton's Ring:** To find the wavelength of light of given monochromatic source. To find the radius of curvature of given lens.	4	
2	**Cauchy's Constant:** To determine Cauchy's constant A and B using given formula and to find the wavelength of unknown line of a mercury spectrum.	4	
3	**Least Square Fitting (Linear Fitting)**	4	
4	**Characteristic of thermistor.**	4	
5	**Melde's Experiment:** To prove (i)P/L & (ii) T/L^2 constant	4	
6	**Resonator:** To test the accuracy of relation n2 (V + Kv) = constant and to determine the frequency of unknown fork.	4	
7	**Diagonalization of given matrix (2x2). Evaluate trace of a matrix.**	4	

Course Outcome: After completion of this course, student will be able to

- Apply knowledge of Newton's laws of motion and classical mechanics to explain natural physical processes and related technological advances.

- Prepare students to work with vectors in the following ways: triple product, Curl, gradient and divergence, vector differentiation and vector related theorems.
- Describe interference in a thin film caused by reflected and transmitted light, as well as the colors seen in reflection by thin films of oil, mica, and soap bubbles.
- Explain how Newton's rings develop and do a Newton's ring experiment to determine an unknown wavelength of light and the refractive index of a liquid.
- Derive the laws of reflection and refraction (Snell's law), apply Fermat's concept of least time.
- Explain the matrix and their multiplication, zero matrix, inverse matrix etc. and the matrix methods to solve the problems of Optical systems.
- Be capable of making observations, displaying data visually, performing calculations based on the data and graph, and determining the results/outcomes/conclusions of the experiment.
- Use a mechanical device to measure with a precision of 0.01 cm and 0.001 cm. They are also taught how to read and use a digital multi-meter.
- Learn how to use the least square method and analysis of error to define the error specification among experimental readings/observations.

List of Textbooks: -Nil-

List of Reference Books:

1. Mathematical methods in Physical Sciences By M.L. Boas: Article no.: 6.1 to 6.11 and Chap. 3-section 6
2. Physics by Halliday, Resnick and Krane, Vol.1, 5th Edition, Wiley Publishing ,Articles: 3.1 to 3.8, 4.1 to 4.6, 6.1 to 6.5, 7.2 to 7.6, 8.1 to 8.6
3. Optics by Subramanyam and Brijlal: Articles: Article no: 2.1, 2.2, 2.5, 2.6, 15.1, 15.2, 15.3, 15.4, 15.5, 15.6 Article no: 5.1, 5.2, 5.3, 5.10
4. Optics by Ajoy Ghatak 6th Ed., McGraw Hill Education (India) Pvt. Ltd. New Delhi, 2017: Article no. : 3.1,3.2, 4.1 to 4.8, 5.2 to 5.5, 12.1 to 12.3
5. Mathematical Methods for Physics and Engineering by Riley, Hobson and Bence, Cambridge University Press, 1998.
6. Physics by Halliday, Resnick and Krane, Vol.1 and 2, 5th Edition, Wiley Publishing
7. Concepts of Physics, Volume 1 and 2 by H C Verma, Bharati Bhawan Pub. & Distributers.
8. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
9. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd.,2015.
10. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014

Open e-Resource:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learnings- https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc.

Semester-1

Subject Code: 10170105	**Subject Title:** Astrology-1
Pre-requisite:	

Course Objective:

1. To introduce the basic principles, origin, development, and key texts of astrology.
2. To understand the astrological view of the universe and its applications in various fields.

Teaching Scheme (Hours per week)			**Credit**	**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**		**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
04	-	-	04	50	50	-	-	100

Subject Contents			
Sr. No	**Topics**	**Total Hours**	**Weight (%)**
1	**Astrology** Introduction Origin Development of Astrology	10	23%
2	**Elements of Astrology** Siddantha Samhitha Hora	11	27%
3	**Concept of Universe** Word Solar family Earth	11	27%
4	**Applications of Astrology** Social Environmental Health and Education	10	23%

Course Outcome: After completion of this course, students will be able to

1. Understand the origin, development, and core elements of astrology, including key texts like Siddantha, Samhitha, and Hora.
2. Describe the astrological universe and the roles of the solar family and Earth.
3. Identify and analyze essential astrology components and terminology.
4. Evaluate astrology's applications in social, environmental, health, and education fields.

Textbooks

1. "Brihat Samhita" by Varahamihira
2. "Surya Siddhanta" (Translation by Ebenezer Burgess or modern Indian authors)
3. "Brihat Parashara Hora Shastra" by Maharishi Parashara
4. "Essentials of Astrology" by Komilla Sutton

Reference Books

1. "Light on Life: An Introduction to the Astrology of India" by Hart de Fouw & Robert Svoboda
2. "Astrology and Science" by B.V. Raman
3. "Phaladeepika" by Mantreswara
4. "Indian Astrology" by B.V. Raman

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 2

Subject Code: 10160202	**Subject Title:** Calculus – II
Pre-requisite: To study this course, a student must have subject Mathematics in class XII.	

Course Objective:

(1) To gain proficiency in advanced calculus computations and analyze the behavior of functions.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Vector Differentiations:** Limit of a vector function, Derivation of a vector function, Geometrical and physical significance of vector differentiation, Gradient, Directional derivatives, Divergence and Curl Operators, Solenoidal and Irrotational Vectors. **Vector Integration:** Line integral, Conservative force field, Scalar potential, Work done by a force, Gauss divergence theorem, Verification of Gauss divergence theorem, Green's theorem, Verification of Green's theorem, Stoke's theorem, Verification of Stoke's theorem.	15	34%
2	**Partial Derivatives**: Limit and Continuity of a function of two variables, Partial Derivatives, Homogeneous functions of multi variable, functions, Total Differentiations, Differentiations of Composite functions, Implicit and Explicit functions, Application of Partial derivatives.	15	33%
3	**Multiple Integration:** Double integrals, Change of order of double integral, Double integral in polar coordinates, Area by double integral, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical coordinates, Jacobian, Change of variables in double integrals and triple integrals.	15	33%

Course Outcome: After completion of this course, student will be able to

- Know the geometrical and physical significance of vector differentiation and apply them.
- Apply vector integration to find the work done by a force.
- Obtain Gauss, Green's and Stoke's theorems and their application in real life problems.
- Understand the derivative in several variables.

- Apply Partial derivatives to find real applications.
- Evaluate the problems in double and triple integrations.
- Evaluate area and volume by multiple integrals.

List of References:

1. G. B. Thomas and R. L. Finney, Calculus, Pearson Education, 2010.
2. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus, Pearson Education, Delhi.
3. Shanti Narayan, Differential Calculus, S. Chand & Co. Ltd,1996 .
4. Shanti Narayan, Integral Calculus, S. Chand & Co. Ltd, 1999.
5. T. M. Apostol, Calculus Vol.-I, John Wiley & Sons Inc., 1974.
6. T. M. Apostol, Calculus Vol.-II, John Wiley & Sons Inc., 1974.
7. B. S. Grewal, Higher Engineering Mathematics, Thirty-fifth edition, Khanna Publ.
8. Louis Leithod, The Calculus with Analytic Geometry, Harper-Collins Pub.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses/122104017)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Problems of direction derivatives, divergence, and curl.
2. Problems of line integral and Gauss theorem.
3. Problems of Green’s theorem.
4. Problems of Stoke’s theorem.
5. Problems of partial derivatives.
6. Problems of Application of partial derivatives.
7. Problems of double and triple integrals.
8. Problems of Application of multiple integrals.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE- Mathematics

SEMESTER- 2

Subject Code: 10160203	**Subject Title:** Linear Algebra
Pre-requisite: To study this course, a student must have knowledge of basic concepts of matrix and its properties.	

Course Objective:

- Linear algebra is a basic course in almost all branches of science.
- A full course in undergraduate program will help students in finding real life applications.
- The objective of this course is to introduce a student the basics of linear algebra and some of its application.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Vector spaces, subspaces, examples, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.	12	27%
2	Linear transformations, null space, range, rank and nullity of a linear transformation. Matrix representation of a linear transformation, Algebra of linear transformations, Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix, Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators, Basics of Fields, Eigenspaces of a linear operator, diagonalizability, Invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator.	18	40%
3	Inner product spaces and norms, Gram-Schmidt orthogonalization process, Orthogonal complements, Bessel's inequality, the adjoint of a linear operator, Least Squares Approximation, minimal solutions to systems of linear equations, Normal and self-adjoint operators, Orthogonal projections, and Spectral theorem.	15	33%

Course Outcome: After completion of this course, student will be able to

- Provide a comprehensive understanding of vector spaces, subspaces, and related concepts in linear algebra.
- Study a deep understanding of linear transformations, matrices, dual spaces, eigenspaces, and more.
- Understand inner product spaces, orthogonalization processes, and the analysis of linear operators.

List of References:

1. Serge Lang, Introduction to Linear Algebra, Springer (India).
2. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley 1995.
3. Shanti Narayan, P.K. Mittal, A Textbook of Matrices, S Chand & Company, 2010.
4. Fuzhen Zhang, Matrix Theory- Basic Results and Techniques, Springer, 1999.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses/122104017)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Identify examples of vector spaces in various contexts (e.g., polynomials, matrices, functions).
2. Determine whether a given subset of a vector space is a subspace.
3. Determine whether a given set of vectors forms a basis for a vector space.
4. Verify the linearity of a given transformation.
5. Compute the change of coordinate matrix between two bases.
6. Explore inner product spaces in Euclidean spaces.
7. Apply the Gram-Schmidt process to orthogonalize a set of vectors.
8. Find the orthogonal projection of a vector onto a subspace.

Gandhinagar Institute of Science
Bachelor of Science- Physics
Semester-2

Subject Code: 10150201	**Subject Title: Fundamental Physics III**
Pre-requisite: Students must comprehend the fundamental ideas of essential topics such as Physics, and Mathematics up to higher secondary level.	

Course Objective:
(1) To develop young Physics and Electronics scholars with a healthy mix of academic, emotional, and cultural development.
(2) Our first goal will be instilling a value system and cultivating sensitivity and tolerance for human being and society.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	**-**	**02**	**04**	**50**	**50**	**25**	**25**	**150**

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Basic Electric & Electronic Circuits:** **AC Bridges:** Condition for bridge balance, Maxwell bridge, Hay bridge, Schering bridge, Wein bridge **Diode circuits:** Load line analysis of a diode circuit, use of diode in rectifier, Half wave, full wave and bridge rectifier with their performance, Capacitor input filter, peak inverse voltage and surge current, clippers and limiters, clampers, the Zener diode, the loaded regulator, The unbiased transistor, the biased transistor, transistor currents, the CE connection, the base and collector curves.	15	34
2.	**Introduction to Electrostatics** Divergence and Curl of Electrostatic fields: Field lines, flux, and Gauss's Law, The Divergence of E, Applications of Gauss's Law, The Curl of E,	15	33

	Electric Potential: Introduction to potential, comments on potential, Poisson's equation and Laplace's Equation, The potential of a localized charge distribution, Summary: Electrostatics boundary conditions, Work and Energy in Electrostatics: The work done to move a charge, The energy of a point charge distribution, The energy of a continuous charge distribution, Comments on electrostatics Energy, Conductors: Basic Properties, Induced Charges, Surface charges and the force on a conductor, Capacitors.		
3.	**Basic Nuclear Physics** **Radioactivity and its applications:** The law of radioactive decay (review), Radioactive growth and decay, ideal equilibrium, Transient equilibrium and secular equilibrium, Radioactive series, Radioactive isotopes of lighter elements, Artificial radioactivity, Age of earth, Carbon dating (Archaeological time scale) **The Q Equation:** Types of Nuclear Reactions, The balance of mass and Energy in Nuclear reactions, The Q Equation, Solution of the Q Equation. Constituents of the nucleus properties: Measurement of Nuclear radius, Constituents of the nucleus and their properties, nuclear spin, moments and statistics. Methods of measurement of half-life, Numericals based on Q-equation.	15	33

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
List of Experiments			100
1	**Stefan Constant:** To verify the Stefan Boltzmann's fourth power law by using dc power source.	4	
2	**Radioactive decay:** Simulation of Nuclear Radioactive decay using random function of scientific Calculator.	4	
3	**Deflection Magnetometer:** To determine the magnetic moment (M) of given bar magnate using deflection magnetometer in Gauss A and B position.	4	
4	**Projection Method:** To find the value of a low resistance by the method of projection of potential.	4	
5	**Value of capacitance: For** given two capacitors determine the value of capacitance for each of them and (i) by connecting them in series (ii) by connecting them parallel.	4	

6	**Owen's Bridge:** To find the value of an inductance of an unknown inductor by using Owen's bridge circuit.	4	
7	**To Determine Wavelength of LASER light using Spectrometer.**	4	

Course Outcome: After completion of this course, student will be able to

- Describe and design HW, FW, and Bridge rectifiers, transistor circuits as well as different power supply filters.
- Describe Divergence and Curl of Electrostatic fields.
- Apply Gauss's law for spherical, cylindrical and plane symmetry. Discuss the electric potential and line integration of the electric field, as well as the relationship between the electric field and the potential gradient.
- **E**xplore the normal component of the electrostatic field by using the concepts of potential and electric field to develop Poisson's equation, Laplace's equation, and the boundary condition.
- Calculate the energy of a point charge as well as the energy of continuous charge distributions. Deduce the capacitance of a given electrostatic system by identifying the fundamental features of conductors, describing capacitors, and identifying the basic properties of conductors.
- Define a Nuclear reaction and understand its various varieties, know the difference between a Natural and Artificial radioactivity and the different kinematics associated with it.
- Apply the formulas in various applications in Geo sciences and Nuclear Physics.

List of Text Books: -Nil-

List of Reference Books:

1. Electronics Devices and Circuits, Allen Mottershead
   Articles: 2.1, 2.3, 2.8, 3.1, 3.4, 3.9, 3.10, 3.13, 4.1, 4.4, 4.6
2. Basic Electronics and Linear Circuits, N N Bhargava, D C Kulshreshtha, and S C Gupta, TMH Edition Articles: 4.6, 4.6.1, 4.6.2, 4.7.2, 4
3. Electronics Devices and Circuit Theory (7th Edition), Robert Boylstead Article: 2.9
4. Electronic Principles by A P Malvino, 6th Edition, Tata McGraw-Hill Ltd., 4.1 to 4.11, 5.1, 5.2, 6.1 to 6.6
5. Introduction to Electrodynamics: Third Edition David J Griffiths, Prentice –Hall of India Private Limited.
6. Electromagnetism by B.B. Laud, Wiley Eastern Limited
7. Physics by Halliday, Resnick and Krane, Vol.1 and 2, 5th Edition, Wiley Publishing Article No: 26.1 to 26.6, 27.1 to 27.6, 28.1 to 28.8 and 31.1 to 31.4.
8. Nuclear Physics By S.B. Patel; New Age International Limited. A: Article no: 2.6 to 2.13 & B: Article no: 3.1 to 3.5
9. Nuclear Physics by Kenneth Krane
10. Modern Physics by Aruldas
11. Physics by Halliday, Resnick and Krane, Vol.1 and 2, 5th Edition, Wiley Publishing
12. Concepts of Physics, Volume 1 and 2 by H C Verma, Bharati Bhawan Pub. & Distributers.

13. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
14. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd.,2015.
15. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014

Open e-Resource:

1. MIT Open Learning - Massachusetts Institute of Technology**,** https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning- https://www.youtube.com/user/nptelhr
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

GANDHINAGAR INSTITUTE OF SCIENCE

B.Sc. /B.A.

Semester-2

Subject Code: 10170205	**Subject Title: Agriculture Business Management**
Pre-requisite: Candidate must have achieved regular 10+2 degree from any recognized Board.	

Course Objective: (1) To expose learners to the environment in which the agri-business is conducted.

(2) Focus will be on understanding micro and macro environmental forces and their impact on agri-business.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
04	-	-	04	50	50	-	-	100

Subject Contents			
Sr. No	**Topics**	**Total Hours**	**Weight (%)**
1	Agri-business: Meaning, definition, history and scope of agri-business (Input, Farm Product Sectors). Importance of agri-business in the Indian economy. Changing dimension of agricultural business. Agri-business Management-distinctive features, nature and components.	15	25%
2	Structure of Agriculture - Linkages among sub-sectors of the Agribusiness sector; economic reforms and Indian agriculture; impact of liberalization, privatization and Globalization on Agri business sector. Emerging trends in production, processing, marketing and exports; policy controls and Regulations relating to the industrial sector with specific reference to agro-industries.	15	25%
3	Role of agriculture in Indian economy; problems and policy changes relating to farm Supplies, farm production, agro processing, agricultural marketing, agricultural finance etc. in the country. Demand and Supply: Definition, Meaning, Laws, Factor affecting, Types, Determinants. Elasticity: Definition, Types Natural Resource Economics.	15	25%

4	Agricultural Economics: Meaning, Definition, Scope and Importance of Agricultural Economics Basic Concepts: Goods, Services, Utility, Value, Price, Wealth, and Welfare, Consumption Wants: Meaning, Characteristics, Classification of Wants, Importance.	15	25%

Course Outcome: After completion of this course, student will be able to

1. Understand the fundamentals of management with reference to agribusiness.
2. Acquaint with various functional areas of agribusiness.
3. Study the managerial functions and its applications with reference to agribusiness.
4. Learn the concepts and process of Planning and Organizing.
5. Provides knowledge about the Staffing, Directing and Control.

List of Reference Books:

1. Freddie L. Barnard, Jay T. Akridge, Frank J. Dooley, Agribusiness Management (Environmental and Agricultural Economics), 2010.
2. John B. Penson, Oral Capps, C. Parr Rosson, Richard T. Woodward, Introduction to Agricultural Economics, Pearson, 2019.
3. W.J. Obst, R. Graham & G. Christie, Financial Management in Agribusiness, Scientific Publishers, 2010.

Gandhinagar University UG/PG
Semester- II

Subject Code: IKS0201	Subject Title: Indian Ancient History and Cultural Heritage

Course Objective:

- Foster an appreciation for the composite nature of Indian history, culture and heritage.
- Instill a sense of love and belonging among learners, contributing to nation-building efforts.
- Provide an overview of various components of cultural heritage, including fairs, festivals, dances, art, architecture, and historical landmarks, which are crucial for a deeper understanding of history.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
02	-	-	02	-	-	25/ Project	25/ Project	50

Subject Contents			
Sr. No	**Topics**	**Total Hours**	**Credit**
1	**Indian Ancient History:** Introduction of Ancient India. Harappan Civilization. Rigvedic & Later Vedic Period. India in the 6th Century B.C. Persian and Greek invasions and its impact. Mauryan and Gupta Periods. Post – Mauryan. Brief History of the Sanskrit literature: The Vedas, The Brahmanas and Upanishads & Sutras, Epics: Ramayana and Mahabharata & Puranas.	15	1
2	**Indian Cultural Heritage:** Ethnic Indian Cultural Construct – Fairs & Festivals and their historical background. Indian dances as Cultural Heritage. Indian Architecture: Temples, Stupas, Caves, Chaityas. Medieval Architecture and Colonial Architecture. Social culture in India- Vedic culture. Ancient period- varna and jati, family and marriage in India, position of women in ancient India, Contemporary period; caste system and communalism.	15	1

Course Outcome:

After completion of this course, students will be able to

- Demonstrate knowledge of the key events, periods, and figures that have shaped Indian history from ancient to modern times, including their impact on the socio-political and economic landscape.
- Analyze the rich cultural heritage of India, including art, architecture, literature, and philosophy, while recognizing the contributions of various communities to India's pluralistic society.

List of Text Books:

1. An advanced history of India – causes and decline of Guptas by B.C. Majumdar and others, 1967, Macmillan.
2. Ancient India by R.C. Majumdar, 1977, Motilal Banarasi Das.
3. History of Ancient India by Rama sankar Tripati, 1942, Motilal Banarasi Das.
4. History and culture of India to 1000 A.D. by H.V. Srinivasa Murthy, 1980, S. Chand and Co.
5. History of South India by K.A. Nilakanta Sastry 1976, Oxford University Press.
6. History of Ancient India by Krishnaswamy Aiyangar, 1980, Seema Publishers.
7. Ancient India by V.D. Mahajan, 1985, S.Chand and Company.
8. Advance History of India by K.A. Nilakantasastry and C.S.Srinivasachari, 1980, Allied Publishers.
9. Ancient Indian History and Civilization by Silendranath Sen, 1988, Wiley Eastern.
10. Lothal and Indus Civilizations by S.R.Rao, 1972, Asia Publishers, Madras

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 3

Subject Code: 10160301	**Subject Title:** Ordinary Differential Equations
Pre-requisite: To study this course, a student must have known about differential equations.	

Course Objective:

(1) To teach Ordinary Differential Equations in more depth.

(2) To teach Applications of Ordinary Differential Equations.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**First Order and First Degree ODE:** Methods of solving differential equations of first order and degree one: Variable separable, Homogeneous and non- homogeneous differential equations, exact differential equations (without proof), Integrating factors, linear differential equation, Bernoulli's differential equation and Differential Equations reducible to them	15	34%
2	**First Order and Higher Degree ODE:** Method of solving differential equations of first order and higher degree solvable for y, solvable for x, solvable for p (where $p = \frac{dy}{dx}$) , Clairaut's differential equation, Lagrange's differential equation.	15	33%
3	**Higher Order ODE:** Linear differential equations of higher order and degree one: Differential operators. Linear differential equations of higher order and degree one with constant coefficients, Complementary and particular integrals. Inverse operator, operational methods for its solutions, Euler form of homogeneous linear differential equations with variable coefficients.	15	33%

Course Outcome: After completion of this course, student will be able to

- Solve first order and first degree ordinary differential equations.
- Solve first order and higher degree ordinary differential equations.
- Solve higher order ordinary differential equations.

List of References:

1. Elementary Differential Equations, Rainville and Bedient, Macmillan Publication.
2. Ordinary and Partial Differential Equations, M. D. Raisingania, S. Chand, 2009.
3. Differential Equations- D.A. Murray, Tata McGraw Hills.
4. Ordinary Differential Equations and Partial Differential Equations, Nita shah, PHI Ltd.
5. Theory and problems on Differential Equations- Frank Ayres, McGraw Hill Book Co., New York.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Problems of variable separable, Homogeneous and non- homogeneous differential equations.
2. Problems of exact differential equations.
3. Problems of linear differential equation.
4. Problems of first order and higher degree ODE solvable for y.
5. Problems of first order and higher degree ODE solvable for x.
6. Problems of first order and higher degree ODE solvable for p.
7. Problems of constant coefficients ODEs.
8. Problems of variable coefficients ODEs.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 3

Subject Code: 10160302	**Subject Title:** Group Theory-I
Pre-requisite: To study this course, a student must have the knowledge of the set theory.	

Course Objective:

(1) To teach the basics of the group theory.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Groups:** Relation, Equivalence Relation, Partition of set, Binary operations, Division Algorithm for Integers, Congruence modulo Relation in Z, Groups, elementary properties, Finite Groups and Group tables, Commutative and non-commutative groups.	15	33%
2	**Subgroups:** Subgroups, normalizer and centralizers, order of an element, order of a group, cyclic subgroup generated by an element, Lattice diagrams of finite groups, cosets and their properties, Lagrange's theorem and their applications, Euler's theorem, Fermat's theorem.	15	34%
3	**Permutations:** Permutations, cycle, transposition, even and odd permutations, order of a permutation, inverse of a permutation and other Properties of Permutations.	15	33%

Course Outcome: After completion of this course, student will be able to

- Understand the groups and their basic properties.
- Understand the subgroups, cyclic subgroup, cosets, Lagrange's and Fermat's theorems.
- Apply many mathematical concepts studied in permutation groups.

List of Textbooks:

1. Abstract Algebra - I. H. Sheth, PHI, New Delhi, 2nd edition-2009.

List of References:

2. Topics in Algebra - I. N. Herstein, Vikas Publishing, New Delhi.
3. A First Course in Abstract Algebra - J. B. Fraleigh, Narosa Publishing, New Delhi.

4. Basic Abstract Algebra - P.B. Bhattacharya, S.K. Jain and S. R. Nagpal, Foundation Books, New Delhi.
5. Abstract Algebra - Dipak Chatterajee, PHI Learing Pvt. Ltd, New Delhi.
6. Algebra - Michael Artin, PHI.
7. A survey of Modern - G. Birkhoff & S. Maclane, Algebra Univ. Press.
8. A first course in Abstract Algebra (Rings, Groups & fields) - Marlow Anderson & Todd Fel, Chrpman & Halilereivy.
9. Contemporary Abstract Algebra, Joseph A. Gallian, 7th EDITION, Cengage learning.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Examples of Groups.
2. Examples on properties of Groups.
3. Examples based on commutativity and non-commutativity of Groups.
4. Examples of Subgroups.
5. Examples on Cyclic Subgroups generated by elements and on cyclic groups.
6. Experiment of preparing group table and drawing Lattice Diagrams of Finite Groups.
7. Experiment based on determining even/odd permutation.
8. Experiment based on finding inverse of permutations and finding order of permutations.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 3

Subject Code: 10160303	**Subject Title:** Numerical Method - I
Pre-requisite: To study this course, a student must have the knowledge of the Calculus.	

Course Objective:

(1) To study the computational techniques involved in different mathematical manipulation.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Solution of Equations:** Method of Triangularisation - Gauss elimination method - Inverse of a matrix - Gauss- Jordan method. Bisection method – Regula falsi method - Newton - Raphson method - Horner's method.	15	34%
2	**Interpolation:** Finite differences – Operators Δ, ∇, D – Relation between operators – Linear interpolation – Interpolation with equal intervals – Newton forward interpolation formula –Newton backward interpolation formula - Interpolation with equal intervals – Lagrange's method – Newton Divided differences method.	15	33%
3	**Curve Fitting and Numerical Integration:** Principles of least squares - fitting a straight line - linear regression - fitting an exponential curve. Trapezoidal Rule - Simpson's 1/3 rule and 3/8 rule - Applications - Weddle's rule	15	33%

Course Outcome: After completion of this course, student will be able to

- Find the solution of equation and system of equations.
- Derive the interpolating polynomial of equal and unequal intervals.
- To fit a curve for the given data using principles of least squares.
- Integrate the functions using different rules.

List of Textbooks:

1. Numerical methods, M.K.Venkatraman, National Publishing Company, (1990).

2. Numerical methods, V. Rajaraman, Prentice - Hall India Pvt. Ltd., (2003).
3. Numerical methods, P. Kandasamy, K. Thilagavathy and K. Gunavathy, S. Chand & Co. (2002).

List of References:

1. Numerical methods for Scientific and Engineering computation , Jain Iyenger and Jain, New Age International (P) Ltd.,(2004).
2. Numerical methods, S.S.Sastry, Prentice Hall of India Pvt. Ltd., NewDelhi(2003).

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)
3. http://www.sst.ph.ic.ac.uk/angur/lectures/compphys/compphys.html.

List of Suggested Experiments

1. Examples of Gauss elimination method.
2. Examples of Gauss- Jordan method.
3. Examples of numerical solution of algebraic and transcendental equation.
4. Examples of Operators.
5. Examples of Interpolation with equal intervals.
6. Examples of Interpolation with unequal intervals.
7. Experiment of Curve Fitting.
8. Experiment of Numerical Integration.

GANDHINAGAR INSTITUTE OF LIBERAL STUDIES
B.A.(HONS.)
Multidisciplinary/Interdisciplinary Course 3
SEMESTER 3

Subject Code: 101360304	**Subject Title: SOCIAL RESPONSIBILITY AND COMMUNITY DEVELOPMENT**
Pre-requisite: Zeal to learn the subject.	

Course Objective:

Students will explore theoretical frameworks, ethical considerations, and practical strategies aimed at enhancing social impact, promoting equitable outcomes, and addressing community needs through collaborative and culturally sensitive approaches.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	4	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Concepts of Social Responsibility:** The social responsibility of organizations: Historical Background; Definition of Social Responsibility and Characteristics of social responsibility; Principles of Social Responsibility; CSR (Corporate Social Responsibility)	15	25
2	**Community Development** Community Development: Concept, Definition and Concerns; Local community, rural culture and practice of community development; Stages, Components and Principles of community development, Utility of Public Resources; Rural Development Program and rural institutions	15	25
3	**Panchayati Raj Institutions (PRIs)** Zilla Parishad: Administrative structure, various committees (Samities), Development officer and his duties and responsibilities Panchayat Samittee: Administrative structure role of BDO and extension workers, local representative's role & responsibilities	15	25

	Gram Panchayat: Process of working, role of Gram sevak, Sarpanch and members, working of Gramsabha Problem and Needs of Disadvantaged Group and their participation (Women, Scheduled Tribes, Scheduled Castes and Panchayat Extension to Scheduled Areas (PESA) Act)		
4	**Visit to one ideal community/ project** Visit to one institution of Panchayat Raj and participation in on Gramsabha/ Gram panchayat meeting Student prepare report of visits with documentary event/ photographs	15	25

Course Outcome: After completion of this course, student will be able to:

- Understand the principles and practices of social responsibility, enabling them to apply ethical decision-making and sustainable practices in personal, professional, and organizational contexts.
- Provide knowledge and skills needed to engage in and promote sustainable community development initiatives.
- Impart a comprehensive understanding of the structure, functions, and significance of Panchayati Raj Institutions in promoting decentralized governance and rural development.
- Develop practical insights and firsthand experience by observing and analyzing the implementation and impact of successful community projects.

List of Reference Books:

1. A.B. Carroll, A.B. (1999) "Corporate social responsibility," *Business and Society, 38(3),* 268-295.
2. A.B. Carroll (1991) "The pyramid of corporate social responsibility: towards the moral management of organizational stakeholders," *Business Horizons, 34(4),* 39-48.
3. A.B. Carroll (1979) A three dimensional conceptual model of corporate performance," *The Academy of Management Review, 4(4),* 1979, 497-505.
4. A.B. Carroll, and A.K. Buchholtz., *Business and society: ethics and stakeholder management,* 7th edn (Mason, Cengage Learning US, 2009).
5. A. Forte (2004) "Antecedents of managers moral reasoning," *Journal of Business Ethics, 54(4),* 2004, 315-334.
6. A.K. Sharma, and B. Talwar (2005) "Insights from practice, corporate social responsibility: modern vis-à-vis vedic approach," *Measuring Business Excellence,* 9(1), 35-45.
7. A. Ugwunwanyi, and C. Ekene (2016) "Corporate social responsibility and its implementation in Nigeria: problems and prospects," *Global Journal of Human Resource Management, 4(2),* 2016, 60-69.
8. A. McWilliams, and D. Siegel. (2001) "Corporate social responsibility: a theory of the firm perspective," *Academy of Management Review, 26(1),* 2001, 117-127.
9. Baviskar, B.S and George Mathew (eds) 2009 Inclusion and Exclusion in local governance: Field studies from rural India, New Delhi, Sage Publications.
10. Bidyut Chakrabarty, Rajendra Kumar Pandey (2018) Local Governance in India, Sage, New Delhi.
11. C. Deegan (2002) "Introduction: the legitimising effect of social environmental disclosures- a theoretical foundation," *Accounting, Auditing and Accountability Journal, 15(3),* 282-311.
12. Clarkson, M. (1995) "A stakeholder framework for analysing and evaluating corporate social performance," *Academy of Management Review, 20(1),* 1995, 92-117.

13. D. Jamali (2008) "A stakeholder approach to corporate social responsibility: fresh insights into theory vs practice," *Journal of Business Ethics, 82(1*), 2008, 213-231.
14. E. Garriga, and D. Mele. (2004) "Corporate social responsibility theories: mapping and territory," *Journal of Business Ethics, 53*, 51-74.
15. E.M. Epstein (1999) "The continuing quest for accountable, ethical and humane corporate capitalism," *Business and Society, 38(3)*, 393-406.
16. Friedman, M., (1970) The social responsibility of business is to increase its profits. The New York Times Magazine 13 September, 32-33. Retrieved from http://umich.edu/~thecore/doc/Friedman.pdf on 11th July 2018.
17. G.P. Lantos (2001) "The boundaries of strategic corporate social responsibility," *Journal of Consumer Marketing, 18(7)*, 2001, 595-632.
18. Guthrie, J., and L.D. Parker. (1990) "Corporate social disclosure practice: a comparative economic analysis," *Advances in Public Interest Accounting, 3*, 1990, 159-175.
19. H. Rothmann Bowen (1953) *Social responsibilities of businessman,* New York, Harper and Row.
20. H. Ijaiya (2014) "Challenges of corporate social responsibility in the Niger Delta Region of Nigeria," *Afe Babalola University Journal of Sustainable Development Law and Policy, 3(1),* 2014, 60-71.
21. J. R. Raghunandan (2012) Decentralization and local governments: The Indian experience, Orient Black Swan, New Delhi.
22. J.S. Harrison, and R.E. Freeman (1995) "Stakeholders social responsibility and performance: empirical evidence and theoretical perspectives," *The Academy of Management Journal*, 42(5), 1995, 479-485.
23. J. Vanhamme, and B. Grobben (2009) "The effectiveness of CSR history in countering negative publicity," *Journal of Business Ethics, 85*, 2009, 273-283.
24. Kaplan (2012) *ACCA-P1: professional accountant, essential text,* UK, BPP Kaplan Publishing.
25. K. Davis (1973)"The case for and against business assumption of social responsibilities," *Academy of Management Journal*, 1973, 312-322.
26. L. G. Jain (2004) Decentralization and Local Governance, Orient Black Swan, New Delhi.
27. M. Ismail. (2009) "Corporate social responsibility and its role in community development: an international perspective," *The Journal of International Social Research, 2(9),* 199-209.
28. M. Porter, and M.E. Kramer (2002) "The competitive advantage of corporate philanthropy," *Harvard Business Review, 80(12),* 2002, 57-68.
29. P.F. Drucker (1993) *Management: task, responsibilities, practices,* New York, Harper Perennial.
30. P. Eua-anant, D. Ayuwat, B. Promphakping (2011) "Relations between positive impacts of CSR, external support, CSR knowledge and the degree of CSR practices in Thai small and medium enterprises," *International Business and Economics Research Journal, 10(11),* 17-26.
31. R. Abd Rahim, F. Waheeda Jalaludin, K. Tajudin (2011) "The importance of corporate social responsibility on consumer behaviour in Malaysia," *Asian Academy of Management Journal, 16(1),* 2011, 119-139.
32. R. Gray, R. Kouhy., S. Lavers (1995) "Corporate social and environmental reporting: a review of literature and longitudinal study of UK disclosure," *Accounting, Auditing and Accountability Journal, 8(2),* 1995, 47-77.
33. R.E. Freeman (1994) "The politics of stakeholder theory: some future directions," *Business Ethics Quarterly, 4(4),* 1994, 409-421.

34. T. Donaldson, and L.E. Preston (1995) "The stakeholder theory of the corporation: concepts, evidence, and implications," *Academy of Management Review, 20(1),* 1995, 65-91.
35. T. Donaldson (1999) "Making stakeholder theory whole," *Academy of Management Review, 23(2),* 1999, 237-241.
36. T. Levitt (1958) "The dangers of social responsibility," *Harvard Business Review, 36(5),* 1958, 41-50.
37. T. Rowley, and S. Berman (2000) "A brand new brand of corporate social performance," *Business and Society, 39(4),* 2000, 397-418.
38. United Nations (1971) Popular participation in development: emerging trends in community development. New York: UN Department of Economic Affairs. Retrieved from https://files.eric.ed.gov/fulltext/ED066638.pdf on 11th July 2018
39. W.C. Frederick (1994) "From CRS1 to CRC2: the maturing business and social thought," *Business and Society, 33(2),* 1994, 150-164.
40. Wood, D., and R. Jones. (1995) "Stakeholder mismatching: a theoretical problem in empirical research on corporate social performance," *International Journal of Organization Analysis, 3(3),* 1995, 229-267.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 4

Subject Code: 10160401	**Subject Title:** Number Theory - I
Pre-requisite: To study this course, a student must have knowledge of number sets.	

Course Objective:

(1) To teach different operations on number sets.

(2) To teach different applications of numbers.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Some Preliminary Consideration**: Well-Ordering Principle, Mathematical Induction, The Binomial Theorem & Binomial coefficients. **Divisibility Theory**: The division algorithm, Divisor, Remainder, Prime, Relatively prime, The greatest common divisor, The Euclidean algorithm (Without proof), The least common multiple, The linear Diophantine equation & its solution.	15	34%
2	**Prime Numbers**: Prime and composite number, The Fundamental Theorem of Arithmetic (without proof), Canonical form of a number, The Sieve of Eratosthenes. **Theory of Congruence**: Definition and basic properties of congruence, Residue class & complete system of residues, Special divisibility test, Linear congruence, Chinese Remainder Theorem. (without proof)	15	33%
3	**Fermat's Theorem**: Fermat's Factorization method, Fermat's little theorem, Wilson's theorem. **Euler's theorem**: Euler's Phi-function and formula for (n), Euler's theorem (without proof) and only problems on Euler's theorem.	15	33%

Course Outcome: After completion of this course, student will be able to

- Gain working knowledge of fundamentals of theory of numbers.
- Solve different mathematical problems using the nature of numbers.
- Apply number theory in different area of mathematics.
- Use some number theoretic functions in solving some mathematical problems.

List of Text Book:

1. Elementary Number Theory - David M. Burton, Sixth Edition, Universal Book stall, New Delhi. Sections: 1) 1.1 & 1.2 2) 2.1 to 2.4 3) 3.1 & 3.2 4) 4.1 to 4.3 5) 5.2 & 5.3 6) 7.2 & 7.3.

List of References:

1. An introduction to the Theory of numbers - Niven, Zuckerman and Montgomery, Wiley Eastern Ltd.
2. Number Theory - S. G. Telang, Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
3. Elementary Theory of Numbers - C. Y. Hsiung, Allied Publishers Ltd.-India.
4. Number Theory - George E. Andrews, Hindustan Publishing Corporation- Delhi.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Problems on the Well-Ordering Principle, Mathematical Induction, the Binomial Theorem, and Binomial Coefficients.
2. Solve problems on the Division Algorithm, including finding the quotient and remainder, and applying it to determine the greatest common divisor (GCD) and least common multiple (LCM).
3. Solve problems on the linear Diophantine equation, using the Euclidean algorithm to find the greatest common divisor and determine the existence of a solution.
4. Solve problems on prime and composite numbers, and express a number in its canonical form using the Fundamental Theorem of Arithmetic.
5. Use the Sieve of Eratosthenes to find all prime numbers up to a given integer and determine the prime factorization of numbers using the canonical form.
6. Solve problems on congruence, including the definition and basic properties, residue classes, and complete systems of residues, and apply special divisibility tests.
7. Solve linear congruences and use the Chinese Remainder Theorem to find solutions to systems of simultaneous congruences.
8. Solve problems using Fermat's Factorization method, Fermat's Little Theorem, and Wilson's Theorem to find factors of a number, test primality, and prove related properties.
9. Solve problems on Euler's Phi-function and use Euler's theorem to find solutions to congruences and test properties related to modular arithmetic.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 4

Subject Code: 10160402	**Subject Title:** Group Theory-II
Pre-requisite: To study this course, a student must have knowledge of Group Theory-I.	

Course Objective:

To provide students with a comprehensive understanding of key concepts in group theory, including normal subgroups, quotient groups, cyclic groups, homomorphisms, isomorphisms, and Cayley's theorem, with an emphasis on practical problem-solving through examples and applications in abstract algebra.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory		Practical		
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Normal Subgroups:** Definition and Examples, Quotients group, Solved Examples. **Isomorphism of Group:** Definition and Examples.	15	34%
2	**Cyclic Groups:** Properties of cyclic groups, Isomorphisms of cyclic groups, Subgroups of a cyclic group, Generator of a cyclic group, Solved examples.	15	33%
3	**Homomorphism-1:** Definition and Examples, Kernal of Homomorphism, Cayley's theorem, Isomorphism of groups, Groups of order four and six, Solved examples.	15	33%

Course Outcome: After completion of this course, student will be able to

- define and apply normal subgroups, quotient groups, and solve related examples.
- understand group isomorphisms and homomorphisms, including Cayley's theorem and examples of groups of order four and six.
- explore properties, subgroups, and isomorphisms of cyclic groups, and solve related examples.

List of Textbooks:

1. Abstract Algebra - I. H. Sheth, PHI, New Delhi, 2nd edition-2009.

List of References:

2. Topics in Algebra - I. N. Herstein, Vikas Publishing, New Delhi.
3. A First Course in Abstract Algebra - J. B. Fraleigh, Narosa Publishing, New Delhi.
4. Basic Abstract Algebra - P.B. Bhattacharya, S.K. Jain and S. R. Nagpal, Foundation Books, New Delhi.
5. Abstract Algebra - Dipak Chatterajee, PHI Learing Pvt. Ltd, New Delhi.
6. Algebra - Michael Artin, PHI.
7. A survey of Modern - G. Birkhoff & S. Maclane, Algebra Univ. Press.
8. A first course in Abstract Algebra (Rings, Groups & fields) - Marlow Anderson & Todd Fel, Chrpman & Halilereivy.
9. Contemporary Abstract Algebra, Joseph A. Gallian, 7th EDITION, Cengage learning.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Examples of Normal subgroups.
2. Examples on Quotients groups.
3. Examples of Isomorphism groups
4. Examples of cyclic groups.
5. Examples of Isomorphisms of cyclic groups.
6. Experiment of Subgroups of a cyclic group.
7. Experiment of Generator of a cyclic group.
8. Experiment of Kernal of Homomorphism.
9. Examples of Groups of order four and six.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 4

Subject Code: 10160403	**Subject Title:** Numerical Method - II
Pre-requisite: To study this course, a student must have the knowledge of the Calculus.	

Course Objective:

(1) To study the computational techniques involved in different mathematical manipulation.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**System of linear algebraic equations:** Gauss Jacobi method, Gauss Seidel method and their convergence analysis. Computing eigen-values and eigenvectors.	15	33%
2	**Solution of Ordinary Differential Equations:** Taylor series method, Picard's method, Euler's methods, Runge-Kutta methods, Predictor-Correctors methods.	15	33%
3	**Numerical Integration:** Euler-Maclaurin formula, Numerical Integration with different step sizes, Gaussian integration, Generalized quadrature, Numerical double integration.	15	34%

Course Outcome: After completion of this course, student will be able to

- Apply Gauss-Jacobi and Gauss-Seidel methods to solve systems of linear algebraic equations and analyze their convergence.
- Compute eigenvalues and eigenvectors using numerical techniques and apply them in practical scenarios.
- Solve ordinary differential equations (ODEs) using methods like Taylor series, Picard's, Euler's, and Runge-Kutta techniques.
- Perform numerical integration using techniques such as Euler-Maclaurin formula, Gaussian quadrature, and numerical double integration.

List of Textbooks:

1. Numerical methods, M.K.Venkatraman, National Publishing Company, (1990).
2. Numerical methods, V. Rajaraman, Prentice - Hall India Pvt. Ltd., (2003).
3. Numerical methods, P. Kandasamy, K. Thilagavathy and K. Gunavathy, S. Chand & Co. (2002).

List of References:

1. Numerical methods for Scientific and Engineering computation , Jain Iyenger and Jain, New Age International (P) Ltd.,(2004).
2. Numerical methods, S.S.Sastry, Prentice Hall of India Pvt. Ltd., NewDelhi(2003).

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)
3. http://www.sst.ph.ic.ac.uk/angur/lectures/compphys/compphys.html.

List of Suggested Experiments

1. Examples of Jacobi method.
2. Examples of Gauss- Seidel method.
3. Examples of eigen value problem.
4. Examples of Tayler's series method and Picard's method..
5. Examples of Euler's methods.
6. Examples of Runge-Kutta Methods.
7. Experiment of Gaussian integration.
8. Experiment of Euler-Maclaurin formula.

Gandhinagar Institute of Science
Bachelor of Science- Physics
Semester-4

Subject Code: 10150401	**Subject Title: Advance Physics IV**
Pre-requisite: Students must comprehend the fundamental ideas of essential topics such as Physics, and Mathematics up to first year of Bachelor of Science.	

Course Objective:

(1) To develop young Physics and Electronics scholars with a healthy mix of academic, emotional, and cultural development.

(2) Our first goal will be instilling a value system and cultivating sensitivity and tolerance for human beings and society.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	**-**	**02**	**04**	**50**	**50**	**25**	**25**	**150**

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Solid State Physics** **Lattice Vibration:** Introduction, Elastic vibration of one dimensional continuous homogenous medium, Vibration of one-dimensional mono-atomic linear lattice, Vibration of one dimensional Diatomic linear lattice, Phonon **Thermal Properties of Solids:** **a)** Introduction, Lattice specific heat, Classical theory (Dulong and Petit law), Einstein's theory, Debye's theory **b)** Anharmonicity, Thermal Expansion, Thermal conductivity of solids, Lattice thermal conductivity.	15	34
2.	**Heat and Thermodynamics** Entropy: Reversible part of the second law (Claussis theorem), Entropy, Entropy of the ideal gas, TS diagram, Application of the Entropy principle. Pure substances: Volume expansivity: Cubic Expansion coefficient, Compressibility. Mathematical methods in thermodynamics: Characteristics functions, Enthalpy, Helmholtz & Gibb's functions, Two mathematical theorems, Maxwell's relations, TdS equations, Internal energy equations, Heat	15	33

	Energy equations, Heat capacity equations. Open Systems: Joule-Thomson expansion, Liquefaction of gases by the Joule-Thomson expansion		
3.	**Electronics:** **Transistor Biasing:** Factors contributing to thermal stability, Effect of temperature increase, Stability factor S, Common base stability, Collector to base bias, Disadvantage of collector to base bias, Emitter bias, Voltage divider bias with emitter bias, Emitter bypass capacitor, Summary of stabilization circuit, Additional stability factors, Bias compensation **Hybrid equivalent circuit for a transistor:** Conversion of a transistor to a standard form, General Black box theory, Hybrid "h" parameters, Obtain the hybrid h parameters, Typical h parameter value, Amplifier equation, Voltage and current gains considering R_g of source, Dependence of amplifier characteristics on R_L and R_g, Comparison of CB, CC and CE	15	33

Subject Contents

Sr. No	Topic	Total Hours	Weight (%)
	List of Experiments		100
1	To study double refraction in calcite prism.	3	
2	Resolving power of grating.	3	
3	Diffraction by single slit.	3	
4	Wavelength of light by Biprism.	3	
5	Phonon dispersion relation of monoatomic lattice.	3	
6	Analysis of elliptical polarized light.	3	

Course Outcome: After completion of this course, student will be able to

- Describe Lattice vibration as elastic wave in crystal, the propagation of this wave in 1-dimensional monoatomic and diatomic crystal, Phonons and its characteristics.
- Describe specific heat using three models Dulong-Petit's model, Einstein's model and Debye's mode, and derive thermal conductivity and thermal expansion.
- Deduce the existence of Entropy, potential functions of thermodynamics and state their characteristics.
- Use Maxwell relations to establish relations among difficult to measure and easy to measure thermodynamic quantities and solve problems related with TdS equations, Internal energy equations and specific heats
- Describe liquefaction of gases by throttling process.

- Know the factor causes thermal instability of Bipolar transistor and design amplifier using BJT with different bias circuit, analyze transistor amplifier using h parameters.

List of Textbooks:

1. Introduction to Solid State Physics, Arun Kumar, PHI, India [Articles no: 5.1, 5.2 5.3, 5.3.2, 5.4 (excluding 5.4.1, 5.4.3), 5.5, 6.7, 6.8, 6.9, 6.10]
2. Solid State Physics, by S O Pillai, New Age Publication [6th Edition, Articles no: I, II, III, IV, V]
3. Heat & Thermodynamics by Zeemansky, McGraw Hill Int. Edition (7th edition) [Article Nos.: 8.1 to 8.5, 8.12, 9.6, 9.7, 10.1 to 10.8, 11.1, 11.2]
4. Electronics Devices and Circuits by Allen Mottershed, PHI [7th Edition, Article no. 12.1 to 12.12, 14.1 to 14.10]

List of Reference Books:

1. Modern Physics by Arthur Beiser
2. Modern Physics by Kenneth Krane
3. Electronic devices and circuits by Salivanhanan and N. Suresh Kumar

Open e-Resource:

1. MIT Open Learning - Massachusetts Institute of Technology**,** https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning- https://www.youtube.com/user/nptelhr
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 5

Subject Code: 10160501	**Subject Title:** Mathematical Analysis - I
Pre-requisite: To study this course, a student must have knowledge of Calculus.	

Course Objective:

(1) Understand and apply fundamental concepts of real analysis.

(2) Analyze and interpret key theorems.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**The Real Numbers** Sets and functions, Finite and infinite sets, Algebraic and order properties of $\mathbb{R}$, Absolute value and real line, The completeness property of $\mathbb{R}$, The applications of supremum property, Intervals. [Articles 1.1, 1.3, 2.1 to 2.5 of Textbook (2)]	12	27%
2	**Sequences** Sequences and limits, Theorems on limits, Monotonic sequences, Sequences defined inductively, Subsequence (includes lim sup and lim inf), Cauchy Sequences, Infinite limits. [Articles 2.1-2.7 of Textbook (1)]	11	24%
3	**Functions and continuity** Limit of a function, Theorems on limits and Other Limits, Continuity. Intermediate values, Extreme values, Uniform continuity, Monotone and Inverse functions. **The derivative** Definition and Rules for differentiation, Mean value theorems, Inverse functions, Intermediate value Property of Derivatives, L'Hospital's Rules. [Articles 3.1-3.6 of Textbook (1), Article 5.6 of Textbook (2), Articles 4.1 to 4.4 of Textbook (2), Sections 6.2.11 and 6.2.12, Article 6.3 of Textbook (2)]	22	49%

Course Outcome: After completion of this course, student will be able to

- Exhibit the analytic properties of the ordered field of real numbers.
- Demonstrate fundamentals of convergence of sequences and related results.
- Exhibit different types of continuity of function in real life in mathematical form.

- Express the most applicable concept of rate of change, the derivative, in different aspects.
- Demonstrate some direct applications of the derivative of function and related results in real life problems.

List of Text Book:

1. An Introduction to Analysis - Gerald G. Bilodeau, Paul R. Thie and G. E. Keough. Jones and Bartlett Student edition.
2. Introduction to Real Analysis - Robert G. Bartle and Donald R. Sherbert, Wiley Student Edition, 2010.

List of References:

1. A Course in Calculus & Real Analysis - S. R. Ghorpade & B. V. Limaye.
2. Elementary Analysis: The theory of calculus - K. Ross, Springer, India.
3. Numbers to Analysis - I. K. Rana, World scientific.
4. Calculus - Michael Spivak.
5. Principles of Mathematical Analysis- W. Rudin, McGraw-Hill
6. Fundamentals of mathematical analysis- G. Das & S Pattanayak, Tata Mcgraw Hill
7. A First course in Analysis- D. Somasundaram & B. Choudhary

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Supremum and Infimum of Bounded Sets on the Real Line.
2. Experiment on Classification of Sets and Behavior of Real-Valued Functions over Different Intervals.
3. Experiment on Convergence and Monotonicity of Sequences (Including Cauchy and Inductive Sequences).
4. Experiment on Subsequence Behavior: lim sup, lim inf, and Infinite Limits.
5. Experiment on Verifying Theorems on Limits and Continuity Using Piecewise and Rational Functions.
6. Experiment on Intermediate Value Theorem, Extreme Values, and Uniform Continuity of Functions.
7. Experiment on Verifying Mean Value Theorems (Rolle's and Lagrange's) Using Polynomial and Trigonometric Functions.
8. Experiment on Application of L'Hospital's Rule to Evaluate Indeterminate Forms.
9. Experiment on Behavior of Derivatives: Intermediate Value Property and Non-differentiability Cases.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 5

Subject Code: 10160502	**Subject Title:** Complex Variables and Fourier Series
Pre-requisite: To study this course, a student must have knowledge of Calculus.	

Course Objective:

(1) Understand and apply foundational concepts of complex numbers and functions.

(2) Analyze and represent periodic functions using Fourier series.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Sum and product of complex numbers with properties, moduli and conjugate, triangle inequality, polar coordinates, product and quotients in exponential form, roots of complex numbers, De Moivre's theorem and application, the exponential function, trigonometric functions, hyperbolic functions, convergence of sequence and series.	18	40%
2	Functions of complex variables, theorems on limits, continuity, derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient condition for differentiability, polar coordinates, analytic functions and harmonic functions. Linear transformations, linear fractional transformations, Elementary transformation, an implicit form, preservation of angles, further properties.	18	40%
3	Fourier series, Bessel's inequality, Riemann-Lebesgue theorem.	09	20%

Course Outcome: After completion of this course, student will be able to

- Perform operations on complex numbers and use it in further concepts of complex analysis.
- Identify differentiable and analytic functions and use it in further concepts of complex analysis.
- Transform complex domain using conformal mapping.
- Identify functions of complex variable having Fourier series and obtain their Fourier series.

List of Text Book:

1. Complex variables and applications - James W. Brown & Ruel V. Churchill, Mcgraw-hill international.
   6th edition, Articles 1 to 7, 23 to 25 and 43. Chapter 2 (omit art. 13). Articles. 68, 69, 70, 71,79, 80.
2. A first course in Mathematical analysis - D. Somasundaram, Chapter-10.1 and 10.2 (only first two theorems).

List of References:

1. Fundamentals of Mathematical Analysis- G. Das & S Pattanayak, Tata Mcgraw Hill Pub. Co. Ltd.
2. Analytical Geometry & Real and Complex analysis - T. Veerarajan, Mcgraw Hill.
3. Complex Analysis - V. Karunakaran, Narosa publishers.
4. Higher Engineering Mathematics - B. S. Grewal, Khanna Publishers.
5. Advance engineering Mathematics - H. K. Dass, S. Chand.
6. A First Course in Complex Analysis with Applications - Dennis G. Zill & Patrick S. Shanahan Jones & Bartlett India Pvt Ltd.
7. Complex Analysis - T. W. Gamelin, Springer (India) Ltd.
8. Theory of Complex functions - Marden & Hoffman W. H. Freeman, N.Y.
9. Functions of One Complex Variable - Conway.
10. An Introduction to Complex Analysis - A. R. Shastri, Macmilan India.
11. Fourier Analysis: An Introduction - E. M. Stein & R. Shakarchi, Princeton Uni. Press.
12. Fourier Series - R. Bhatia, Hindustan Book Agency-2010 corrected edition.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Geometric Representation and Operations of Complex Numbers in Cartesian and Polar Form.
2. Experiment on Application of De Moivre's Theorem to Find Powers and Roots of Complex Numbers.
3. Experiment on Exploring Convergence of Complex Sequences and Series Including Exponential, Trigonometric, and Hyperbolic Functions.
4. Experiment on Verifying Cauchy-Riemann Equations and Conditions for Analyticity in Cartesian and Polar Forms.
5. Experiment on Testing Continuity and Differentiability of Complex Functions Using Theorems on Limits and Derivatives.
6. Experiment on Identifying and Analyzing Harmonic Functions and Their Conjugates.
7. Experiment on Studying Linear and Linear Fractional Transformations and Their Effect on Geometric Figures.
8. Experiment on Constructing Fourier Series of Periodic Functions and Verifying Bessel's Inequality.
9. Experiment on Exploring the Convergence of Fourier Series and Demonstrating the Riemann-Lebesgue Theorem.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 5

Subject Code: 10160503	**Subject Title:** Linear Programming
Pre-requisite: To study this course, a student must have knowledge (12th Basic Mathematics)	

Course Objective:

(1) Understand and apply mathematical formulation and solution techniques.

(2) Develop problem-solving skills using optimization algorithms.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Convex Set and Linear Programming Problem:** Convex set, extreme points of a convex set, Convex Combination, Examples of convex sets and theorems on convexity. Formulation techniques of LPP (only examples), Graphical method, Simplex method for solving LPP, Big-M (penalty) method, Two-phase method, Integer programming problem (only Gomory's cutting plane method).	15	33%
2	**Duality and Dual simplex method:** Introduction, Definition of the dual problem, General rules for converting any primal problem into its dual, How to interpret the solution of the dual from its primal and vice versa, Comparison of the solution of the primal and its dual, Find initial solution for dual simplex table, Mathematical procedure to find solution by dual simplex method.	15	33%
3	**Transportation and Assignment Problems:** Introduction, Mathematical formulation, Tabular representation, definitions, Methods for finding initial basic feasible solution (North West corner rule, Least cost method, Vogel's approximation method), Optimality test, degeneracy in transportation problem, unbalanced transportation problem. Introduction of assignment problem, Mathematical formulation of assignment problem, Method for solving assignment problem (Hungarian method), Unbalanced assignment problem, Examples.	15	34%

Course Outcome: After completion of this course, student will be able to

- Formulate and model linear programming problems.
- Solve linear programming problems and interpret solution of linear programming problems.

- Formulate and model assignment and transportation problems.
- Solve assignment and transportation problems and interpret solution of assignment and transportation problems.

List of Text Book:

1. Optimization method in O.R. & System Analysis - K. V. Mittal, New Age inter. Publishers.

List of References:

1. Mathematical models in Operations Research - J. K. Sharma, Tata-MacGraw Hills book-company.
2. Operations Research - Nita H Shah, Ravi Gor and Hardik Soni. PHI - Learning.
3. Operation Research - S. D. Sharma, Kedarnath Ramnath & Co.
4. Operation Research - Kanti Swaroop & Man Mohan, Sultan Chand & Co.
5. Linear Programming - L. I. Gass, Tata MacGraw Hills book-company.
6. Linear Programming - G. Hadley, Narosa Publishing house.
7. Operation Research- A. M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education.
8. Operations Research: An Introduction (9th Edition): Hamdy A Taha, Pearson Education.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Identification and Visualization of Convex Sets, Convex Combinations, and Extreme Points.
2. Experiment on Formulating and Solving Linear Programming Problems Using the Graphical and Simplex Methods.
3. Experiment on Solving Integer Linear Programming Problems Using Gomory's Cutting Plane Method and the Big-M Method.
4. Experiment on Formulating the Dual of a Given Primal Linear Programming Problem Using General Rules.
5. Experiment on Interpreting and Comparing the Solutions of Primal and Dual Problems.
6. Experiment on Solving Linear Programming Problems Using the Dual Simplex Method.
7. Experiment on Finding Initial Basic Feasible Solutions of Transportation Problems Using North-West Corner Rule, Least Cost Method, and Vogel's Approximation Method.
8. Experiment on Solving Balanced and Unbalanced Transportation Problems Using MODI Method and Handling Degeneracy.
9. Experiment on Solving Assignment Problems Using the Hungarian Method Including Cases of Unbalanced Assignment Problems.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - Mathematics

SEMESTER - 5

Subject Code: 10160504	**Subject Title:** Discrete Mathematics
Pre-requisite: To study this course, a student must have knowledge of 12th Basic Mathematics.	

Course Objective:

(1) Understand and apply the principles of Boolean algebra.

(2) Explore the structure and representation of finite Boolean algebras.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	04	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	Binary relation, Reflexive, Irreflexive, Symmetric, Antisymmetric, Transitive, Partial ordering (omit lexicographic ordering), Hasse diagram, Upper bound, Lower bound, Least upper bound, Greatest lower bound, Lattice as a POSET, Properties of lattices.	15	33%
2	Lattice as an algebraic system (only definition), Sublattice, Homomorphism, Some special lattices, Boolean algebra, Subalgebra, Direct product, Homomorphism, Join irreducible, Atoms.	15	33%
3	Boolean expression, Equivalent Boolean expression, Minterm, Maxterm, values of Boolean expressions, Stone's representation theorem for finite Boolean algebra, Sum of products canonical forms, Product of sums canonical forms.	15	34%

Course Outcome: After completion of this course, student will be able to

- Use the techniques of discrete mathematics in the problems of logic.
- Convert from SOP to POS and vice-versa.
- Create Hasse diagram to study lattice structure.
- Use Boolean algebra in some scientific applications.

List of Text Book:

1. Discrete Mathematical Structures with Applications to Computer Science - J. R. Tremblay and R. Manohar, Macgraw-Hill International Editions. Definitions: 2-3.3 to 2-3.7, Definition 2-3.16, 2-3.17 (omit Lexicographic ordering), Article 2-3.9, Chapter 4 up to 4-3.

List of References:

1. Boolean Algebra and its Application - J. E. Whitesitt, Addison-Wesley Publishing Co. Inc.
2. Foundation of Discrete Mathematics - K. D. Joshi, New Age International Limited Publishers.
3. Logic and Boolean Algebra - B. H. Arnold, P H Inc LCCN 62-19100.
4. Introduction to Lattice Theory - D. E. Rutherford, University Mathematical Oliver and Boyed Ltd.
5. Modern Applied Algebra - Garret Birkhoff and Thomas C Bartee, CBS Publishers and Distributors.
6. Sets Lattices and Boolean Algebras - James C Abbott.
7. Lattice Theory: First Concepts and Distributive Lattices - George A. Gratzer, Dover Books.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Identifying Properties of Binary Relations: Reflexivity, Symmetry, Transitivity, and Antisymmetric.
2. Experiment on Constructing and Analyzing Hasse Diagrams for Partially Ordered Sets.
3. Experiment on Determining Upper Bounds, Lower Bounds, LUB, GLB, and Verifying Lattice Properties in Posets.
4. Experiment on Identifying Sublattices and Join-Irreducible Elements in Given Lattices.
5. Experiment on Exploring Boolean Algebra Structures and Their Subalgebras with Basic Operations.
6. Experiment on Constructing Direct Products and Verifying Homomorphisms in Lattices and Boolean Algebras.
7. Experiment on Constructing and Simplifying Boolean Expressions Using Minterms and Maxterms.
8. Experiment on Verifying Equivalence of Boolean Expressions Using Truth Tables and Canonical Forms (SOP and POS).
9. Experiment on Demonstrating Stone’s Representation Theorem for Finite Boolean Algebras with Examples.

Gandhinagar Institute of Science
Bachelor of Science - Mathematics
Semester 5

Subject Code: 10160505	**Subject Title: Computational Power of Vedic Sutras**
Pre-requisite: -	

Course Objective: The main objective of this course is to make students appreciate the amazing computational power of Vedic Sutras and help them to develop skill for doing faster and accurate calculations.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	4	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Vinculum:** Introduction, Conversion, Application, Addition and Subtraction, Beejank **Multiplication: Introduction** -Vertically and Crosswise, Base number/sub base number, Sum and difference of Products **Division:** Introduction –Nikhilam, Paravartya Yojayet, Flag Digit (Vertically and Crosswise), Mixed Operations **Indices:** Introduction -Meru Prastar, Square, Cube, Fourth and Fifth Power, Mixed Operations **Roots:** Introduction -up to Fifth Root (Vilokanam), Square root and Cube root, Mixed Operations **Divisibility:** Introduction -Osculator (vestanam **LCM/HCF:** Introduction -different methods **Recurring Decimals:** Introduction -Denominator ending with 1, 3, 7, 9 **Numerical Code (Devnagari script) :** Introduction –Word, Consonant, Letter	15	25 %
2	**Algebra :** Introduction **Multiplication (Quadratic and cubic expressions of 1 or 2 variables):** Introduction - Vertically and Crosswise, Sum and difference of Products **Division algorithm and application (Expressions of 1 variable and divisor of degree upto 3):** Introduction -Paravartya Yojayet, Mixed Operations **Expansion:** Introduction -Meru Prastar -upto fifth Power, Mixed Operations **Factorisation (Cubic expression)** -Remainder Theorem, use of Differentiation,LCM/HCF Partial Fractions, Anurupye sunyamanyat (3 elementary methods)	15	25 %

	Solution of Equations, (Quadratic equations /simultaneous equations of 2 or 3 variables)		
3	**Geometry** Introduction **Concept of Bhaudhayana Number (BN)** **i) BN of an angle** **ii)** Multiplication of a constant in a BN **iii)** BN of complementary angles **iv)** BN of sum and difference ($\alpha \pm \beta$) of an angle **v)** BN of half angle **Trigonometry** **i)** Definitions of Trigonometric Ratios **ii)** Trigonometric Identities **Co-ordinate Geometry** **i)** Different forms of straight lines **ii)** Vector Products (dot and cross)	15	25 %
4	**Complex Numbers** - Multiplication, Division and square-root **Calculus Introduction –**Differentiation, Integration **Various Number System: (Binary, Quadral, Octal and Hexadecimal Systems) –**Introduction, Conversion and Basic operations.	15	25 %

Course Outcome:

After Completion of this Course Students will be able to:

- Understand and apply Vedic methods for arithmetic operations, including vinculum, Beejank multiplication, and division techniques like Nikhilam and Paravartya Yojayet.
- Solve problems involving indices, roots, LCM/HCF, divisibility, recurring decimals, and numerical codes using traditional Vedic approaches.
- Apply Vedic techniques in algebra for multiplication, division, expansion, factorisation, partial fractions, and solving equations.
- Demonstrate basic understanding of geometry, trigonometry, coordinate geometry, complex numbers, calculus, and number systems using foundational Vedic and mathematical concepts.

List of Reference Books:

1. Bharatiya Krishna Teerth : Vedic Mathematics (Motilal Banarasidas New Delhi, 2001).
2. V.G. Heroor : The History mathematics and Mathematicians of India.
3. V.G. Unkalkar : Magical world of Mathematics, (Vandana Publishers Bangalore, 2008).
4. Dr. Vyawahare-Chouthaiwale- Borgaonkar: Introduction to Vedic Mathematics.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - MATHEMATICS

SEMESTER - 6

Subject Code: 10160601	**Subject Title:** Mathematical Analysis-II
Pre-requisite: To study this course, a student must have knowledge of sequences and series , Limits and Continuity of functions.	

Course Objective:

(1) To understand the concept and properties of Riemann integration and apply it to evaluate definite integrals.

(2) To study infinite series, including tests for convergence and their applications in analysis and approximation of functions.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	05	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Riemann Integration:** Definition of Integral, Properties of the integral, Existence theory (Monotone, Continuous functions etc. (includes Riemann sums), Fundamental theorem, Integration by parts and change of variable, Mean value theorems (Weierstrass's Form and Bonnet's Form)	15	34%
2	**Infinite series:** Basic Theory (covers upto comparison test), Series with positive terms (Condensation Test, Pringsheim's Test), Absolute convergence (includes alternating series), Ratio and Root tests with lim sup and lim inf, Rearrangement of series, Cauchy Product of Series, Merten's theorem, Power Series, Improper integrals of the first and second kind	17	33%
3	**Taylor's Series:** Taylor's Theorem with Lagrange and Cauchy form of remainders, Expansions of exponential, Logarithmic and trigonometric functions, Binomial series theorem, Power series solutions of differential equations	13	33%

Course Outcome: After completion of this course, students will be able to

- Recognize use of real analysis in different real-life problems.
- Solve mathematical problems using integrability of functions
- Obtain series expansion of several real valued functions of one variable.
- Solve differential equations using power series method

List of Text Book:

1. An Introduction to Analysis, Gerald G. Bilodeau, Paul R. Thie and G.E. Keough. Jones and Bartlett Student edition

List of References:

1. Fundamentals of Mathematical Analysis, Das and Pattanayak, TMH.
2. Calculus Vol 1, Tom M. Apostol
3. A Course in Calculus & Real Analysis - S. R. Ghorpade & B. V. Limaye
4. A First course in Analysis- D. Somasundaram & B. Choudhary, Narosa Publication

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Approximating Riemann Integrals Using Riemann Sums for Monotone and Continuous Functions.
2. Experiment on Verifying the Fundamental Theorem of Calculus and Integration Techniques (By Parts and Change of Variable).
3. Experiment on Exploring the Mean Value Theorems for Integrals: Weierstrass's and Bonnet's Forms.
4. Experiment on Testing Convergence of Infinite Series Using Comparison, Ratio, Root, and Alternating Series Tests
5. Experiment on Analyzing Absolute and Conditional Convergence, Rearrangement of Series, and Cauchy Product
6. Experiment on Exploring Power Series, Radius of Convergence, and Improper Integrals of the First and Second Kind
7. Experiment on Verifying Taylor's Theorem with Lagrange and Cauchy Forms of Remainder
8. Experiment on Expanding Standard Functions (Exponential, Logarithmic, Trigonometric) Using Taylor and Binomial Series
9. Experiment on Solving Differential Equations Using Power Series Method

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - MATHEMATICS

SEMESTER - 6

Subject Code: 10160602	**Subject Title:** Mathematical Analysis-III
Pre-requisite: To study this course, a student must have knowledge of calculus and particularly limits of functions	

Course Objective:

(1) To introduce the foundational concepts of metric spaces, including distance, open and closed sets, and convergence.

(2) To develop understanding of uniform convergence of functions and its implications in analysis.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	05	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Metric Spaces:** Definitions & Examples, Open Sets, Closed Sets, Convergence, Completeness and Baire's Theorem	10	20%
2	**Continuity, Compactness & Connectedness:** Continuous Mappings, Compactness, Continuous function on compact set, Connected Set, Continuous function on connected set	15	30%
3	**Uniform Convergence and Applications of Uniform Convergence:** Pointwise Convergence, Uniform Convergence, Continuity, Differentiation, Abel's Limit Theorem, Multiplication of Power Series, Taylor's Series, Weierstrass' Approximation Theorem, Exponential, Logarithmic and Trigonometric Functions	20	50%

Course Outcome: After completion of this course, students will be able to

- Identify open sets and closed sets in metric space.
- Identify continuous mappings on metric space.
- Identify connected and compact metric spaces.
- Test and use convergence in different form in metric space.

List of Text Book:

1. Introduction to Real Analysis, Robert G. Bartle and Donald R. Sherbert, Wiley Student Edition, 2010
2. Topology and Modern Analysis, G.F. Simmons

List of References:

1. A Course in Calculus & Real Analysis - S. R. Ghorpade & B. V. Limaye
2. Elementary Analysis: The theory of calculus - K. Ross, Springer.India.
3. Numbers to Analysis - I. K. Rana, World Scientific
4. Metric Spaces - Shirali, Springer, India.
5. Mathematical Analysis: Linear & Metric Structure & Continuity - Mariano Giaquinta & Giuseppe Modica Birkhauser, Boston
6. Topology of Metric Spaces - S. Kumaresan, Narosa

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Identifying Open and Closed Sets in Various Metric Spaces with Examples.
2. Experiment on Exploring Convergence and Completeness of Sequences in Metric Spaces.
3. Experiment on Demonstrating Baire's Category Theorem Through Constructive Examples in Complete Metric Spaces.
4. Experiment on Testing Continuity of Mappings Between Metric Spaces.
5. Experiment on Exploring Compact Sets and Verifying Properties of Continuous Functions on Compact Sets.
6. Experiment on Identifying Connected Sets and Analyzing Behavior of Continuous Functions on Connected Sets.
7. Experiment on Comparing Pointwise and Uniform Convergence of Function Sequences with Graphical and Analytical Methods.
8. Experiment on Studying the Effect of Uniform Convergence on Continuity, Differentiability, and Integration.
9. Experiment on Applications of Uniform Convergence: Taylor's Series, Abel's Limit Theorem, and Weierstrass' Approximation Theorem.

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - MATHEMATICS

SEMESTER - 6

Subject Code: 10160603	**Subject Title:** Graph Theory
Pre-requisite: To study this course, a student must have knowledge of discrete mathematics including sets, relations and functions	

Course Objective:

(1) To introduce the fundamental concepts and structures of graph theory, including graphs, trees, connectivity, and traversals.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	05	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Graphs:** Definition of Graphs, Vertex Degrees, Subgraphs, Path and Cycles	15	33%
2	**Trees:** Trees and their properties, Bridges, Spanning trees, Cut Vertices and Connectivity	15	33%
3	**Matrix Representation of Graphs:** Matrix representation of graphs, Hamiltonian graphs, Euler Graphs, Euler Tour	15	34%

Course Outcome: After completion of this course, students will be able to

- Demonstrate properties of different graphs.
- Use mathematical problems using isomorphism of graphs.
- Use to solve mathematical problems using isomorphism invariant properties of graphs
- Apply the relationship between the matrix representation of a graph and the structure of the underlying graph.
- Apply various graph theoretical algorithms to solve some real life problems.

List of Text Book:

1. A First Look at Graph Theory - John Clark and Derek Allan Holton, Allied Publishers Limited, Chapters 1 to 3

List of References:

1. Introduction to Graph Theory - R. J. Wilson, Longman Elementary Analysis: The theory of calculus - K. Ross, Springer, India.

2. Introduction to Graph Theory - Douglas B. West, Prentice-Hall of India, Second Edition, 2006
3. Graph Theory - G. Suresh Singh, Prentice Hall of India
4. A First Course in Graph Theory and Combinatorics, Sebastian M Cioaba and M Ram Murty, Hindustan Book Agency.
5. Graph Theory with Application- John Bondy and U.S.R Murty, Palgrave

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Identifying Types of Graphs and Calculating Vertex Degrees
2. Experiment on Constructing and Analyzing Subgraphs from Given Graphs
3. Experiment on Tracing and Classifying Paths and Cycles in Graphs
4. Experiment on Identifying Trees and Verifying Their Basic Properties
5. Experiment on Constructing Spanning Trees and Detecting Bridges in Graphs
6. Experiment on Finding Cut Vertices and Analyzing Connectivity in Graphs
7. Experiment on Constructing Adjacency and Incidence Matrices for Given Graphs
8. Experiment on Identifying Euler Graphs and Tracing Euler Tours
9. Experiment on Verifying Hamiltonian Graphs Using Path and Cycle Conditions

GANDHINAGAR INSTITUTE OF SCIENCE

BACHELOR OF SCIENCE - MATHEMATICS

SEMESTER - 6

Subject Code: 10160604	**Subject Title:** Operation Research
Pre-requisite: To study this course, a student must have fundamental knowledge and skills to understand OR methods effectively.	

Course Objective:

(1) To develop student's ability to apply optimization and analytical methods for effective problem solving in business, and management contexts.

(2) To introduce the fundamental principles and techniques of Operations Research for modeling and solving real-world decision-making problems.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
03	-	02	05	50	50	25	25	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Inventory Problems:** Introduction, types of Inventory, Cost involved in inventory problems, Notations, EOQ model, Limitations of EOQ formula, EOQ model with finite replenishment rate, EOQ model with shortages, Order - level Lot - size model, Order - level Lot - size model with finite replenishment rate.	15	33%
2	**PERT and CPM:** Introduction, origin of PERT & CPM, applications of PERT & CPM, framework of PERT & CPM, construction of project network, dummy activities and events, rules for network construction, finding the critical path, concepts of float, total float and free float and its interpretations.	15	33%
3	**Game Theory:** Introduction, Two person zero-sum games, Maximin and Minimax Principles, Mixed strategies, expected pay-off, solution of mixed strategy game, solution of mixed strategy game by the method of oddments, Dominance Principle, solution of mixed game by matrix method, solution of a two person zero-sum game, Algebraic method for solving a game, solution of games with mixed strategy by the method of oddments, Iterative method for approximate solution.	15	34%

Course Outcome: After completion of this course, students will be able to

- Develop the inventory models with different characteristics like model with finite replenishment rate, with shortages, Order-level Lot-size model, Order-level Lot-size model with finite replenishment rate.

- Exhibit the notion of PERT & CPM and its applications.
- Set up framework of PERT & CPM and construct project network.
- Set up different game strategies and solve some real-life problems.

List of Text Book:

1. Operations Research - Nita H. Shah, Ravi M. Gor and Hardik Soni, PHI learning.

List of References:

1. Operations Research: An Introduction (9th Edition): Hamdy A Taha, Pearson Education
2. Mathematical models in O.R. - J. K. Sharma,Tata-MacGraw Hills book-company.
3. Operation Research - S. D. Sharma, Kedarnath Ramnath & Co.
4. Operation Research - Kanti Swaroop & Man Mohan, Sultan Chand & Co.

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/courses)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

List of Suggested Experiments

1. Experiment on Solving Basic EOQ Models and Analyzing the Effect of Cost Parameters.
2. Experiment on EOQ Models with Finite Replenishment Rate and With Shortages.
3. Experiment on Order-Level Lot-Size Models Including Cases with Finite Replenishment Rate.
4. Experiment on Constructing Project Networks Using PERT and CPM with Dummy Activities and Events.
5. Experiment on Finding the Critical Path in a Project Network and Analyzing Project Duration.
6. Experiment on Calculating Total Float and Free Float and Interpreting Their Significance in Project Management.
7. Experiment on Solving Two-Person Zero-Sum Games Using Maximin, Minimax, and Dominance Principles.
8. Experiment on Finding Solutions of Mixed Strategy Games Using Matrix Method, Algebraic Method, and Method of Oddments.
9. Experiment on Applying the Iterative Method for Approximate Solutions in Games with No Saddle Point.

Gandhinagar Institute of science
Bachelor of Science - Mathematics
Semester 7

Subject Code: 10160701	**Subject Title: Advanced Ordinary Differential Equations**
Pre-requisite: Basic Knowledge of Ordinary differential Equation	

Course Objective:

1. Demonstrate a working knowledge of Strum Liouville's Problem.
2. Demonstrate a working knowledge transition matrix eigenvalue method, Peano-Backer series method.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	4	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Mathematical Modeling and Fundamental Theory:** • Mathematical modeling using ordinary differential equations (ODEs) and difference equations • Reduction of nth-order differential equations into first-order systems • Existence and uniqueness of solutions for nonlinear ODE systems • Lipschitz condition and Gronwall's lemma	15	25%
2	**Linear and Nonlinear System Analysis:** • Phase plane analysis • Linearization of nonlinear systems • Autonomous and non-autonomous linear systems • Linear dependence and independence of solutions • Wronskian	15	25%
3	**Solution Techniques for Dynamical Systems:** • Transition (fundamental) matrix for linear systems • Computation of transition matrix using • Eigenvalue method • Peano–Baker series • Solution of nonlinear systems using variation of parameters	15	25%
4	**Stability and Special Differential Equations:** • Stability of dynamical systems • Lyapunov, exponential, and asymptotic stability • Sturm–Liouville problems and eigenvalue problems • Series solutions of non-autonomous continuous systems • Frobenius method, Bessel and Legendre series	15	25%

Course Outcome: After completion of this course, student will be able to

- Formulate mathematical models using ordinary differential and difference equations.

- Analyze linear and nonlinear systems using phase plane and linearization techniques.
- Solve dynamical systems using transition matrix and variation of parameters methods.
- Examine stability and eigenvalue problems in differential equations and dynamical systems.

List of Text Books:

1. **S**.L. Ross, Differential equations, Blaisdell publishing company, First edition, 1964
2. Birkhoff G, Ordinary differential equations, Boston, 1962

List of Reference Books:

1. Coddington E. A and N. Levinson,Theory of ordinary differential equations, McGraw-Hill, New York, 1955.
2. An introduction to Differential Equations, Springer- verlag, Second edition, 1995
3. V.I. Arnold, Ordinary Differential Equations, Prentice- Hall of India, New Delhi, 1998
4. Verhulst, Nonlinear Equations

Open e-Resource: : NPTEL Ordinary differential Equation lecture: https://swayam.gov.in/

Gandhinagar Institute of Science
Bachelor of Science - Mathematics
Semester 7

Subject Code: 10160702	**Subject Title: Numerical Analysis and Complex Analysis**
Pre-requisite: Various Mathematical Series, Calculus	

Course Objective:

1. To familiarize students with error analysis and its significance in numerical computations, including round-off and truncation errors.
2. To equip students with the ability to solve nonlinear equations, systems of linear equations, and differential equations numerically.
3. To develop a comprehensive understanding of analytic functions, conformal mappings, complex series, and complex integration techniques for solving problems in complex analysis.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	4	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Errors, Approximation, and Numerical Integration:** • Floating point numbers and round-off errors • Absolute and relative errors • Types of approximations • Polynomial approximation using orthogonal polynomials • Approximation using Chebyshev polynomials • Romberg integration and adaptive quadrature • Multistep methods: Milne–Simpson method	15	25
2	**Eigenvalue Problems, Interpolation, and Matrix Factorization:** • Properties of eigenvalues and eigenvectors • Power method, Inverse power method • Jacobi's method, Givens method • Schur theorem, Gershgorin's theorem • Orthogonal factorization, QR algorithm • Eigenvalues and eigenvectors of complex matrices • Hermite interpolation with error analysis • Richardson interpolation, Aitken extrapolation • Spline interpolation • Escalator method and Cholesky factorization	15	25 %
3	**Analytic Functions and Harmonic Functions:**	15	25 %

	• Functions of a complex variable • Continuity and differentiability of complex functions • Necessary and sufficient conditions for differentiability of $f(z)$ • Holomorphic and homomorphic functions • Elementary properties of holomorphic functions • Harmonic functions and applications to potential theory		
4	**Conformal Mapping, Complex Integration and Power Series:** • Mapping and transformations: Linear transformation, Inversion, Linear fractional transformation • Conformal mapping and its applications • Mapping by elementary and special functions • Complex integrals: contours and contour integrals • Cauchy's integral theorem and consequences • Morera's theorem, Liouville's theorem • Maximum modulus theorem, Fundamental theorem of algebra • Power series representations of $f(z)$ • Singularities and Residues of $f(z)$ • Residue theorem, Applications of residue theory	15	25 %

Course Outcome:

After Completion of this Course Students will be able to:

- Apply numerical approximation and integration techniques with error analysis.
- Compute eigenvalues and solve interpolation and matrix factorization problems using numerical methods.
- Analyze analytic and harmonic functions of a complex variable and their properties.
- Apply conformal mapping and complex integration theorems to solve problems in complex analysis.

List of Textbooks:

1. M.K. Jain: Numerical solution of differential equations, Wiley Eastern (1979), Second Edition.
2. C.F. Gerald and P.O. Wheatley: Applied Numerical Methods, Low- priced edition, Pearson Education Asia (2002), Sixth Edition.
3. L.V.Ahlfors, Complex analysis, Third Edition, McGraw Hill Book Company,1979
4. R. V. Churchill and James Ward Brown: Complex Variables and Applications, McGraw-Hill, Inc (VI Edition).

List of Reference Books:

1. S.C. Chapra, and P.C. Raymond: Numerical Methods for Engineers, Tata Mc Graw Hill, New Delhi (2000).
2. S.D and Carl Deboor: Elementary Numerical Analysis: an algorithmic approach, Mc Graw Hill company, Third edition (1981).
3. R.L. Burden, and J. Douglas Faires: Numerical Analysis, P.W.S. Kent Publishing Company, Boston (1989), Fourth edition.

4. S.S. Sastry: Introductory methods of Numerical analysis, Prentice- Hall of India, New Delhi (1998).
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain: Numerical methods for scientific and Engineering computation, Wiley Eastern (1993).
6. G.D. Smith: Numerical Solutions of partial differential equations 2nd edition London, Oxford University Press (1978).
7. B.C.Palka, An Inroduction to the Complex function Theory, Springer, 1991.
8. H.A. Priestley, Introduction to Complex Analysis, Second Edition, Oxford University Press, 2003.

Open e-Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ma94/preview
2. https://onlinecourses.nptel.ac.in/noc23_ge35/preview

Gandhinagar Institute of Science
Bachelor of Science - Mathematics
Semester 7

Subject Code: 10160703	**Subject Title: Advanced Linear Algebra**
Pre-requisite: Basic linear algebra.	

Course Objective:

- The aim of this course is to make students to learn about abstract concepts of vector spaces, linear transformations and their properties.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	4	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Vector Spaces and Linear Systems:** • Review of vector spaces • Examples of sequence spaces and function spaces • Linear span, linear dependence and independence, basis • Finite and infinite dimensional vector spaces • Quotient spaces and their dimension • Dual space, dual basis, annihilator and its dimension • Solution of systems of linear homogeneous equations	15	25 %
2	**Linear Transformations and Matrix Representation:** • Definitions and examples of algebras • Algebraic analogue of Cayley's theorem • Minimal polynomial and rank of a linear transformation • Characteristic roots and characteristic vectors • Matrix associated with a linear transformation • Isomorphism between linear transformations and matrices • Similarity of matrices and linear transformations	15	25 %
3	**Canonical Forms and Jordan Theory:** • Relation between minimal polynomials of a linear transformation and its induced transformation on a quotient space • Triangular matrix associated with a linear transformation • Nilpotent linear transformations • Canonical matrix of a nilpotent transformation • Existence and uniqueness of invariants • Jordan canonical form of a linear transformation	15	25 %

4	**Determinants, Trace, and Quadratic Forms** • Trace of a matrix and its applications • Jacobson's lemma, transpose of a matrix • Determinant: definition and properties • Determinant of triangular matrices • Determinant of matrices with equal rows • Determinant of product of matrices • Applications of determinants: Regularity of a matrix, Cramer's rule for non-homogeneous systems • Quadratic forms: Diagonalization of symmetric matrices, Classification of quadrics	15	25 %

Course Outcome:

After Completion of this Course Students will be able to:

- Understand vector spaces, dual spaces, and solve systems of linear equations.
- Analyze linear transformations using matrix representation and similarity concepts.
- Apply canonical forms, nilpotent theory, and Jordan decomposition of linear transformations.
- Use determinants, trace, and quadratic forms to solve algebraic and geometric problems.

List of Textbooks:

1. Herstein I. N., Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. Kwak J. H., Hong S., Linear Algebra, (Second Edition), Birkhauser, 2004.

List of Reference Books:

1. Kumaresan S., Linear Algebra: A Geometric Approach, Prentice Hall of India, 2000.
2. Simmons G. F., Introduction to Topology and Modern Analysis, McGraw-Hill Co., Tokyo, 1963.
3. Helson H., Linear Algebra, (Second Edition), Hindustan Book Agency, TRIM-4, 1994.
4. Ramachandra Rao A. and Bhimasankaram P., Linear Algebra (Second Edition), Hindustan Book Agency, TRIM-19, 2000.

Open e-Resources:

1. https://onlinecourses.nptel.ac.in/

Gandhinagar Institute of Science
Bachelor of Science - Mathematics
SEMESTER - 7

Subject Code: 10160704	**Subject Title: Programming using MATLAB**
Pre-requisite: To study this course, a student must have subject Mathematics in BSc.	

Course Objective:

1. To gain proficiency in programming languages.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
-	-	08	04	-	-	50	50	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**MATLAB Basics and Arithmetic Operations:** • Introduction to MATLAB programming environment • Polynomial and matrix operations • Arithmetic operations on numbers, vectors, and matrices • Programs for o Area of circle, square, rectangle, and triangle o Volume of cube, cylinder, and cone o Simple and compound interest	30	25%
2	**Data Analysis and Visualization:** • Statistical computations • Mean, median, mode • Frequency distribution • Plotting graphs using MATLAB	30	25%
3	**Control Structures and Series Expansion:** • Branching structures: if, if–else, if–elseif–else, switch • Looping structures: do–while, while, for • Series expansion of functions $\sin x$, $\cos x$, e^x, etc.	30	25%
4	**Numerical Methods Using MATLAB:** • Writing and using function files • Square root of a number using iterative algorithms • Bisection method • Runge–Kutta method • Trapezoidal rule and Simpson's rule	30	25%

Course Outcome: After completion of this course, student will be able to

- Apply MATLAB for arithmetic, polynomial, and matrix computations.
- Perform statistical analysis and graphical visualization using MATLAB.
- Implement control structures and series expansions in MATLAB programs.

- Solve numerical problems using standard numerical methods in MATLAB.

List of References:

1. E.V. Krishnamurthy and S.K. Sen, Computer based numerical Algorithms, East – West press Pvt. Ltd. (1976)
2. S.S. Sastri, Introductory Methods of Numerical Analysis, Prentice Hall of India, New Delhi (1997)
3. J.D.Faires and R. Burden, Numerical methods, Brooks/Cole publishing Co., second edition (1998)

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

Gandhinagar Institute of Science
Bachelor of Science - Mathematics
SEMESTER - 8

Subject Code: 10160801	**Subject Title: Partial Differential Equations**
Pre-requisite: Real analysis, multivariable calculus, and ordinary differential equations.	

Course Objective:

- The objective of this course is to acquaint students with partial differential equations and diverse solution techniques.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	04	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**First-Order Partial Differential Equations:** • Formation of partial differential equations • Singular integrals • Solution of first-order PDEs using Lagrange's method • Nonlinear first-order PDEs • Compatible systems of first-order PDEs • Charpit's method and Jacobi's method	15	25%
2	**Linear PDEs with Constant Coefficients:** • Origin of second-order PDEs • Linear second-order PDEs with constant coefficients • Solution of $F(D,D')z = F(x,y)$ for Polynomial Exponential Sine/Cosine functions • General method for homogeneous equations	15	25%
3	**Complementary Function and Separation of Variables:** • Solution of homogeneous and non-homogeneous linear PDEs • Complementary function (CF) and particular integral (PI) method • Separation of variables method • Solutions in Cartesian and polar coordinates	15	25%
4	**Classification, Boundary Value Problems, and Applications:** • Classification of second-order linear PDEs • Initial and boundary conditions • Modeling and solution of One-dimensional heat equation, One-dimensional wave equation, Laplace	15	25%

	equation (two and three dimensions) • Nonlinear second-order PDEs • Green's functions and integral representations		

Course Outcome: After completion of this course, student will be able to

- Formulate and solve first-order partial differential equations using standard analytical methods.
- Solve linear partial differential equations with constant coefficients using operator techniques.
- Apply complementary function, particular integral, and separation of variables methods to PDEs.
- Analyze and solve boundary value problems arising from physical models using PDE theory.

List of Text Books:

1. Grewal B. S. and Grewal, J. S., Higher Engineering Mathematics, Khanna Pub., New Delhi, 2000
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).

List of Reference Books:

1. T. Amarnath, An Elementary Course in Partial Differential Equations, (2nd edition), Narosa Publishing House, 1997.
2. R.K. Gupta, Partial Differential Equations, Krishna Prakashan, Meerut, 2014
3. F. John, Partial Differential Equations, 3rd ed. Narosa Publ. Co., New Delhi, 1979.
4. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Company, New York,1957.
5. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th edition, Wiley India

Open e-Resource:

1. NPTEL Partial differential Equation lecture: https://swayam.gov.in/

Gandhinagar Institute of Science
Bachelor of Science - Mathematics
Semester 8

Subject Code: 10160802	**Subject Title: Applied Analysis**
Pre-requisite: To study this course, a student must have subject real analysis in BSc.	

Course Objective:

1. Main objective of this course is to give a knowledge and idea of the theory of Hilbert spaces and Lebesgue theory.
2. Students will learn modern mathematical analysis.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	4	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Lebesgue Measurable Sets:** • Algebra and σ-algebra of sets • Borel sets and Borel σ-algebra in $\mathbb{R}$ • Structure theorem for open subsets of $\mathbb{R}$ • G_δ-sets and F_σ-sets • Outer measure in $\mathbb{R}$ and its basic properties • Lebesgue measurable sets • Lebesgue measure on $\mathbb{R}$ and basic results • Construction of a non-measurable set and a non-Borel set	15	25%
2	**Lebesgue Measurable Functions and Integration:** • Simple functions and canonical form • Measurable functions and basic properties • Littlewood's three principles • Egoroff's theorem	15	25%

	• Simple approximation theorem • Convergence in measure • Relation between pointwise convergence and convergence in measure • Monotone functions and continuity • Riemann integral		
3	**Hilbert Spaces – I:** • Inner product spaces and normed linear spaces • Examples of inner product spaces • Polarization identity, Schwarz inequality, parallelogram law • Uniform convexity of norm induced by inner product • Orthonormal sets and Pythagoras theorem • Gram–Schmidt orthonormalization • Bessel's inequality • Riesz–Fischer theorem • Hilbert spaces, orthonormal basis, separability	15	25%
4	**Hilbert Spaces – II:** • Orthogonality and best approximation • Existence and uniqueness of best approximation from a convex subset • Continuity of a linear mapping • Projection theorem • Riesz representation theorem • Weak convergence and weak boundedness	15	25%

Course Outcome: After completion of this course, student will be able to

- Understand the structure of Lebesgue measurable sets and Lebesgue measure on $\mathbb{R}$.
- Analyze measurable functions and convergence concepts in measure theory.
- Apply inner product space theory and orthonormal systems in Hilbert spaces.
- Use projection, representation, and convergence theorems in Hilbert space analysis.

List of Text Books:

1. Royden H. L. and Fitzpatrick P. M., Real Analysis, Pearson, Fourth Edition, 2010.
2. Thumban Nair, Functional Analysis: A First Course, Prentice-Hall of India, New Delhi, 2002.

List of Reference Books:

1. De Barra G., Introduction to Measure Theory, Van Nostrand Reinhold Co., 1974.
2. Rana I. K., An Introduction to Measure and Integration, Narosa Publication House, New Delhi, 1997.
3. Limaye B.V., Functional Analysis, New Age International Publ. Ltd., New Delhi, 1996.
4. Simmons, G.F., Introduction to Topology and Modern Analysis, McGraw-Hill Co., Tokyo, 1963.

Gandhinagar Institute of Science
Bachelor of Science - Mathematics
Semester -8

Subject Code: 10160803	**Subject Title: Advanced Abstract Algebra**
Pre-requisite: Strong foundation in group theory.	

Course Objective:

1. To study ring theory further, and to introduce Galois theory with some applications

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	-	4	50	50	-	-	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Rings and Homomorphisms:** • Brief review of algebraic structures • Ideals and factor rings • Ring homomorphisms and their properties	15	25 %
2	**Polynomial Rings and Factorization:** • Polynomial rings • Irreducibility tests • Unique factorization in $Z[X]$ • Divisibility in integral domains	15	25 %
3	**Field Extensions and Finite Fields:** • Splitting fields • Finite extensions of fields • Properties of algebraic extensions • Finite fields • Applications to geometric constructions	15	25 %
4	**Galois Theory and Applications:** • Fundamental theorem of Galois theory • Solvability of polynomials by radicals • Insolvability of the quintic (quantic) • Cyclotomic polynomials	15	25 %

Course Outcome: After Completion of this Course Students will be able to:

- Understand ideals, factor rings, and ring homomorphisms in algebraic structures.
- Apply factorization and irreducibility concepts in polynomial rings.
- Analyze field extensions, finite fields, and their algebraic properties.
- Use Galois theory to study solvability of polynomials and related applications.

List of Textbooks:

1. Contemporary Abstract Algebra (Eighth Edition) by Joseph A. Gallian, Cengage India Learning Private Limited, 2013.

List of Reference Books:

1. A Course in Algebra by E. B. Vinberg, American Mathematical Society, 2003.
2. Basic Abstract Algebra (Second Edition) by P. B. Bhattacharya, S. K. Jain, S. R. Nagpal, Cambridge University press, 1995.

GANDHINAGAR INSTITUTE OF SCIENCE
Bachelor of Science - Mathematics
SEMESTER - 8

Subject Code: 10160804	**Subject Title: Programming using Python**
Pre-requisite: To study this course, a student must have subject Mathematics in BSc.	

Course Objective:

1. To gain proficiency in programming languages.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
-	-	8	4	-	-	50	50	100

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1	**Python Basics and Logical Programming:** • Introduction to Python programming • Programs to develop logical thinking • Polynomial operations • Matrix operations	30	25%
2	**Operators and Mathematical Applications:** • Arithmetic operators on numbers, vectors, and matrices • Programs for Area of various geometrical shapes Volume of various geometrical shapes	30	25%
3	**Data Analysis and Visualization:** • Statistical computations Mean, median, mode Frequency distribution • Plotting graphs using Python	30	25%
4	**Control Structures and Series Expansion:** • Branching structures if, if–else, if–elif–else, switch • Looping structures do–while, while, for • Series expansion of functions $\sin x$, $\cos x$, e^x, etc.	30	25%

Course Outcome: After completion of this course, student will be able to

- Develop Python programs using logical and matrix-based computations.
- Apply operators to solve mathematical and geometrical problems using Python.

- Perform statistical analysis and graphical visualization using Python.
- Implement control structures and series expansions in Python programs.

List of References:

1. Eric Matthes,Python Crash Course, Second Edition, No Starch Press, (2019).
2. John M Zelle, Python Programming: An Introduction to Computer Science, Ingram short title, (2016).
3. Sam Morley, Applying Math with Python, (2022).

Open e-Resource:

1. National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in)
2. Massachusetts Institute of Technology (MIT) Open Learning. (https://ocw.mit.edu/search/?d=Mathematics)

A. Ability Enhancement Courses (AEC)

Sl. No	Course Name	Tick (Any 05)
1	Business Communication – Blended with ICSI	AEC001
2	Communication and Presentation for Technical Professionals (IEEE)	AEC002
3	Conversational Hindi (Modern Indian Language)	AEC003
4	Corporate Grooming and Business Etiquettes	AEC004
5	Digital Privacy: Understanding and Operational Framework (IEEE)	AEC005
6	Digital Transformation: Game Changing Opportunities (IEEE)	AEC006
7	Economics & Business Environment Blended with ICSI	AEC007
8	Freelancing and Content Writing	AEC008
9	French	AEC009
10	Functional Grammar and Composition	AEC010
11	German	AEC011
12	Gujarati	AEC012
13	Marathi	AEC013
14	Mass Communication and Journalistic Writing	AEC014
15	Personality Development for Effective Leadership	AEC015
16	Practical English	AEC016
17	Punjabi	AEC017
18	Spanish	AEC018
19	Radio Jocky	AEC019

B. Skill Enhancement Courses (SEC)

Sl. No	Course Name	Tick (Any 05)
1	Animation & Graphics Design	SEC001
2	Aptitude and Logical Reasoning Blended with ICSI	SEC002
3	AutoCAD and Basic Drafting	SEC003
4	Business Administration	SEC004
5	Current Affairs and Quantitative Aptitude Blended with ICSI	SEC005
6	Data Analysis using Spreadsheet	SEC006
7	Digital Marketing	SEC007
8	Eco-Engineering: Designing for the Future	SEC008
9	Engineering Mastery: Tools and Techniques	SEC009
10	Event Management	SEC010
11	ICT Skills for Leadership	SEC011
12	Innovation & Entrepreneurship	SEC012
13	Interpersonal Skills – Blended with ICSI	SEC013
14	Introduction of Cyber Security (IEEE)	SEC014
15	Office Automation Tools	SEC015
16	Performing Arts (Dance, Music, Drama)	SEC016
17	Personal Financial Planning	SEC017
18	Practical Workshop Training	SEC018
19	Social Media Management	SEC019
20	Tally Accounting	SEC020
21	Visual Arts	SEC021
22	Public Speaking	SEC022
23	Organic Farming	SEC023

C. Value **Addition** Courses (VAC)

Sl. No.	Course Name	Tick (Any 05)
1	Anti-ragging – Blended with IEEE	VAC001
2	Art of Living for Wellness	VAC002
3	Awareness of Cyber Crime and Ethical Hacking	VAC003
4	Basic Life Support (BLS)	VAC004
5	Community Development	VAC005
6	Economics & Social Development	VAC006
7	Emotional Intelligence	VAC007
8	Environmental Studies	VAC008
9	Ethics and Values in Ancient Indian Tradition	VAC009
10	Gandhian Studies	VAC010
11	Indian Economy and Planning	VAC011
12	Indian Geography and Environmental Ecology	VAC012
13	Indian History and Cultural Heritage	VAC013
14	Integrated Personality Development Course	VAC014
15	Life Lessons from Bhagvad Gita	VAC015
16	Life Skills	VAC016
17	National Cadet Corps (NCC)	VAC017
18	National Service Scheme (NSS)	VAC018
19	Prevention of Sexual Harassment	VAC019
20	Psychology	VAC020
21	Stress and Time Management	VAC021
22	Sustainable Development and Environmental Studies	VAC022
23	Universal Human Values	VAC023
24	Yoga and Meditation for Wellness	VAC024

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