Gujarat University
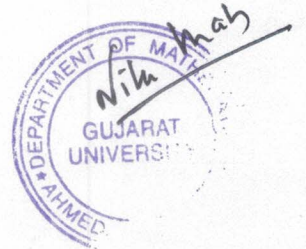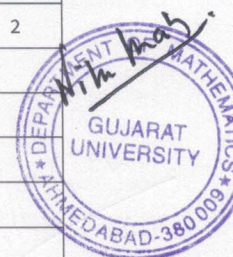**Choice Based Credit System**
Revised Syllabus for Under Graduate (B. Sc.) Mathematics
Effective from June-2018

Department	Semester		Course		No. of Hours per Week				Course Credits
			Name		Lectures	Others	Practi-cals	Total	
Mathematics	1	EC 101	Mathematics Basics and Quantitative Skills		3	-	-	3	2
		MAT101	Calculus and Matrix Algebra		4	-	-	4	4
		MAT102	Practical (Based on MAT101)		-	-	4	4	3
			Total		7	-	4	11	9
	2	MAT103	Differential Equations and Co-ordinate Geometry		4	-	-	4	4
		MAT104	Practical (Based on MAT103)		-	-	4	4	3
			Total		4	-	4	8	7
	3	MAT201	Advanced Calculus - I		4	-	-	4	4
		MAT202	Linear Algebra - I		4	-	-	4	4
		MAT203	Practical (Based on MAT201, MAT202 and Numerical Methods - I)		-	-	6	6	2.5
			Total		8	-	6	14	10.5
	4	MAT204	Advanced Calculus - II		4	-	-	4	4
		MAT205	Abstract Algebra - I		4	-	-	4	4
		MAT206	Practical (Based on MAT204, MAT205 and Numerical Methods - II)		-	-	6	6	2.5
			Total		8	-	6	14	10.5
	5	MAT301	Linear Algebra - II		4	-	-	4	4
		MAT302	Analysis - I		4	-	-	4	4
		MAT303	Complex Variables and Fourier Series		4	-	-	4	4
		MAT304	Mathematical Programming		4	-	-	4	4
		MAT305E	Discrete Mathematics		3	-	-	3	2
			Combinatorics						
			C Programming for Mathematical Problems						
			Financial Mathematics						
			Mathematical Statistics						
			Number Theory						
		MAT306	Practical - I (Based on MAT301, MAT302)		-	-	12	12	5
			Practical - II (Based on MAT303, MAT304)						
			Total		19	-	12	31	23
	6	MAT307	Abstract Algebra - II		4	-	-	4	4
		MAT308	Analysis - II		4	-	-	4	4
		MAT309	Analysis - III		4	-	-	4	4
		MAT310	Graph Theory		4	-	-	4	4
		MAT311E	Convex Analysis and Probability Theory		3	-	-	3	2
			Mechanics						
			Cryptography						
			Operations Research						
			Bio-Mathematics						
		MAT312	Practical - I (Based on MAT307, MAT308)		-	-	12	12	5
			Practical - II (Based on MAT309, MAT310)						
			Total		19	-	12	31	23
			Grand Total (for Mathematics only)					109	83

Gujarat University
Choice Based Credit System (CBCS)

Syllabus for Semester IV (Mathematics)
MAT 204: Advanced Calculus-II(Theory)

Hours: 4 /week   **Credits: 4**

Unit I Multiple integrals

Introduction to double integral, repeated or iterated integral, double integral over a closed region, evaluation of double integral, changing the order of double integral, triple integrals, Iterated triple integrals, Geometrical interpretation of double and triple integrals and problems based on it, Introduction to Jacobian (only definition), transformation of double and triple integrals.

Unit II Beta and Gamma functions and Vector calculus

(a) Definition of beta and gamma functions, properties of beta and gamma functions, relation between beta and gamma functions, duplication formula, evaluation of definite integrals using beta-gamma functions.

(b) Definition of gradient, divergence and curl, properties of theses operators.

### Unit III Line surface and volume integrals

Definition of line integral, Green's theorem, surface and volume integral, Gauss's divergence theorem, Stoke's theorem, verification of the three theorems and problems based on the theorems.

Unit IV Partial Differential Equations

Formation of' Partial differential equations by the elimination of Arbitrary constants and arbitrary functions. Partial differential equations of the first order, the complete and particular integrals, Lagrange's solution of' the linear equation. Some special types of equations which can be solved easily by the methods other than Charpit's method.

Reference Books:

1. Mathematical Analysis – S. C. Malik and Savita Arrora, Second Edition, New Age Int. (P) Ltd.
2. Integral calculus – Shanti Narayan.
3. Calculus – Second Edition, David V. Widder, PHI.
4. Advanced Calculus Volume II – T. M. Apostol.
5. Calculus- James Stewert.
6. Ordinary and Partial Differential Equations – Nita H Shah, PHI Learning.
7. Partial Differential Equations - T. Amarnath.
8. Elements of' Partial Differential Equations- Ian N. Sneddon, McGraw Hill co.
9. Calculus with Early Transcendental functions - James Stewart, Indian Edition, Engage Learning India Pvt Ltd.
10. Calculus & Analytic Geometry - G. B. Thomas & R. L. Finney, Addison - Wesley pub. India.
11. A course in Multivariable Calculus & Analysis – S. R. Ghorpade & B. V. Limaye, Springer India.
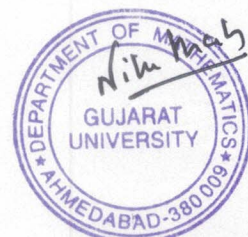
Gujarat University
Choice Based Credit System (CBCS)

Syllabus for Semester IV (Mathematics)
MAT 205: Abstract Algebra-I (Theory)

Hours: 4 /week   **Credits: 4**

Unit I   Relation, Binary operations & Groups:

Relation, Equivalence Relation, Partition of set, Binary operations. Division Algorithm for Integers, Congruence modulo Relation in Z, Definition and Examples of Groups, Elementary properties of Group, Equivalent Definitions of a Group, Finite Groups and their tables, Commutative and non-commutative groups.

Unit II Subgroups & Lattice diagrams:

Subgroups: Definition and Examples, normalizer and centralizers, order of an element, order of a group, cyclic subgroup generated by an element, Lattice diagrams of finite groups, cosets and its properties, Lagrange's theorem and its applications, Euler's theorem, Fermat's theorem.

Unit III Permutations & Normal subgroups:

Permutations: Definitions and Examples, cycle, transposition, even and odd permutations, order of a permutation, inverse of a permutation, Symmetric groups and Alternating groups. Examples, Quotient groups.
Normal subgroups: Definitions and Examples, Quotient group.

**Unit IV Homomorphism & Isomorphism of Groups:**

Isomorphism of groups: Definitions and Examples, Isomorphism as an equivalence relation. Cyclic Groups: Properties of Cyclic Groups, Isomorphism of Cyclic Groups. Homomorphism of groups: Definitions and Examples, Kernel of a Homomorphism, Fundamental Theorem of Homomorphism, Caley's Theorem, Automorphism of Groups.

Text Book:

Abstract Algebra - I. H. Sheth, PHI, New Delhi, Second edition-2009.

Reference Books:

1. Topics in Algebra - I. N. Herstein, Vikas Publishing, New Delhi.
2. A First Course in Abstract Algebra – J. B. Fraleigh, Narosa Publishing, New Delhi.
3. Basic Abstract Algebra – P.B. Bhattacharya, S.K. Jain and S. R. Nagpal, Foundation Books, New Dehli.
4. Abstract Algebra - Dipak Chatterajee, PHI Learing Pvt. Ltd, New Delhi.
5. Arup Bijganit (Gujarati) - I. H. Sheth, University Granth Nirman Board, Ahmedabad.
6. Algebra - Michael Artin, PHI.
7. A survey of Modern - G.B irkhoff & S. Maclane, Algebra Univ. Press.
8. A first course in Abstract Algebra (Rings, Groups & fields) - Marlow Anderson & Todd Fel, Chrpman & Halilereivy.
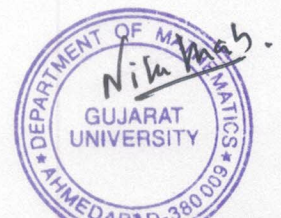
Gujarat University
Choice Based Credit System (CBCS)

Syllabus for Semester IV (Mathematics)
MAT 206: Practicals (Based on MAT204, MAT205 and Numerical Methods-II)

Hours: 6 /week   **Credits: 2.5**

List of Practicals:
Unit I
1. Problems based on relation between roots and coefficients of a polynomial equation and problems of finding equations from given conditions.
2. Cardon's method to solve a cubic polynomial equation
3. Ferrari's method to solve a bi-quadratic polynomial equation
4. Graphical method to find a real root of an equation.

Unit II
5. Bisection method and method of false position
6. Fixed point iteration method and Newton-Raphson's method
7. Euler's method to solve an Initial Value Problem (IVP) and Modified Euler's method to solve an IVP.
8. Taylor's series method to solve an IVP and Picard's method to solve an IVP.

Unit III
9. Runge-Kutta method of order two and order four to solve an IVP.
10. Numerical differentiation for equispaced arguments: Newton's forward and backward differentiation formula, Gauss's forward differentiation formula
11. Numerical differentiation for unequispaced arguments: Newton's divided difference interpolation and Lagrange's interpolation formula.
12. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule.

Unit IV
13. Problems on change of the order of integration.
14. Problems on line integrals and volume integrals.
15. Examples of Permutation or symmetric group.
16. Examples of cyclic group and its subgroups and lattice diagrams.

Reference Books:
1. Numerical Analysis and Computational Procedures – S.A.Mollah.
2. Numerical Analysis with C++ programming – Nita H Shah. PHI Learning.
3. Elementary Numerical Analysis - Shastry.
4. Numerical Mathematical Analysis - James Scarborough.
5. Numerical Analysis - S. Kunz.
6. Numerical Methods for Scientific and Engeenering Computation - 6th Edition, M. K. Jain, S. R. Iyengar, R. K. Jain, New Age International Publishers.