

Gujarat University

NEP 2020 Based Syllabus

Syllabus for B. Sc. Sem-III Mathematics Major

Effective from June-2024



Subject Code For UG Science Courses: -MAT

Semester	Discipline Specific Courses - Core (DSC - C)	Minor (DSC - M)	Multi / Inter disciplinary courses (MDC / IDC)	Ability Enhancement Courses (Language) (AEC)	Enhancement Courses / Internship / Dissertation Skill	Common Value Added Courses (VAC / IKS)	Total Credits
I	DSC - C - MAT - 111T : 4 DSC - C - MAT - 112P : 4	DSC - M - MAT - 113T : 2 DSC - M - MAT - 113P : 2	MDC - MAT - 114T : 2 MDC - MAT - 114P : 2	AEC - 115 : 2	SEC - 116 : 2	IKS - 117 : 2	22
II	DSC - C - MAT - 121T : 4 DSC - C - MAT - 122P : 4	DSC - M - MAT - 123T : 2 DSC - M - MAT - 123P : 2	MDC - MAT - 124T : 2 MDC - MAT - 124P : 2	AEC - 125 : 2	SEC - 126 : 2	VAC - 127 : 2	22
III	DSC - C - MAT - 231T : 4 DSC - C - MAT - 232T : 4 DSC - C - MAT - 233P : 4	-	MDC - MAT - 234T : 2 MDC - MAT - 234P : 2	AEC - 235 : 2	SEC - 236 : 2	IKS - 237 : 2	22
IV	DSC - C - MAT - 241T : 4 DSC - C - MAT - 242T : 4 DSC - C - MAT - 243P : 4	DSC - M - MAT - 244T : 2 DSC - M - MAT - 244P : 2	-	AEC - 245 : 2	SEC - 246 : 2	VAC - 247 : 2	22
V	DSC - C - MAT - 351T : 4 DSC - C - MAT - 352T : 4 DSC - C - MAT - 353P : 4	DSC - M - MAT - 354T : 4 DSC - M - MAT - 355P : 4	-	-	SEC - 356 : 2	-	22
VI	DSC - C - MAT - 361T : 4 DSC - C - MAT - 362T : 4 DSC - C - MAT - 363P : 4	DSC - M - MAT - 364T : 2 DSC - M - MAT - 364P : 2	-	AEC - 365 : 2	Internship - 4	-	22
VII	DSC - C - MAT - 471T : 4 DSC - C - MAT - 472T : 4 DSC - C - MAT - 473P : 4	DSC - M - MAT - 474T : 2 DSC - M - MAT - 474P : 2	-	-	-	OJT / RP - 6	22
VI	DSC - C - MAT - 481T : 4 DSC - C - MAT - 482T : 4 DSC - C - MAT - 483P : 4	DSC - M - MAT - 484T : 2 DSC - M - MAT - 484P : 2	-	-	-	OJT / RP - 6	22

Syllabus for B Sc Semester - III (MATHEMATICS)

Mathematics Major

Course-DSC-C-MAT-231T

Paper Title: LINEAR ALGEBRA-I

UNIT I (IKS)

a) Brahmagupta's Bhāvanā: The Bhāvanā- An Introduction, Bhāvanā and Modern Algebra, Binary

Composition (samāsa- Bhāvanā), The Bhāvanā laws, Binary Quadratic Form (Brahmagupta's identity), and its Solutions

b) "Karan" "i" (Surd):" Indian History of Surd, Operations of Surds with examples in context of IKS

UNIT II Vector spaces and Subspaces.

Vector space: Definition of vector space, Properties of a vector space, Examples, results on vector space and its properties.

Subspaces: examples, results, theorems on subspace, intersection, union, addition, and direct sums of subspaces.

Basis and Dimension of a Vector Space and Dimension Theorem.

Definition of Linear independence and linear dependence, Finite linear combination, Definition of a basis of a vector space and dimension of a vector space.

Examples and results on dimension and basis of a vector space, Dimension theorem, Examples and results of dimension theorem.

UNIT III Linear Transformation and Rank-Nullity Theorem.

Linear transformation: Definition of linear transformation, examples, and results based on it. Range, kernel, rank & nullity of linear transformations, examples, and results.

Rank-nullity theorem, examples, results of finding rank and nullity of linear maps, and verification of rank-nullity theorem.

UNIT IV Matrices:

Matrices: Matrix associated with linear map, linear map associated with matrix, examples, results, linear operations in $\mu_{m,n}$, definitions of $L(U,V)$ and isomorphism between $\mu_{m,n}$ & $L(U,V)$, dimension theorem for dimension of $\mu_{m,n}$ & $L(U,V)$, Rank and nullity of matrices and their examples.

Reference Books

- 1) Bhāskarācāryā, “Bijaganitam” The Sanskrit text, edited and translated by S.K. Abhyankar, published by the Bhaskaracharya Pratishthana, Pune (1980), page-22, Chapter-4 & 6.
(<https://www.ebharatisampat.in/pdfs/ebharati-pdf-1644646691BijaGanita-Bhaskaracharya-Translation-AbhyankarSK-1980.pdf>)
- 2) Amartya Kumar Dutta , “Brahmagupta's Bhāvanā: Some Reflections” in “Contributions to the History of Indian Mathematics” edited by Gerard G, Emch, R. Sridharan, M. D. Srinivas, 2005.
([https://www.ms.uky.edu/~sohum/ma330/files/chennai_talks/Emch_Sridharan_Srinivas%20%20Contributions%20ot%20the%20History%20of%20Indian%20Mathematics%20\(2005\).pdf](https://www.ms.uky.edu/~sohum/ma330/files/chennai_talks/Emch_Sridharan_Srinivas%20%20Contributions%20ot%20the%20History%20of%20Indian%20Mathematics%20(2005).pdf))
- 3) B. Datta, A. N. Singh, “Surds in Hindu Mathematics”, Indian Journal of History of Science, Vol. 28(3), 1993, PP. 253-264.
(https://cahc.jainuniversity.ac.in/assets/ijhs/Vol28_3_2_BDatta.pdf)
- 4) An Introduction to Linear Algebra- V. Krishnamurthy, V P Mainra, J L Arora, East-West Press Pvt Ltd., New Delhi.
- 5) Linear Algebra Geometric Approach – S. Kumaresan, PHI.

Syllabus for B Sc Semester - III (MATHEMATICS)

Mathematics Major Course-DSC-C-MAT-232T

Paper Title: Group Theory

UNIT I Binary Operations and Groups:

Relation, Binary operations & Groups: Relation, Equivalence Relation, Partition of set, Binary operations. Congruence modulo Relation in \mathbb{Z} , Definition and Examples of Groups, Elementary Properties of 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. Basic Abstract Algebra—P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Foundation Books, New Delhi.
- 3) Abstract Algebra - Dipak Chatterajee, PHI Learning Pvt. Ltd, New Delhi. A survey of Modern - G. Birkhoff & S. Maclane, Algebra Univ. Press.

Syllabus for B Sc Semester–III
(MATHEMATICS PRACTICAL)- Maths Major
Course-DSC-C-MAT-233P

Maths Practical (Based on MAT-231T & MAT-232T)

Practicals:

- 1) Examples based on properties of vector space.
- 2) Examples on sub spaces.
- 3) Examples of LI set, LD set.
- 4) Examples based on a basis of a vector space.
- 5) Examples on span of sets.
- 6) Examples of finding of dimensions of subspaces of a vector space.
- 7) Examples of verification of dimension theorem.
- 8) Examples of showing linearity and nonlinearity of maps.
- 9) Verification of rank-nullity theorem for linear maps.
- 10) Examples on matrix associated with linear map
- 11) Examples on linear map associated with a matrix.
- 12) Examples on rank-nullity of matrices.
- 13) Examples of Relations and Equivalence Relations.
- 14) Examples of Groups.
- 15) Examples on properties of Groups.
- 16) Examples based on commutativity and non-commutativity of Groups.
- 17) Examples of Subgroups
- 18) Examples on Cyclic Subgroups generated by elements and on cyclic groups.
- 19) Experiment of preparing group table and drawing Lattice Diagrams of Finite Groups.
- 20) Experiment based on determining even/odd permutation
- 21) Experiment based on finding inverse of permutations and finding order of permutations.
- 22) Examples of Normal subgroups along with Quotient groups.
- 23) Examples of cyclic groups, examples of group isomorphism and examples of Isomorphism between cyclic groups.
- 24) Experiment based on examples of group Homomorphism and finding the Kernel of Group Homomorphisms. Examples of Automorphisms.