

Sri Sathya Sai College for Women, Bhopal

(An Autonomous College affiliated to Barkatullah University, Bhopal)

(NAAC Accredited 'A' Grade)



SYLLABUS

UG

SESSION- 2023-24

CLASS: B.Sc. II YEAR

SUBJECT: Mathematics

Sri Sathya Sai College for Women, Bhopal

(An Autonomous College Affiliated to Barkatullah University Bhopal)

Department of Higher Education, Govt. of M.P.

Under Graduate Syllabus (Annual Pattern)

As recommended by Central Board of Studies and approved by the Governor of M. P.

wef 2022-2023

(Session 2023-24)

(NEP-2020)

Class/कक्षा	:	B.Sc. Second Year/ बी.एससी. द्वितीय वर्ष
Subject/विषय	:	Mathematics / गणित
Title of Paper/ प्रश्नपत्र का शीर्षक	:	Abstract Algebra and Linear Algebra /अमूर्त बीजगणित एवं रैखिक बीजगणित
Course Type/कोर्स टाइप	:	Major I
Paper/प्रश्नपत्र	:	I
Max Marks:अधिकतम अंक	:	70 + 30 Regular Students/ नियमित विद्यार्थी
Min. Marks : न्यूनतम अंक	:	35
Credit Value	:	06 (Theory)

Course The course will enable the students to:

Learning outcomes

1. Recognize the algebraic structures as a group, and classify them as abelian, cyclic and permutation groups, etc.
2. Link the fundamental concepts of groups and symmetrical figures.
3. Analyze the subgroups of cyclic groups.
4. Explain the significance of the notion of cosets, normal subgroups, and quotient groups.
5. The fundamental concept of rings, fields, subrings, integral domains and the corresponding morphisms.
6. Analyse whether a finite set of vectors in a vector space is linearly independent. Explain the concepts of basis and dimension of a vector space.
7. Understand the linear transformations, rank and nullity, matrix of a linear transformation, algebra of transformations and change of basis.
8. Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.

Contents

Unit- 1	1.1 Historical background: 1.1.1 A brief historical background of the Algebra in the context of India and Indian heritage and culture 1.1.2 A brief biography of Brahmagupta 1.2 Groups, Subgroups and their basic properties 1.3 Cyclic groups 1.4 Coset decomposition 1.5 Lagrange's and Fermat's theorem 1.6 Normal subgroups 1.7 Quotient groups
ईकाई - 1	1.1 ऐतिहासिक पृष्ठभूमि 1.1.1 भारत और भारतीय धरोहर एवं संस्कृति के संदर्भ में बीजगणित की संक्षिप्त ऐतिहासिक पृष्ठभूमि 1.1.2 ब्रह्मगुप्त की संक्षिप्त जीवनी 1.2. समूह, उपसमूह तथा उनके आधारभूत गुणधर्म 1.3. चक्रीय समूह 1.4. सहसमुच्चय वियोजन 1.5 लॉग्रान्ज एवं फर्मा का प्रमेय 1.6 प्रसामान्य उपसमूह 1.7 विभाग समूह
Unit- 2	2.1 Homomorphism and Isomorphism of groups 2.2 Fundamental theorem of homomorphism 2.3 Transformation and permutation group S_n ($n < 5$) 2.4 Cayley's theorem 2.5 Group automorphism 2.6 Inner automorphism 2.7 Group of automorphisms
ईकाई - 2	2.1. समूहों की समाकारिता एवं तुल्यकारिता 2.2. समाकारिता के मूलभूत प्रमेय 2.3. रूपान्तरण एवं क्रमचय समूह S_n ($n < 5$) 2.4. कैली का प्रमेय 2.5. समूह स्वकारिता 2.6 अंतः स्वकारिता 2.7 स्वकारिताओं का समूह
Unit-3	3.1 Definition and basic properties of rings 3.2 Ring homomorphism 3.3 Subring 3.4 Ideals 3.5 Quotient ring 3.6 Polynomial ring 3.7 Integral domain 3.8 Field

ईकाई -3	3.1. वलय की परिभाषा एवं सामान्य गुणधर्म 3.2. वलय समाकारिता 3.3. उपवलय 3.4. गुणजावली 3.5. विभाग वलय 3.6. बहुपद वलय 3.7. पूर्णांकीय प्रान्त 3.8. क्षेत्र
Unit-4	4.1 Definition and examples of Vector space 4.2 Subspaces 4.3 Sum and direct sum of subspaces 4.4 Linear span, Linear dependence, linear independence and their basic properties 4.5 Basis 4.6 Finite dimensional vector space and dimension 4.6.1 Existence theorem 4.6.2 Extension theorem 4.6.3 Invariance of the number of elements 4.7 Dimension of sum of subspaces 4.8 Quotient space and its dimension
ईकाई -4	4.1. सदिश समष्टि की परिभाषा एवं उदाहरण 4.2. उपसमष्टि 4.3. उपसमष्टियों का योग एवं प्रत्यक्ष योग 4.4. रैखिक विस्तृति, रैखिक परतंत्रता, रैखिक स्वतंत्रता एवं उनके मूल गुणधर्म 4.5. आधार 4.6. परिमित विमीय सदिश समष्टि एवं विमा 4.6.1 अस्तित्व प्रमेय 4.6.2. विस्तार प्रमेय 4.6.3. अवयवों की संख्या की निश्चरता 4.7. उपसमष्टियों के योग की विमा 4.8. विभाग समष्टि एवं उसकी विमा
Unit-5	5.1 Linear transformation and its representation as a matrix 5.2 Algebra of linear transformation 5.3 Rank-Nullity theorem 5.4 Change of basis, dual space, bi-dual space and natural isomorphism 5.5 Adjoint of a linear transformation 5.6 Eigenvalues and Eigenvectors of a linear transformation 5.7 Diagonalization
ईकाई -5	5.1. रैखिक रूपान्तरण एवं इसका आव्यूह निरूपण 5.2. रैखिक रूपान्तरणों का बीजगणित 5.3. जाति शून्यता प्रमेय 5.4. आधार का परिवर्तन, द्वैत समष्टि, द्विद्वैत समष्टि एवं प्राकृतिक तुल्यकारिता 5.5. रैखिक रूपान्तरण का सहखंडज 5.6. रैखिक रूपान्तरणों के आइगेन-मान एवं आइगेन सदिश 5.7. विकर्णीकरण Keywords/Tags: Brahmagupta, Groups, Subgroups, Homomorphism, and Isomorphism of group, Ring, Ideals, Field, Vector space, Basis and dimension, Linear transformation, Diagonalisation.
	सारबिन्दु – ब्रह्मगुप्त, समूह, उपसमूह, समूहों की समाकारिता एवं तुल्यकारिता, वलय, गुणजावली, क्षेत्र सदिश समष्टि, आधार और विमा, रैखिक रूपान्तरण, विकर्णीकरण।

Suggested Reading: Text Books:

1. I.N. Herstein: Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1977.
2. K.B. Datta: Matrix and Linear Algebra. Prentice hall of India Pvt Ltd, New Delhi, 2000.
3. Gerard G. Emch, R. Sridharan and M.D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.
4. मध्यप्रदेश हिन्दी ग्रंथ अकादमी पुस्तकें।

Reference Books:

1. Surjeet Singh and Qazi Zameeruddin: Modern Algebra, Vikas Publishing House Pvt Ltd, Eighth edition, 2006.
2. N. Jacobson: Basic Algebra. Vol. I and II, W. H Freeman, 1980.
3. L. S. Luther and I. B. S. Passi: Algebra. Vol. I and II, Narosa Publishing House, 1997.
4. Shanti Narayan: A text book of Modern Abstract Algebra, S. Chand and Company. New Delhi, 1967.
5. A. K. Vasishtha and A. R. Vasishtha: Modern Algebra, Krishna Publication; 68th edition, 2015.
6. K. Hoffman and R. Kunze: Linear Algebra. 2nd Edition, Prentice Hall Englewood Cliffs, New Jersey, 1971.
7. A. R. Vasishtha and J. N. Sharma: Linear Algebra, Krishna Prakashan Media (P) Ltd., 2019.
8. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

Suggested Digital Platforms Web links:

<https://epgp.inflibnet.ac.in>
<https://www.highereducation.mp.gov.in/?page=xhziQmpZwkylQo2b%2Fy5G7w%3D%3D>
<http://www.bhojvirtualuniversity.com>

Suggested Equivalent Online Courses:

<https://nptel.ac.in/courses/111/106/111106137/>
<https://nptel.ac.in/courses/111/105/111106112/>
https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/32

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Scheme of Marks:

Suggested Continuous Evaluation Methods:

Maximum Marks: 100		
Continuous Comprehensive Evaluation 30 marks (CCE): Term End Exam Theory 70 marks		
Internal Assessment : Continuous Comprehensive Evaluation (CCE): 30 Marks	There shall be 4 class tests of 10 marks each, out of which the 3 best scores are to be taken into account.	10+10+10= 30
External Assessment: Term End Exam (Theory) 70 (Time : 03:00 Hrs.	Section (A) 10 Marks (a) Objective questions – 5 (b) Very Short Answer type question – 5 (word limit 50 words) Section (B) 24 Marks: Short Answers Type Questions 1 question from each unit (word limit – 250 words) 4 to be attempted out of 7 given questions Section (C) 36 Marks: Long answer type questions (word limit 500 words) 4 to be attempted out of 7 given questions	10 question 01 marks each - 10 4 question 06 marks each - 24 4 questions 09 marks each - 36
		Total 70

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