

With effect from :2025-26 (R-24)

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)**

Accredited by NAAC with A++ Grade

9-5-81, Ibrahimbagh, Hyderabad-500031

**DEPARTMENT OF MATHEMATICS**

**ALGEBRAIC STRUCTURES**

**(OPEN ELECTIVE)**

**For B.E., IV- Sem.,**

**(Common to CSE, AIML & IT Branches)**

Instruction : 3 Hours per week	Sem. End Exam Marks : 60	Subject Reference Code : U24OE420MA
Credits : 3	Sessional Marks : 40	Duration of Semester End Exam : 3 Hrs

<b>COURSE OBJECTIVES</b>	<b>COURSE OUTCOMES</b>
<i>The course will enable the students to :</i> <ol style="list-style-type: none"><li>1. <b>Study</b> the concept of Groups, Finite Groups, Subgroups, Cyclic Groups and their properties.</li><li>2. <b>Understand</b> Isomorphism – Automorphism of groups and their Properties.</li><li>3. <b>Learn</b> group Homomorphism and related concepts.</li><li>4. <b>Acquire</b> knowledge of Rings, Integral domains and Fields, External and Internal direct products.</li><li>5. <b>Identify</b> Ring Homomorphism, properties and polynomial rings</li></ol>	<i>At the end of the course students should be able to:</i> <ol style="list-style-type: none"><li>1. <b>Solve</b> the problems on Groups and will be equipped to apply them in applications like robotics, computer vision, computer graphics and medical image analysis</li><li>2. <b>Implement</b> the concepts of automorphism in developing encoding and decoding tools of Cryptography</li><li>3. <b>Apply</b> homomorphism in the study of formal languages, automata theory, and compiler design.</li><li>4. <b>Use</b> the knowledge of Ring, Integral domain and Field in coding theory.</li><li>5. <b>Compute</b> the programming of modern computer algebra algorithms using ring homomorphism.</li></ol>

**UNIT – I: (8 Hours)**

**GROUPS**

Binary operations - Groups – Definition, Elementary properties of Groups, Finite Groups, Subgroups, Cyclic Groups – Properties of Cyclic Groups, Fundamental theorem of Cyclic Groups-Classification of Subgroups of Cyclic Group.

**UNIT – II: (8 Hours)**

**GROUP ISOMORPHISM**

Isomorphism – Definition, Properties (without proof)- Automorphism - Cosets -Properties of Cosets (without proof), Lagrange's theorem.

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### **UNIT – III: (8 Hours)**

#### **GROUP HOMOMORPHISM**

External Direct Product - Definition, Properties (without proof). Normal Subgroups and Factor Groups.  
Internal Direct Product, Group Homomorphism - Definition, Properties (without proof).

### **UNIT – IV: (8 Hours)**

#### **RINGS**

Rings, Properties of Rings (without proof) – Subrings - Integral Domains and Fields - Ideals- Prime and Maximal Ideals.

### **UNIT – V: (8 Hours)**

#### **RING HOMOMORPHISM**

Ring Homomorphism - Properties of Ring Homomorphism (without proof) - Polynomial Rings - The Division Algorithm.

#### **Text Books:**

Contemporary Abstract Algebra, Joseph A. Gallian, CRC Press

#### **Reference Books:**

1. Topics in Algebra, I. N. Herstein, John Wiley & Sons
2. Basic Abstract Algebra, P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul, Cambridge University Press
3. Abstract Algebra, D. S. Dummit, R. M. Foote, John Wiley & Sons, Inc.
4. A First Course in Abstract Algebra, John B. Fraleigh, Pearson Education Limited

#### **Online Resources :**

1. <https://ocw.mit.edu/courses/18-703-modern-algebra-spring-2013/>
2. [https://onlinecourses.nptel.ac.in/noc19\\_cs78/preview](https://onlinecourses.nptel.ac.in/noc19_cs78/preview)

The break-up of CIE: Internal Tests + Assignments + Quizzes

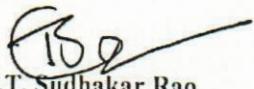
1	No. of Internal Tests	:	2	Max. Marks for each Internal Tests	:	30
2	No. of Assignments	:	3	Max. Marks for each Assignment	:	5
3	No. of Quizzes	:	3	Max. Marks for each Quiz Test	:	5
4	Duration of Internal Tests	:	90 Minutes			

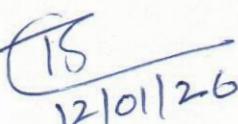
  
Prof. N. Kishan  
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(Industry Expert)

  
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(Chairman, BOS)

  
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