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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------|
| Lecture Plan                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                    |
| Name of the College: Government College of Arts, Science and Commerce, Sanquelim-Goa                                                                                                                                                                                                                                                                                                                                      |                      |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                    |
| Name of Faculty: Vishal Vinayak Gawas                                                                                                                                                                                                                                                                                                                                                                                     | Subject: Mathematics |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                    |
| Paper code: MAT-301 -Group Theory I                                                                                                                                                                                                                                                                                                                                                                                       | Program: B.Sc.       | Division: -        |
|                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                    |
| Academic year: 2026-27                                                                                                                                                                                                                                                                                                                                                                                                    | Semester: V          | Total Lectures: 60 |
|                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                    |
| Course Objectives:                                                                                                                                                                                                                                                                                                                                                                                                        |                      |                    |
| 1. The course is designed keeping in mind that it is the first course in abstract algebra. The course will give the student a gentle introduction to basic group theory. The various topics covered in this course are Binary Structures, Groups and Subgroups, Cyclic Groups, Permutations Groups, The Fundamental Theorem of Finitely Generated Abelian Groups, Homomorphisms and The Fundamental Homomorphism Theorem. |                      |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                    |
| Expected Course Outcome:                                                                                                                                                                                                                                                                                                                                                                                                  |                      |                    |
| 1) Recollect the basic definitions and theorems in Group Theory                                                                                                                                                                                                                                                                                                                                                           |                      |                    |
| 2) Explain the various proofs and concepts in Group Theory.                                                                                                                                                                                                                                                                                                                                                               |                      |                    |
| 3) Explain the various proofs and concepts in Group Theory.                                                                                                                                                                                                                                                                                                                                                               |                      |                    |
| 4) Solve problems using the concepts learnt in the course.                                                                                                                                                                                                                                                                                                                                                                |                      |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                    |
| Student Learning Outcome: Student will be able to                                                                                                                                                                                                                                                                                                                                                                         |                      |                    |
| 1) Recollect the basic definitions and theorems in Group Theory and explain the various proofs and concepts involved                                                                                                                                                                                                                                                                                                      |                      |                    |
| 2) Apply the concepts of Group Theory to explain proofs and solve problems effectively.                                                                                                                                                                                                                                                                                                                                   |                      |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                    |

| Month                  | Lecture From | Lecture To | No. of lectures allotted | Topic, Subtopic to be covered                      | Exercise/ Assignme nt | ICT Tools        | Reference books                                                                      |
|------------------------|--------------|------------|--------------------------|----------------------------------------------------|-----------------------|------------------|--------------------------------------------------------------------------------------|
| June                   | 22/06/2026   | 27/06/2026 | 4                        | Discussion of prerequisites                        |                       | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| June/July              | 29/06/2026   | 04/07/2026 | 4                        | Multiplication of Complex Numbers, Euler's Formula |                       | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| July                   | 06/07/2026   | 11/07/2026 | 4                        | Roots of Unity, Binary Operations,                 |                       | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| July                   | 13/07/2026   | 18/07/2026 | 4                        | Isomorphic Binary Structures                       |                       | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| July<br>July<br>August | 20/07/2026   | 25/07/2026 | 4                        | Groups, Examples of Groups                         |                       | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |

|          |            |            |   |                                                                                                 |  |                  |                                                                                             |
|----------|------------|------------|---|-------------------------------------------------------------------------------------------------|--|------------------|---------------------------------------------------------------------------------------------|
|          | 27/07/2026 | 01/08/2026 | 4 | Groups, Examples of Groups and properties                                                       |  | Marker and Board | <b>John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013</b> |
| August   | 03/08/2026 | 08/08/2026 | 4 | Subgroups, Cyclic Groups                                                                        |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013        |
| August   | 10/08/2026 | 15/08/2026 | 4 | Generating Sets and Cayley Digraphs                                                             |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013        |
| August   | 17/08/2026 | 22/08/2026 | 4 | Groups of Permutations, Orbits                                                                  |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013        |
| August   | 24/08/2026 | 29/08/2026 | 4 | Cycles and the Alternating Groups, Cosets and the Theorem of Lagrange                           |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013        |
| Aug/Sept | 31/08/2026 | 05/09/2026 | 4 | Direct Products and Finitely Generated Abelian Groups (Proof of Fundamental Theorem of Finitely |  | Marker and Board | <b>John B. Fraleigh, A First Course in Abstract Algebra,</b>                                |

|           |            |            |   |                                                                               |  |                  |                                                                                      |
|-----------|------------|------------|---|-------------------------------------------------------------------------------|--|------------------|--------------------------------------------------------------------------------------|
|           |            |            |   | Generated Abelian Groups is not included.),                                   |  |                  | <b>Seventh Edition,<br/>Pearson, 2013</b>                                            |
| September | 07/09/2026 | 12/09/2026 | 4 | Plane Isometries, Discussion of groups $D_3$ , $D_4$ and $D_5$                |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| September | 14/09/2026 | 19/09/2026 | 0 | <b>Ganesh Chaturthi Break (14–19 Sep)</b>                                     |  |                  |                                                                                      |
| September | 21/09/2026 | 26/09/2026 | 4 | Group Homomorphisms, Properties of Homomorphisms and kernel of a homomorphism |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| Sept/Oct  | 28/09/2026 | 03/10/2026 | 4 | Normal Subgroups and Factor Groups                                            |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| October   | 05/10/2026 | 10/10/2026 | 4 | The Fundamental Homomorphism Theorem                                          |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |
| October   | 12/10/2026 | 14/10/2026 | 2 | Definitions of automorphisms and inner automorphisms                          |  | Marker and Board | John B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson, 2013 |

**\* Assessment Rubrics**

| Component         | Max Marks |
|-------------------|-----------|
| ISA 1             | 10        |
| ISA 2             | 10        |
| Practical         | Nil       |
| Project           | Nil       |
| Semester End Exam | 80        |