Yogoda Satsanga Mahavidyalaya
JAGANNATHPUR, DHURWA, RANCHI – 834004
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(NAAC Accredited, Grade: B++, CGPA: 2.89)

COURSEPLAN

NAME OF THE DEPARTMENT: MATHEMATICS

NAME OF THE FACULTY: Dr. R.C.L Das

Prof Shekhar Suman

Dr. Kandarp Vidyasagar

ACADEMIC SESSION: 2021-2024

YEAR: 2023

PROGRAMME: B.Sc.

SEMESTER: 3

COURSE TYPE: Core

COURSE: Ring Theory

COURSE CODE: C-10

TOTAL CREDIT: 6 (5+1)

PROGRAMME OUTCOMES (POs):

Student will be able:

PO1: Develop in-depth knowledge of algebra, Groups, Rings, Fields and several other branches of mathematics. This also leads to study of related areas like computer science and statistics.

PO2: Analyze intrinsic beauty which can be utilized for solving real life problems through the use of mathematical modeling, cryptography and coding.

PO3: Apply knowledge of mathematical science in understanding and skills to identify the difficult/unsolved problems in mathematics. Realize the given scientific data critically and systematically and to do research so that to get the ability to draw the objective conclusions.

PO4: Understand logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society.

PO5: This program will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

PO6: Design solutions for complex scientific problems and design processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, legal, constitutional and environmental considerations.

PO7: Demonstrate fundamental systematic knowledge of mathematics and its applications in engineering, science, technology and mathematical sciences. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.

PO8: Demonstrate knowledge and understanding of the scientific principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9: Communicate effectively on complex science activities with the science community and the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO10: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of scientific development, technological advancement and global changes.

PO11: Use research-based knowledge and research-based methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO12: To value and foster physical, physiological and psychological well-being by staying committed through personal practice and conduct. Apply the learning for life-long committing to ethics, to fulfill professional and social obligations.

PO13: Apply academic learning fora sustainable living, initiation of entrepreneurial advents through innovation to create opportunities and wealth for self and society.

PO14: Value and support social causes and rural development through service and philanthropic activities.

PROGRAMME SPECIFIC OUTCOMES (PSO):

PSO1: Understand the requirements in mathematics, drawing from a range of contemporary research works and their applications in diverse areas of mathematical sciences and demonstrate educational skills in the areas of analysis, geometry, algebra, mechanics, differential equations etc.

PSO2: Apply skills and knowledge through on-the-job training, research projects and internships to use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion and creating Mathematical models, algorithms, etc. to facilitate application of mathematics in different professions and knowledge domains.

PSO3: Analyze the applications of Mathematics and computing methods using MATLAB, PYTHON, MATHEMATICA etc. to solve the problems of Science in general and Mathematics in particular.

COURSE OUTCOMES (COs):

Semester-3

Paper: Ring theory (C-10)

This course will enable the students to:

CO1: Recognize and analyze the mathematical objects called Rings.

CO2: Understand the fundamental concepts of Nilpotent element, idempotent element, zero divisors, integral domain, division ring and field. Characteristic of a ring.

CO3: Analyse the significance of the notions of Ideal, ideal generated by a subset of a ring, simple ring, factor rings.

CO4: Apply Ring homomorphism, properties of ring homomorphism, Isomorphism to solve problems pertaining to Rings.

CO5: Discuss about concepts of Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests

CO1: Solid Foundation in Knowledge: Bachelor Degree in Mathematics is the culmination of in-depth knowledge of many core branches of mathematics, viz. Algebra, Calculus, Geometry, Differential Equations, Mechanics, Real and Complex Analysis. Thus, this course

helps students in building a solid foundation for further higher studies and research in Mathematics.

CO2: Competency in Skills: The skills and knowledge gained in this course leads to proficiency in analytical reasoning, critical understanding, analysis and synthesis in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, can also be utilized in modeling and solving real life problems.

CO3:Problem Solving: Students undergoing this course learn to logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems.

CO4: Interdisciplinary and Research Skills: Students completing this course will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.

CO5: Proficiency in Employments: This course will help students to enhance their employability for Government jobs, jobs in banking, insurance and investment sectors, data analysis jobs, and jobs in various other public and private enterprises.

A. CORRELATION BETWEEN POs AND COs

POs → Cos ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PSO 1	PSO 2	PSO 3
CO1	2	-	3	-	2	3	2	-	1	-	-	2	2	2	3	-	3
CO2	3	3	2	-	3	2	3	2	1	2	3	3	3	3	2	3	3
CO3	-	-	2	2	-	2	2	-	-	1	2	-	2	-	3	2	-
CO4	2	-	-	2	-	-	2	1	-	1	-	2	-	1	3	3	-
CO5	3	2	1	-	2	1	2	-	2	-	2	2	2	-	2	3	2

1. **Weak** **2. Moderate** **3. Strong**

COURSE TEACHING AND LEARNING ACTIVITIES

A. PEDAGOGY

i. **Whiteboard**
ii. **PPT**
iii. **Zoom, Google meet**

B. COURSE DELIVERY PLAN:

UNIT	TOPIC/SUBTOPIC	LECTURE REQUIRED	CO ADDRESSED
1	Ring : Definition and examples, commutative ring, ring with unity, unit in a ring	6	CO1
2	Matrix ring, Boolean ring, Ring of continuous functions. Direct product of rings, Properties of rings, subrings	6	CO1
3	Nilpotent element, idempotent element, zero divisors, integral domain	6	CO2
4	Division ring and field. Characteristic of a ring	7	CO2
5	Ideal, ideal generated by a subset of a ring, simple ring, factor rings	8	CO3
6	Operations on ideals, prime and maximal ideals	6	CO3
7	Ring homomorphism, properties of ring homomorphism	7	CO4
8	Isomorphism theorems I, II and III, field of quotients	7	CO4
9	Polynomial rings over commutative rings, division algorithm	7	CO5
10	Principal ideal domains, factorization of polynomials	8	CO5
11	Reducibility tests, irreducibility tests, Eisenstein's criterion	7	CO5

C. SUGGESTED READINGS

a. TEXT BOOKS:

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House, New Delhi, 1999

b. REFERENCE BOOKS

1. C Musili, *Introduction to Rings and Modules*, 2nd edition, Narosa Publishing House.
2. Modern Algebra – surjeet singh & Qazi Zamiruddin

c. VIDEO RESOURCE

1. https://nptel.ac.in/courses/111106053
2. https://nptel.ac.in/courses/111106113
3. https://archive.nptel.ac.in/courses/111/106/111106100/

a. WEB RESOURCES:-

1. **https://en.wikipedia.org/wiki/Ring_theory**

2. https://brilliant.org/wiki/ring-theory/

b. E-RESOURCES

1.https://www.ms.uky.edu/~sohum/ma561/notes/note2.pdf