	P.R.Government College (Autonomous) KAKINADA	Program&Semester IIB.Sc. (IIISem)			
Course Code MAT-301/3201	TITLEOFTHECOURSE **Abstract Algebra**				
Teaching	HoursAllocated:60(**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on sets and number system.	5	1	-	5

Course Objectives:

To provide the learner with the skills, knowledge and competencies to carry out their duties and responsibilities in pure Mathematic environment.

CourseOutcomes:

On Completion of the course, the students will be able to-	
CO1	Acquire the basic knowledge and structure of groups, subgroups and cyclic groups.
CO2	Get the significance of the notation of a normal subgroups.
CO3	Understand the ring theory concepts with the help of knowledge in group theory and to prove thetheorems.
CO4	Study the homomorphisms and isomorphisms with applications.

Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development			Employability			Entrepreneurship	

UNIT I : **(12 Hours)**

GROUPS : Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

UNIT II: **(12 Hours)**

SUBGROUPS:Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition- examples-criterion for a complex to be a subgroups. Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups. **Co-sets and Lagrange's Theorem:** Cosets Definition-properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

UNIT III: **(12 Hours)**

NORMAL SUBGROUPS: Definition of normal subgroup – proper and improper normal subgroup– Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group –quotient group – criteria for the existence of a quotient group.

HOMOMORPHISM : Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

UNIT IV: **(12 Hours)**

PERMUTATIONS: Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

UNIT V: (12 Hours)

RINGS

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings,Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field. Sub Rings.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Group theory and its applications / Problem Solving.

TEXT BOOK :

1. A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, published byS.Chand & Company, New Delhi.

REFERENCE BOOKS :

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna.
3. Rings and Linear Algebra by Pundir & Pundir, published by Pragathi Prakashan.

Additional Inputs :

Cyclic Groups, Maximal Ideals and Prime Ideals .

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	1	2	2	3	2	3	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1
CO3	2	3	2	3	2	3	2	2	2	3	2	2	3
CO4	3	2	3	2	2	2	3	3	1	1	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN

SEMESTER-III

Unit	**TOPIC**	**S.A.Q**	**E.Q**	**Marks allotted to the Unit**
I	Groups	2	1	20
II	Subgroups , Co-sets and Lagrange's Theorem	2	1	20
III	Normal subgroups, Homomorphism	1	2	25
IV	Permutations.	1	1	15
V	Rings	1	1	15
Total		7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

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Total Marks = 50 M

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P.R. Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - III Semester
Mathematics Course: Abstract Algebra
Paper III (Model Paper w.e.f. 2021-22)

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Time: 2Hrs **Max. Marks: 50**

PART - I

Answer any FOUR questions. Each question carries FIVE marks. 4 X 5 M=20 M

1. Prove that in a group $G(\neq \emptyset)$, for $a, b, x, y \in G$,the equations $ax = b, ya = b, \forall\ a, b \in G$ have unique solutions.
2. If G is a group,for $a, b \in G$ prove that $(ab)^{-1} = b^{-1}a^{-1}$
3. If a non empty complex H of a group G is a subgroup of G then prove that $H = H^{-1}$.
4. If G is a finite group and $a \in G$ then show that O(a) divides O(G) .
5. Define Normal subgroup. Prove that a subgroup H of a Group (G,.) is a normal subgroup of G if and only if $xHx^{-1} =$ H ∀ x ∈ G.
6. Express the product (2 5 4)(1 4 3)(2 1) as a product of disjoint cycles and find its inverse.
7. Prove that the characteristic of an integral domain is either a prime or zero.

PART - II

Answer Any THREE questions. Each question carries Ten marks. 3 X 10 M = 30 M

9. A finite semi –Group (G, ·) satisfying the cancellation laws is a group.

10. Prove that a non empty complex H of a group G is a subgroup of G if and only if

$a, b \in H \Rightarrow ab^{-1} \in H$.

11. If H is a normal subgroup of a group (G,.) then prove that the product of two right (or) left cosets of H is also a right (or) left coset of H in G.

12. State and prove fundamental theorem on homomorphisms of groups .

13 . State and prove Cayley’s theorem .

14. Prove that the ring of integers Z is a principal ideal ring.