Exam Seat No:____

C.U.SHAH UNIVERSITY Summer Examination-2017

Subject Name: Group Theory

	Subject	Code: 4SC05GTC1	Branch: B.Sc.(Mathema	Branch: B.Sc. (Mathematics)		
	Semester Instructio	r: 5 Date: 24/03/2017 ons:	Time:02:30 To 05:30	Marks: 70		
	 Use of Programmable calculator & any other electronic instrument is prohibited. Instructions written on main answer book are strictly to be obeyed. Draw neat diagrams and figures (if necessary) at right places. Assume suitable data if needed. 					
Q-1		Attempt the following question	s:		(14)	
-	a)	Prove that if a, b, c are in G , then	$ab = ac \Rightarrow b = c.$		(02)	
	b)	Examine whether the following p	permutation is even or odd :		(02)	
	·	(1 2 3 4 5 6 7 8 9	∂ ∖			
		2 5 4 3 6 1 7 9 8	₃).			
	c)	Show that every subgroup of an a	abelian group is normal.		(02)	
	d)	Define: Order of an element.If <i>G</i>	$= \{1, -1, i, -i\}$ is a multiplic	ative group, then	(02)	
		find order of $-i$.				
	e)	If <i>H</i> and <i>K</i> are finite subgroups of	of a group G. If $o(H)\&o(K)$ as	re respectively	(02)	
		prime integers then show that H	$\cap K = \{e\}.$			
	f)	Define: Normal subgroup.			(01)	
	g)	Define: Index of <i>H</i> in <i>G</i> .			(01)	
	h)	The intersection of two subgroup whether the statement is True or	os of a group is also a subgrou False.	p. Determine	(01)	
	i)	Every cyclic group is an abelian or False.	group. Determine whether the	e statement is True	(01)	
Atte	empt any f	four questions from Q-2 to Q-8				

Q-2 Attempt all questions (14) Show that the set of positive rational numbers becomes a commutative group a) (05) under binary operation ' * ' where $a * b = \frac{ab}{2}$. Prove that in a group G, the equations a * x = b and y * a = b, where $a, b \in G$ b) (05) have unique solution. Prove that if the element a of a group G is of order n, then $a^m = e$ if and only if (04) **c**) *n* is a divisor of *m*. Q-3 **Attempt all questions** (14)

(14) a) Show that $G = \left\{ \begin{pmatrix} a & 0 \\ 0 & 0 \end{pmatrix} \right|$ a is any non – zero real number is a commutative (05)

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 b) Define: Cyclic group. Show that the group ({1, 2, 3, 4, 5, 6},×₇) is cyclic. How many generators are there? c) Define a permutation. If A = (1 2 3 / 2 3 1) and B = (1 2 3 / 3 1 2), find AB and B Attempt all questions a) If G = (a) is a cyclic group of order 12, then obtain all subgroups of G and prepare their lattice diagram. b) Show that a → a⁻¹ is an automorphism of a group G if and only if G is abelia c) Prove that if H, K are two subgroups of a group G, then HK is a subgroup of G and only if HK = KH. Q-5 Attempt all questions a) If R is the additive group of real numbers and R₊ the multiplicative group positive real numbers, then prove that the mapping f: R → R₊ defined f(x) = e^x, for all x ∈ R is an isomorphism. b) Prove that a subgroup H of a group G is a normal subgroup of G if and only i each left coset H in G is a right coset of H in G. c) Define the binary operation * on Z as a * b = max{a, b}. Examine the binary operation * for commutativity, associativity and identity element. Q-6 Attempt all questions a) Show that the set G = {[0], [1], [2], [3], [4], [5]} is a finite abelian group of or 6 with respect to addition modulo 6. b) Prove that every subgroup of a cyclic group is cyclic. c) Using the Euler's theorem, find the remainder obtained on dividing 3²⁵⁶ by 1 Attempt all questions a) State and prove Lagrange's theorem. b) State and prove Lagrange's theorem. c) Prove that the order of a permutation f ∈ S_n is the least common multiple of lengths of its disjoint cycles. b) State and prove first fundamental theorem of Homomorphism. 	
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