BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2025)

CLASS: IMSC | **SEMESTER : III**
BRANCH:MATHEMATICS AND COMPUTING | **SESSION : MO/2025**

SUBJECT: MA202R1 ABSTRACT ALGEBRA

TIME:02 HOURS | **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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			CO	BL
Q.1(a)	Use Euclidean Algorithm to compute GCD (12378,3054).	[2]	1	
Q.1(b)	Let '+' be defined on the set $Z_2 \times Z_2$ by $(a,b)+(c,d)=(a+_2c, b+_2d)$ for $(a,b),(c,d) \in Z_2 \times Z_2$, where $+_2 = addition\ (mod\ 2)$. Show that $Z_2 \times Z_2$ is a abelian group under addition.	[3]	1	
Q.2(a)	Find order of each element of $(Z_6,+)$.	[2]	1	
Q.2(b)	Show that the relation ρ on the set $S = Z$ is an equivalence relation, where $\rho = \{(a,b) \in Z \times Z: 3a + 4b\ is\ divisible\ by\ 7\}$. by	[3]	1	
Q.3(a)	Let $G = (Z,+)$ and $\phi: G \to G$ is defined by $\phi(x) = x + 3$, $x \in Z$ .Prove that ϕ is a homomorphism.	[2]	2	
Q.3(b)	Prove that, if $\phi : (G,.) \to (G',*)$ be a homomorphism, then $\ker\phi$ is subgroup of G and $Im\ \phi$ is a a subgroup of G'.	[3]	2	
Q.4(a)	Define Quotient group. If $G = (Z_6,+)$ and $H = \{\bar{1}, \bar{4}\}$. Find G/H.	[2]	2	
Q.4(b)	Find $[G:H]$, where $H = \{\rho_0, \rho_1, \rho_2\}$ and $G = (S_3,*)$, where $\rho_0 = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \end{pmatrix}$, $\rho_1 = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix}$ $\rho_2 = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{pmatrix}$.	[3]	2	
Q.5(a)	Find the conjugacy classes in the group $G = \{1, -1, i, -i\}$ (group w.r.to multiplication).	[5]	3	

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