Avinashilingam Institute for Home Science and Higher Education for Women

Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD (now MoE)
Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

Continuous Internal Assessment Test I – August 2025

Semester V

Class : III UG **Time : 2 Hours**
Major : Mathematics **Max. Marks : 60**

23BMAC10 – Advanced Algebra

Course Outcomes:

CO1: understand the basic concepts of group actions anr their applications.

CO2 : recognize and use the Sylow theorems to characterize certain finite groups.

CO3 : know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains and fields.

CO4 : learn in detail about polynomial rings.

CO5 : grasp the fundamental properties of finite field extensionsand classification of finite fields.

PART A **6 x 1 = 6**

Choose the Correct Answer

1. For g in G and for x in X, $stab(x)$= CO1K2
   a. $x\ stab(x)\ x^{-1}$ b. $g\ stab(x)\ g^{-1}$ c. $x\ stab(x)$ d. $g\ stab(x)$

2. The cardinality of the orbit of x , $|G_x| =$ CO1K2
   a. $|G||x|$ b. $|G|$ c. $|G|\ |stab(x)|$ d. $|G|/|x|$

3. For a group of order 72, any subgroup of order 8 is a _____. CO2K1
   a. Sylow 8-subgroup of G b. Sylow 9-subgroup of G
   c. Sylow 3-subgroup of G d. Sylow 2-subgroup of G

4. A Sylow p-subgroup of a finite group G is a normal subgroup of G if and only if it is ____. CO2K1
   a .the only Sylow p-subgroup of G b. any one of Sylow p-subgroup of G
   c. the largest Sylowp-subgroup of G d. the smallest Sylowp-subgroup of G

5. The set 2Z of even integers under ordinary addition and multiplication is a _____. CO3K1
   a. ring b. commutative ring c. ring with unity d. commutative ring with unity

6. For the subring {0,2,4} of the ring Z_6, the unity is ____. CO3K1
   a . 0 b. 1 c. 2 d. 4

Part B **3 x 6 = 18**

Answer ALL questions

7. a .State and prove structure theorem for orbits. CO1K3

(or)

7. b. State and prove orbit counting theorem CO1K3

8. a. Determine the number of normal subgroups of a group G of order 30. CO2K4

(or)

8. b. If G is a group of order pq, where p and q are primes, p<q and p does not divide q-1, then show that G is cyclic CO2K4

9. a. State and prove subring test. CO3K3

(or)

9. b. Prove that a finite integral domain is a field. CO3K3

Part C **3 x 12 = 36**

Answer ALL questions

10 a. How many distinct necklaces of 8 beads can be made by stringing together beads of two colours? CO1K4

(or)

10. b. Prove that An is simple for $n \geq 5$. CO1K4

11. a. State and prove Sylow's first theorem. CO2K3

(or)

11. b. State and prove Sylow's second theorem. CO2K4

12. a. State and prove (i) characteristic of a ring with unity CO3K3
(ii) characteristic of an integral domain.

(or)

12. b. State and prove existence of factor rings. CO3K4

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