Unit – I

Algebra/ PG – TRB Test Batch

TEST- 1

1. Any group of order A is

(a) Cyclic (b) Abelain (c) Normal (d) Permulation

Answer : b

2. If $p(x) = x^n - 1$. The Galois group of $p(x)$ over the field of rational number is

(a) abelian (b) cyclic (c) non – abelain (d) an empty set

Answer : a

3. Which of the following set in a group?

(a) Set of all natural numbers under addition. (b) z_{10} with multiplication modulo 10

(c) z_6 with addition modulo 6 (d) Set of $2x2$ real matrices with multiplication.

Answer : c

4. Let G be a group such that $(ab)^i = a^i b^i$ k $a, b \epsilon G$, Then G is abelian ift

(a) i = 1 (b) i = 2 (c) i = 3 (d) i = 4

Answer : b

5. Which is not a group under +

(a) Z (b) Q (c) R (d) N

Answer : d

6. The number of generators of the cyclic group of order 12

(a) 2 (b) 3 (c) 4 (d) 6

Answer : c

7. If $\frac{G}{Z}$ is cyclic then G is

(a) group (b) abelian (c) cyclic (d) Non abelian

Answer :b

Test – 2

1. F is the field of rational number and $f(x) = x^3 - 2$ E is the splitting field of F over F the degree of E over E is

(a) 1 (b) 2 (c) 3 (d) 6

Answer : d

2. Each non zero element in R has

(a) Group (b) Ring (c) Maximal ideal (d) None of these

Answer : c

3. Non zero element form a group under

(a) Multiplication (b) Addition (c) Subtraction (d) divisor

Answer : a

4. If $a \neq 0, b \neq 0 \Rightarrow a.b = 0$ The a is

(a) Divisor (b) Zero divisor (c) no zero divisor (d) none of these

Answer : b

5. If Z_7 is a field with addition modulo 7 & multiplication modulo 7, then the multiplicative inverse of 3 is

(a) 2 (b) 3 (c) 4 (d) 5

Answer : d

6. Commulative division ring is

(a) Ring (b) Field (c) Finite (d) Domain

Answer : b

7. z is a ring of integers, then which of the following sets is a maximal ideal of z?

(a) {all integral multiples of 10} (b) {……-20, -15, -10, -5, 0, 5, 10, 15,….}

(c) {0,1,2,3……} (d) {……-3, -2, -1}

Answer :b

8. In anEudidean ring R, ideal generator by a_0 is maximal iff

$(a) a_0 = 0$ $(b) a_0 = 1$ (c) a is a prime element of R (d) $a_0 \neq 0$

Answer : c

9. In $(R, +, \bullet)$ the field of real number, the ideal of R are

$(a)(Z, +, \bullet)(b) R\ only$ $(c)(Q, +, \bullet)(d)(O) and\ R$

Answer : d

10. If m is integer and $ma = 0\ k\ a \in D, then\ D\ is$

(a) Integral Domain (b) Ring (c) Field (d) Finit characteristics

Answer : d

11. Any finite element of a field of Char. zero is

(a) separable (b) simple extension (c) perfect (d) normal

Answer : b

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PGTRB Mathematics

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2. The arc length element is given by:

(A) sqrt(dx^2+dy^2) (B) $(dx^2+dy^2+dz^2)^{1/2}$ (C) dx+dy+dz (D) None

Answer: (B)

3. Curvature of a straight line is:

(A) 0 (B) 1 (C) ∞ (D) Undefined

Answer: (A)

4. The spherical indicatrix of the tangent vector($\vec{t}$) of a space curve lies on
A) A paraboloid B) A sphere C) A cylinder D) A plane
Answer: B)

5. The Gaussian curvature of a surface at a point is defined as

A) Product of the principal curvatures B) Sum of the principal curvatures
C) Ratio of the principal curvatures D) Square of the mean curvature
Answer: A

6. The first fundamental form gives information about

A) The curvature of space B) Intrinsic geometry of surface
C) External bending of the surface D) None of these
Answer: B)

4. Which of the following surfaces is generated by rotating a curve about an axis?

A) Helicoid B) Surface of revolution C) Cone D) Plane
Answer: B)

5. The second fundamental form contains information about:

A) Tangents to the surface B) Distance on the surface
C) Extrinsic curvature D) Geodesic length
Answer: C)

6. If a regular surface has constant Gaussian curvature K = 0, the surface is:

A) Hyperbolic B) Spherical C) Flat D) Elliptic
Answer: C)

7. The unit normal vector is used in the definition of
A) First fundamental form B) Christoffel symbols
C) Second fundamental form D) Geodesic curvature
Answer: C)

8. Which of the following surfaces is minimal and ruled?

A) Cone B) Helicoid C) Plane D) Sphere
Answer: B)

9. The lines along which the normal curvature is maximum and minimum are:

A) Geodesics B) Lines of curvature C) Asymptotic lines D) Principal directions

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Algebra(unit-I)

1.In the context of equivalence relations, which property is defined by: if a ~ b then b ~ a?

a) Reflexivity b) Symmetry c) Transitivity d) Antisymmetric

Answer: b

2. A mapping φ: G -> $\bar{G}$ is a homomorphism if:

a) $\varphi(ab) = \varphi(a) + \varphi(b)$ $\varphi(b)$ b) $\varphi(ab) = \varphi(a)\varphi(b)$

c) $\varphi(a^{-1}) = \varphi(a)^{-1}$ d) $\varphi(e) = \bar{e}$

Answer: b)

3. The kernel of a homomorphism $\varphi: G \to \bar{G}$ is

a) The image of φ b) The set of all $x \in G$ such that $\varphi(x) = \bar{e}$

c) The center of G d) A subgroup of $\bar{G}$

Answer: b)

4. Lagrange's Theorem states that for a finite group G and a subgroup H

a) o(H) is a multiple of o(G) b) o(G) is a divisor of o(H)

c) o(H) divides o(G) d) o(G) and o(H) are coprime

c) An abelian group d) A quotient group

Answer: b

8. The inner automorphism Tg is defined by

a) $T_g(x) = gx$ b) $T_g(x) = xg$ c) $T_g(x) = g^{-1}xg$ d) $T_g(x) = x^{-1}gx$

Answer: c)

9. If G is a group of order p (a prime), then G must be

a) Abelian b) Cyclic c) Simple d) All of the above

Answer: d)

10. The number of distinct right cosets of a subgroup H in G is called

a) The order of H b) The index of H in G c) The kernel of H

d) The center of G

Answer: b)

11. The identity element in the quotient group G/N is

a) e b) N c) Ne d) N^{-1}

Answer: C)

12. A group G is simple if

a) It is abelian b) It has no nontrivial normal subgroups

c) It is cyclic d) It is finite

Answer: b)

13. The order of the group of integers modulo n under multiplication is

a) n b) n-1 c) $\varphi(n)$ d) n^2

Answer: c)

14. The intersection of two subgroups of a group G

a) Is always a subgroup b) Is never a subgroup

c) Is a subgroup only if G is abelian d) Is a normal subgroup

Answer: a)

15. The center of a group G is defined as

a) $\{ x \in G \mid xg = gx \text{ for all } g \in G \}$ b) $\{ x \in G \mid x^2 = e \}$

c) The kernel of a homomorphism d) The commutator subgroup

Answer: a)

16. The Fundamental Homomorphism Theorem states

a) $G / \ker \varphi \cong \varphi(G)$ b) $G \cong \varphi(G)$ c) $\ker \varphi \cong \varphi(G)$ d) $G / \varphi(G) \cong \ker \varphi$

Answer: a)

17. The number of generators of a cyclic group of order n is

a) n b) n-1 c) $\varphi(n)$ d) n^2

Answer: c)

18. The order of the symmetric group Sn is

a) n b) 2^n c) n! d) n^2

a) G is isomorphic to G b) G/K is isomorphic to G

c) K is isomorphic to $\bar{G}$ d) G is isomorphic to $K \times \bar{G}$

Answer: b)

158. An isomorphism from a group G to itself is called a(n):

a) Endomorphism b) Epimorphism

c) Automorphism d) Monomorphism

Answer: c)

159. The group of inner automorphisms I(G) is isomorphic to:

a) G b) G / Z(G), where Z(G) is the center c) A(G) d) Z(G)

Answer: b)

160. If every element in a group G is its own inverse (i.e., $a^2 = e$ for all a in G), then G must be:

a) Cyclic b) Abelian c) Finite d) Simple

Answer: b)

161. For the symmetric group S_3, which of the following subgroups is normal?**

a) {e, φ} b) {e, φψ} c) {e, ψ, ψ^2}d) {e, φψ^2}

Answer: c)

162. The commutator subgroup G' of a group G is generated by all elements of the form:

a) xy b) $x^{-1}y^{-1}$ c) $xyx^{-1}y^{-1}$ d) x^2y^2

Answer: c)

163. If a group G has order p (a prime number), then G must be:

a) Abelian b) Cyclic c) Simple d) All of the above

Answer: d)

164. The set Z(G) = {z in G | zx = xz for all x in G} is called the:

a) Normalizer b) Centralizer c) Center d) Core

Answer: c)

165. The mapping φ from the positive real numbers (under multiplication) to all real numbers (under addition) defined by $\varphi(x) = \log_{10}(x)$ is an example of a:

a) Isomorphism b) Automorphism c) Endomorphism

d) Homomorphism

Answer: d)

166. If N is a normal subgroup of G, the product of two cosets Na and Nb in the quotient group G/N is defined as:

a) N(ab) b) NaNb c) N(a + b) d) aNbN

Answer: a)