IIT DELHI :

Q-1 What is compact set?
By giving union of closed set, it was asked why
it can't reducible to finite subcovering.
(∵ open subcovering is reducible not closed) – Ans.

Q-2 Uniform continiuity :
$$\frac{1}{x} \ , \ Sin\frac{1}{x} \ , \ x$$

Q-3 Prime Ideal and Maximal ideal result based question of to prov
intyral domain and field respectively.
Proving the same result with the help of chinese
Remainder Theorem.

Q-4 Number of Elements in Quotient Group.
$$\underline{C/R} -$$

Q-5. Special property about conjugacy class of elements
of S_n. ("if and only if" form result)
[Ans— same kind of cyclic decomposition have same conjugacy class.)

Q-6. A linear transformation $T : \mathbb{R}^2 \to \mathbb{R}^2$ is s.t.
? $T(x,y) = (0, y)$

IIT KHARAGPUR:

Q-1 Define $\mathbb{Z}_n$.

Q-2 When $\mathbb{Z}_n$ will form group w.r.t. multiplication?

Q-3 Can we find subset of $\mathbb{Z}_n$ for every n s.t. it forms a group w.r.t. multiplication?
(Ans – U(n))

Q-4 Number of element in U(n).

Q-5 When U(n) will be cyclic?

Q-6 Generator of U(n).
By giving a group U(n) and asked to find generators of that group. Will there be more or not? (I gave one, then last one was asked.)

Q-7. Fundamental theorem of finite abelian group.

Q-8 By giving a number, it was asked how many abelian group will be there of that order upto isomorphism.

[Written Test]:

Q-1 Linear Algebra: Based on Cayley-Hamilton Theorem., Matrix Related

Q-2. Calculus (B.Sc. 1st sem) — Area of curves.

Q-3. ODE: Solution by laplace transformation.

Q-4 Topology

Q-5 Complex Analysis

Spiral

IIT DELHI :

Q-1 Let G be a group. H be a normal subgroup of G. If $xy \in H$. Prove that $yx \in H$.

Q-2 Let G be a group. H be a subgroup of G s.t. $g \in G$ and $o(g) = n$, and $g^m \in H$ where $(m, n) = 1$. Can we say $g \in H$?

Q-3 Prove that $Q(\sqrt{2} + \sqrt{3}) = Q(\sqrt{2}, \sqrt{3})$

Q- Prove that roots of monic $f(x) \in \mathbb{Z}[n]$ can't belong to $Q - \mathbb{Z}$.

Q-4 Why order of finite field is p^n. Detailed questions related it?

Q-5 How to find mapping from z-plane to w-plane? (find a mapping that maps unit circle to horizontal, vertical lines

Q-6 what does $e^{i\theta}$ represent?

Q-7 Mobius Transformation.

Q-8 Under mobius transformation circles or straight lines mapped into - what?

Q-9 Fixed point of mobius transformation.

Q-10 Discrete metric space. (open ball, closed ball)

Q-11 Metric space definitions.

Written Test :

① Linear Algebra : Based on Cayley Hamilton theorem.

② Permutation/Combination : Inequality based solution (see R.D. Sharma)

B

Spiral

) Probability Theory : Baye's Theorem.

) Based on definition of differentiability

) Topology

) Abstract Algebra — Symmetric group related.

IISER KOLKATA :

Q-1 Define prime Ideals and Maximal ideals. Give relation between them.

       (with Proof and example)

Q-2 An example of (non-zero) a prime ideal that is not maximal.

       (Every Details about above two questions).

Q-3 Suppose G_1 and G_2 be two finite abelian groups s.t. H_1 and H_2 be their normal subgroups respectively. Also, $G_1 \approx G_2$, $H_1 \approx H_2$. Can we conclude that

$$G_1/H_1 \approx G_2/H_2.$$

Answer : No

Example : let $G_1 = G_2 = \mathbb{Z}_2 \times \mathbb{Z}_4$

and $H_1 = \langle (0,2) \rangle$, $H_2 = \langle (1,0) \rangle$

IIT Hyderabad :

Q-1. (a) Define eigenvalue.

(b) Define eigenvector. what is scalar 'c' when we define eigenvector.

Q-2 How many eigenvectors can be there for L.T on finite dimensional vector space.

Prove the above result without considering matrix and hence determinant approach. i.e. Prove the above result ~~with~~ by just the help of linear operator T and eigenvector v (that's all we know).

Q-3 What kind of matrices are similar to identity matrix?   (Answer: Only identity matrix)*

Q-4. Given matrices A and B. ~~can~~ with the same characteristic equation. Can we conclude that they define same linear transformation.

For Example:

$A = I_2, \ B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, Both have

same characteristic equation but do not similar

(Answer : NO

Because, apart from Above condition matrices must be similar too)

(3*) Infact, more can be said about *
   All scalar matrices are similar to itself.

IIT Gandhinagar

Q-1 Does every vector space has basis?

Q-2 Define finite dimensional vector space.

Q-3 How can we extract basis from given spanning set

Q-4 How will we get to know we have basis set if we don't know about dimension (in finite dimensional vector space).

(i.e. we ~~base~~ given a linearly independent vector then how can we approach to basis indirectly said ↑)

Q-4 Let V be a finite dimensional vector space over a field F. 'W' be any subspace. What condition should be imposed on a linear operator 'T' so that

$$\ker T = W.$$

Q-5 Suppose f is continuous function on compact set in a metric space. What information can you conclude from here? i.e. what properties f will have ?

Q-6 Suppose $E \subseteq \mathbb{R}$ is bounded set. And, f is continuous function on E. (E is bdd. but not closed) What condition should be imposed on E other than closedness so that f become bounded.

Q-6 Define alternating Group.

Q-7 What do you mean by even permutation? Give an example of even permutation.

Q-8 Give proof of ~~sta theorem #~~ the theorem,

"Number of transpositions for an permutation is either even or odd when a permutation is expressed as product of transpositions."

Q-9 ~~Do~~ Is alternating group normal subgroup of S_n?

Q-10 Give an example of subgroup (other than alternating group) s.t subgroup of that group is normal in that group having index 2.

Q-11 Consider a ~~group element~~ of order 14. Will there exist an ~~subgroup~~ $\wedge$ of order 7? And tell whether this subgroup will be normal or not?

(By Sylow's theorem as well as by Cauchy's Theorem.)