Oral Exam – The List of Questions

1) Weierstrass preparation lemma
2) Hartogs theorem
3) Properties of the local ring of analytic functions $\mathcal{O}_{\mathbb{C}^n,0}$
4) Classification of complex compact curves
5) Examples of complex compact manifolds. All about $\mathbb{P}^n$,
6) Lefschetz hyperplane theorem (by Morse theory), cohomology of hypersurfaces in $\mathbb{P}^n$
7) Hodge decomposition of C^∞ forms for compact Riemannian manifolds
8) Laplasian for compact Riemannian manifolds
9) Differential forms on complex manifolds, differentials ∂ and $\bar{\partial}$
10) Cousin problems and Čech cohomology
11) Dolbeault cohomology and their relation with $H^*(X;\mathbb{C})$
12) Definition(s) of Kähler structure
13) Kähler identities
14) Hard Lefschetz theorem
15) The action of $\mathfrak{sl}_2(\mathbb{Z})$ on differential forms and on cohomology of Kähler manifolds
16) Dualities: Poincaré, Serre, conjugation and Hodge diamond
17) Signature of Kähler manifolds
18) Fubini-Study metric on complex projective space
19) Connection and curvature for complex vector bundles,
20) Concordance of connection with complex and Hermitian structure
21) The first Chern class of a line bundle
22) Chern classes of holomorphic vector bundles
23) Hirzebruch-Riemann-Roch
24) Positive line bundles, Kodaira theorems