PROPOSED SCHEDULE FOR HIGHER STRUCTURES SEMINAR ON SYMPLECTIC COHOMOLOGY

(1) Lecture 1:
- Symplectic and contact manifolds definitions and examples. Exact symplectic manifolds, symplectisation of contact manifolds. Compatible (almost) complex structures.
- Reeb vector fields. Reeb orbits.
- Liouville domains.

This would be suitable for a master's student or beginning PhD student. Possible references include
- Chapters 1 and 2 of https://people.math.ethz.ch/ acannas/Papers/lsg.pdf
- Chapters 3 and 4 of 'Introduction to symplectic topology' by McDuff and Salamon.
- A nice reference for contact geometry is: https://etnyre.math.gatech.edu/preprints/papers/phys.pdf.

(2) Lecture 2:
- Liouville manifolds.
- Examples/ non examples of all of the above. How does symplectic topology differ from topology? E.g., explain how $T^*\mathbb{R}$ and $\mathbb{R}^2$ are not the same as Liouville manifolds.
- Background on Morse theory. Emphasis on the parts of the theory which generalise to Floer cohomology.
- Explicit examples (at least the two-torus).
- Arnol'd's conjecture.

This would be suitable for a master's student or beginning PhD student. Possible references would be the same as those for the first talk, as well as
- Chapter 1 of https://people.math.ethz.ch/ salamon/PREPRINTS/floer.pdf
- Milnor's book 'Morse theory.'
- Michael Hutching's lecture notes 'Morse homology (with an eye towards Floer theory and pseudoholomorphic curves)'.
- Alex Ritter's lecture notes: http://people.maths.ox.ac.uk/ritter/morse-cambridge.html

(3) Lecture 3:
- Introduction to Hamiltonian Floer theory.
- Product structure in Hamiltonian Floer theory via pair-of-pants.
- Explain why a choice of Hamiltonian matters for Liouville manifolds. Which class of Hamiltonians do we want to allow?
- Symplectic cohomology via quadratically growing Hamiltonians.
- Example: Symplectic cohomology for punctured surfaces.

This would be suitable for a master's student or beginning PhD student. Possible references would be the same as those for the first talk, as well as
- Chapter 4 of https://people.math.ethz.ch/ salamon/PREPRINTS/floer.pdf is an excellent resource.
- Seidel's biased view: https://arxiv.org/pdf/0704.2055.pdf
- Chapter 1 of Abouzaid's notes: https://arxiv.org/pdf/1312.3354.pdf

Warning: The conventions in Salamon's notes differ from Abouzaid and Seidel's work. Namely, Salamon constructs Floer *homology*.

(4) Lecture 4
- Symplectic cohomology as a limit. Continuation maps.
- Relation to Hochschild (co)homology. Closed-open and open-closed maps. Lots of pictures.
- TQFT structure on symplectic cohomology.

This talk would be suitable for a PhD student, or enthusiastic master's students. I would suggest Abouzaid and Seidel's notes from the previous talk as good references, as well as Ritter's paper https://arxiv.org/pdf/1003.1781.pdf, which establishes the TQFT structure on symplectic cohomology.

(5) Lecture 5
  - Introduction to string topology.
  - Chas-Sullivan product.
  - Morse theorical model for the homology of the free loop space.

  This would be appropriate for a PhD student or enthusiastic master's student. Possible references include
  - Chapter 3 of Abouzaid's lecture notes.
  - Chapter 1 of Cohen-Voronov's lecture notes: https://arxiv.org/pdf/math/0503625.pdf.

(6) Lecture 6
  - Symplectic cohomology for cotangent bundles. This is the most important example.
  - Viterbo's theorem. Constructing the isomorphism to $H_*(\mathcal{L}M)$, at least heuristically.

  This would be appropriate for a PhD student or enthusiastic master's student. Possible reference include
  - Chapters 4-6 of Abouzaid's lecture notes.

(7) Lecture 7
  - Rabinowitz Floer homology.
  - Poincaré duality in this context.
  - How does this relate to other examples of Poincaré duality we already understand?
  - Long exact sequence for symplectic homology/ cohomology with Rabinowitz Floer homology.

  This would be appropriate for a PhD student or enthusiastic master's student. Possible reference include
  - Section 3 of https://arxiv.org/pdf/0903.0768.pdf
  - The main theorems of https://arxiv.org/pdf/2008.13161.pdf

(8) Lecture 8
  - Explain Goodwillie's theorem $H_*(\mathcal{L}M) \simeq HH_*(C_*(\Omega M))$.
  - Explain Poincaré duality in this context.
  - Passing this through Viterbo's theorem, what does Poincaré duality look like on $SH^*(T^*M)$?