APPROXIMATE WEEKLY SCHEDULE
– TOPOLOGY OF MANIFOLDS –
ETH ZÜRICH, FALL 2022

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Week (1)

Lecture 1. – **20.09** – **What is this course about?**
- Definition of Top and Diff manifolds.

Key Thm 1. Diff and Top: Schoenflies Conjecture
Key Thm 2. Top: Poincaré Conjecture
Key Thm 3. Diff: exotic smooth structures

Week (2)

Ex Class I – **26.09**
- fundamental and homotopy groups
- smooth manifolds
- vector and fibre bundles

Lecture 2. – **27.09** – Diff
- orientations, tangent bundle
- vector fields, Thm: can find integral curves
- Collar Thm, Thm: no crit.pts implies product
- Handle Decomposition Thm: statement
- Key Thm 0 [h-and s-cobordism Thms]: statements and outline

Week (3)

Lecture 3. – **04.10** – Diff
- submanifolds, transversality, isotopy, regular homotopy
- Whitney Embedding Thm, Whitney trick
- tubular neighbourhoods

Week (4)

Ex Class II – **10.10**
- orientations on manifolds
- Diff: tangent bundles, vector fields, proof of Collar Thm
- retraction to ∂N
- immersions and embeddings
- 2 crit. pts $\implies$ a sphere

Lecture 4. – **11.10** – Diff
- gluing, connected sum, handle attachment
- examples of handle decompositions
- Isotopy Lemma, Unknot Lemma & Cor

Week (5)

Ex Class III – **17.10**
- connected and boundary connected sum, handle attachments
- definitions of knots
- Heegaard splittings
- homotopy spheres

Lecture 5. – **18.10** – Diff
- Reordering Lemma
- Cancellation Lemma
- Remove 0-handles Lemma
- Handle Decomposition Thm: sketch of proof
- Upside Down Lemma
- Remove n-handles Lemma

Week (6)

– **25.10** – **Cancelled.**

Week (7)

Lecture 6 – **31.10** – Diff
- Morse chain complex
- h- and s-cobordism Thm: sketch of proof
- Handle Trading Lemma

Lecture 7. – **01.11** – Diff
- Handle Slides Lemma + def. of Whitehead torsion
- s-cobordism Thm: the rest of the proof
- applications: Diff Schoenflies proof
- applications: Top Poincaré proof

Week (8)

Lecture 8. – **08.11** – Diff **overflow**
- Equivariant intersection numbers
- Whitney Trick Lemma

Week (9)

Ex Class IV – **14.11**
- recapitulation of Diff part of the course
- equivariant intersection numbers

Lecture 9. – **15.11** – Top
- (Bi)Collar Thms
- proof of Top Schoenflies Conjecture by Mazur

Week (10)

Lecture 10. – **22.11** – Top
- end of proof of Top Schoenflies Conjecture by Morse
- other applications of the push–pull argument
- topological tangent bundle

Week (11)

Ex Class V – **28.11** – Office Hours

Lecture 11. – **29.11** – Top
- sketch proof of Kister's Thm
- survey of smoothing theory

Week (12)

– **06.12** – **Cancelled.**

Week (13)

Lecture 12 – **12.12** – **Dimension 4**
- Top: Freedman's s-cobordism Thm
- proof: reduction to Disk Embedding Thm (DET)

Lecture 13. – **13.12** – **Dimension 4**
- end of proof of Freedman's s-cobordism Thm, modulo DET
- exotic phenomena in dim 4

Week (14)

Exam – **20.12** – **16:30–18:00**