

LTCC
"MORSE THEORY, TOPOLOGY AND ROBOTICS"
EXAM 2024 - 2025

EXAMINER: PROFESSOR MICHAEL FARBER

1.

- (a) Give the definition of a vector field on a manifold,
- (b) What is meant by a 1-parameter group of diffeomorphisms,
- (c) State the theorem about the 1-parameter group of diffeomorphisms generated by a vector field.

2.

- (a) Give the definition of a Morse critical point,
- (b) State the Morse Lemma,
- (c) State the theorem about changes in the sub-level set when crossing a non-degenerate critical level,

- (d) State the Morse inequalities,
- (e) What is the minimal number of critical points of a Morse function on a closed orientable surface of genus g ?
- (f) Describe a Morse function on \mathbb{CP}^n and find all its critical points.

3.

- (a) Give the definition of a linkage,
- (b) Describe the configuration space of a planar linkage,
- (c) What is meant by the length vector of a linkage?
- (d) When do we say that the length vector is generic?
- (e) State the theorem about Betti numbers of moduli spaces of planar linkages.