MA222 Metric Spaces
Course Program

Warwick University, 2018/2019

(b) Subspaces and product spaces (of metric spaces).
(c) Open and closed sets, continuous functions.
(d) Convergence of sequences in metric spaces and closed sets.
(e) Equivalent metrics and isometries.

Part 2  (a) Topology: definitions and examples. Topological properties vs. metric properties.
(b) Subspaces and product spaces (of topological spaces)
(c) Topological constructions: boundary, interior, closure. Cantor sets, $F_\sigma$, $G_\delta$, $F_{\sigma\delta}$ properties, dense, nowhere dense, and meagre sets.
(d) Product, composition, and a linear combination of continuous functions.
(e) Induced topology.
(f) Metrizability, Hausdorff property and Zariski topology.
(g) Normal topological spaces, Urysohn Lemma and Tietze Theorem.
(h) Closure in metrizable and non-metrizable topological spaces.
(i) Homeomorphisms and topological invariants.

(b) Compactness and (semi)continuity
(c) Compact sets in $\mathbb{R}^n$ and nets.
(d) Uniform continuity.
(e) Sequential compactness in metric spaces.
(f) * Relative compactness.

(b) Unions, products, and continuous images of connected sets. Connected components.
(c) Path-connectedness.
(d) Open sets in $\mathbb{R}^n$.
(e) (Path)connectedness as a topological invariant.

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(b) Complete and closed subspaces of a metric space.
(c) Completeness of the spaces of bounded and continuous functions.
(d) Banach fixed point Theorem and applications.
(e) Total boundedness. Definitions, properties, and a criterion.
(f) Compactness and total boundedness.
(g) Equicontinuity and uniform equicontinuity.
(h) Arzela-Ascoli Theorem and applications.
(i) Baire’s category theorem and applications.
(j) Topological completeness and $G_δ$ property.
(k) Completion: definition, existence, and examples.
(l) Compact metric spaces as images of the Cantor set. Peano curves.
(m) Baire classes.

The following books, jointly covering the course material, are available for download via the University Library:


In addition, I can also recommend excellent synopsis by David Preiss (from 2015) and complete lecture notes by David Epstein (from 2000).