

MTH402 Analysis in Euclidean and Metric Spaces

Level: 4

Credit Units: 5 Credit Units

Language: ENGLISH

Presentation Pattern: EVERY JULY

Synopsis:

The techniques developed in MTH401 are exploited in spaces of continuous functions and applications are made to differential and integral equations. Differentiable aspects of vector-valued functions are then discussed.

Topics:

- The space of continuous functions.
- Banach spaces. Equicontinuity and pointwise compactness.
- Arzela-Ascoli Theorem.
- Lipschitz condition.
- Contraction Mapping Principle and applications to differential and integral equations.
- Bernstein polynomials.
- Stone-Weierstrass Theorem.
- Differentiability and the derivative of vector-valued functions.
- Jacobian matrix, gradient vectors.
- Differentiable curves and tangent vectors.
- Conditions for differentiability.
- Directional derivatives. Chain rule. Product rule.

Textbooks:

Jerrold Marsden, Michael Hoffman, WH Freeman: Elementary Classical Analysis 2nd edition - ISBN-13: 9780716721055-AA

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Learning Outcome:

- solve calculus problems between Euclidean spaces;
- examine the type of local extrema of functions;
- test the validity of various theorems in analysis;
- verify that conditions in analysis are satisfied in order to apply major theorems;
- construct matrix representations of the derivative of maps between Euclidean spaces;
- construct from definition various types of derivatives of specific maps between Euclidean spaces;
- construct proofs of normed, metric, completeness and topological structures, and various properties of given subsets of the space of continuous maps;
- create proofs of various properties, identities and relations for continuous, contraction or differentiable mappings;
- design iteration schemes that use contraction mappings to solve problems in differential or integral equations.
- solve a number of problem sets within strict deadlines;
- construct a range of mathematical techniques to solve a variety of formal problems;
- formulate solutions to problems individually and/or as part of a team.

Assessment Strategies:

Continuous Assessment Component	Weightage (%)
TUTOR-MARKED ASSIGNMENT	10
TUTOR-MARKED ASSIGNMENT	10
TUTOR-MARKED ASSIGNMENT	10
Sub-Total	30

Examinable Component	Weightage (%)
Written Exam	70
Sub-Total	70

Weightage Total	100
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