**Tennessee Technological University**
**Mathematics Department**

**MATH 4750/5750: Category Theory of Sets**

## I. COURSE DESCRIPTION FROM CATALOG:

Abstracts sets and mappings, categories, sums, universal property, monomorphisms and parts, finite inverse limits, colimits, epimorphisms, the Axiom of Choice, mapping sets and
diagonal argument, powers sets, variable sets, models of additional variation, selected applications. Lec. 3. Cr. 3.

## II. PREREQUISITE(S):

C or better in MATH 3400 (or consent of instructor for MATH 5750)

## III. COURSE OBJECTIVE(S):

Advanced undergraduate or beginning graduate students need a unified foundation for their study of geometry, analysis, and algebra. This is an introductory course in category theory o



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8 More on Power Sets (Optional)
- 8.1 Images
- 8.2 The Covariant Power Set Functor
- 8.3 The Natural map $PX \quad 2^{2X}$
- 8.4 Measuring, Averaging, and Winning with V-Valued Quantities
- 8.5 Additional Exercises

9 Introduction to Variable Sets (Optional)
- 9.1 The Axiom of Infinity: Number Theory
- 9.2 Recursion
- 9.3 Arithmetic of *N*
- 9.4 Additional Exercises

10 Models of Additional Variation (Optional)
- 10.1 Monoids, Posets, and Grupoids
- 10.2 Actions
- 10.3 Reversible Graphs
- 10.4 Chaotic Graphs
- 10.5 Feedback and Control
- 10.6 To and From Idempotents
- 10.7 Additional Exercises

11 Selected Application and Examples from Computer Science (Optional, see [5] and references therein)
- 11.1 Omega-Algebras
- 11.2 Functional Programming Language (FPL) category
- 11.3 Exponentiation, eval, and curry
- 11.4 e Functors: List, maplist.
- 11.5 F-Algebras and F-homomorphisms
- 11.6 Adjoints
- 11.7 Cartesian Closed Categories
- 11.8 Implicit Conversions and Generic Operators
- 11.9 Programming Language Semantics
- 11.10 Recursive Domain Equations

## VI. ADDITIONAL INFORMATION:

Recommended prerequisite: One or more of the following: MATH 3510, 3520, 4050/5050, 4110/4120, 5110/51120, 4530/4540, 5530/5540.

Graduate credit is earned on the basis of additional work that can be required by the instructor per TTU Graduate Catalog] Graduate students will be expected to present topics and applications in class.

The main body of



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Computer applications can be selected from [5] and references therein.

## VII. POSSIBLE TEXTS AND REFERENCES:

1. F. William Lawvere, Robert Rosebrugh, W. Lawvere, R. Rosebrugh, s for Mathematics, Cambridge University Press, 2002 (ISBN 0-