MODULE: FORMAL SPECIFICATIONS

Aims and Objectives
- Introduce students to a formal approach to system specification;
- Show how both predicate and propositional calculus are used as a foundation for specification;
- Introduce the Z notation for system specification;
- Develop case studies;
- Show students how to prove properties of specifications formally;
- Introduce complexity analysis.

Assessment Methods:
- Written Exam 80%
- Course Work 20%

Reading List:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>&amp; Till</td>
<td></td>
</tr>
<tr>
<td>Z An Introduction to Formal Methods</td>
<td>Diller A.</td>
<td>John Wiley 1990</td>
</tr>
<tr>
<td>An Introduction to Z</td>
<td>Imperato M.</td>
<td>Chartwell-Bratt 1991</td>
</tr>
<tr>
<td>The Z Notation</td>
<td>Spivey J.</td>
<td>Prentice-Hall 1989</td>
</tr>
<tr>
<td>Discrete Mathematics in Computer Science</td>
<td>Stanat &amp; McAllister</td>
<td>Prentice-Hall 1977</td>
</tr>
</tbody>
</table>

SYLLABUS

1. Logic
   - Propositional Calculus: propositions, truth tables, laws of deduction, argument forms – modus ponens, modus tollens, hypothetical syllogism, contradiction, addition, constructive dilemma, destructive dilemma, proof of the validity of arguments;
   - Predicate Calculus: predicates, laws of the calculus, quantifying over ranges, proof involving equivalences of predicates, trading laws.

2. Set Theory
   - Proof of the laws of set theory using predicate calculus;

3. Relations & Functions
   - Theory of relations and functions with emphasis on operators introduced in Z;

4. Z notation
   - Schemas, state space, initial state, observer operations, constructor operations, input and output for change of state;
   - Case studies;
   - Sequences and Bags.
   - Proving properties of specifications.

5. Complexity Theory
   - Introduction to the analysis of algorithms.