Memorial University of Newfoundland  
Faculty of Engineering and Applied Science  

**Eng. 9093 Ice Class Ship Structures**

I. **Objectives:** The aim of this course is to introduce the students to the concepts and detailed engineering aspects of ice class ship structures. Ice Class structural requirements have been developed from ice impact scenarios and plastic behavior of steel panels subject to patch loads. The course will help students fully understand two key areas of importance.

1) Ice loads specification. Rule loads reflect a combination of rigorous analytical models of the physics of contact loads and the highly empirical experience that has been gained by operating ships in ice. The Polar Rules reflect this combination of science and experience. The course will also look beyond the existing rules, with discussion of the latest direct assessment techniques.

2) Structural requirements specification. The IACS Polar rules use Plastic criteria for plating and framing. The course will fully describe the limit state formulations inherent in the PC rules. These will be contrasted with other ice class rules such as the Baltic and Russian rules. The course will also look at direct numerical approaches to determining ice capability.

II. **Course Structure:**

There will be 3 hours of lectures per week. The students will also have to do a project. The project will be to conduct a direct assessment of a candidate ship structure.

III. **Topic List**

Regulations
- IACS PC rules
- Baltic Rules
- Russian Register Rules

Ice load Concepts and Models
- analytical models (Popov)
- numerical models (eg. GEM, LS Dyna)

Structural Concepts and Theory
- Plate Strength
- Frame Strength
- Large Structural Member analysis

Direct Capability Assessment
- Safe Speed Concepts
- LS Dyna Modeling
- Overload Analysis

**TEXTS AND REFERENCES:**

- Codes (IACS URI, Class Ice Rules, ISO Arctic Standard)
- Background Reports to IACS Polar Rules
- Various conference and journal publications

**ASSESSMENT**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>40%</td>
</tr>
<tr>
<td>Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Final examination</td>
<td>30%</td>
</tr>
</tbody>
</table>

**INSTRUCTOR:** Dr. C. Daley, Rm. 4032D, Tel: 8805, email: cdaley@mun.ca