Description: Discovering research problems whose solutions will have high impact is fundamental to both academic and non-academic research. This course will provide the students with a diverse set of tools to aid the student from discovery of a problem to a problem solution, using process skills developed and validated in cognitive science literature. The skills developed in this course will be linked directly to current challenges faced by graduate students and in their future careers in academia and industry.

Instructor: Ali Khan
RRI 1240A, 519-931-5777 ext. 24280, alik@robarts.ca
Consultation hours: By appointment

Lectures: 3 lecture hours/week, 0.5 course.
Tuesdays 11:00am -12:30pm (1.5 hours/lecture)
Wednesdays 11:30am -1:00pm (1.5 hours/lecture)
Location: Medical Sciences Building, Room 493
(Medical Biophysics Conference Room, MSB 493)

Prerequisites: None

Required Textbook: None

Specific Learning Outcomes

1. Introduction to problem solving

At the end of this section, students will be able to:
- Identify and differentiate between a problem and a mess and the understand impact of structure
- Understand the difference between domain knowledge and process skills.
- Understand the definition of metacognition
- Understand the overall concept of cognitive load theory
• Recognize the importance of affective metacognition in the context of public speaking and a graduate thesis defence
• Understand the concept of locus of control and how it can be modified
• Analyze and evaluate the quality of communications based on known models

2. Divergent thinking

At the end of this section, students will be able to:
• Recall divergent thinking techniques
• Recognize how divergent thinking techniques can aid in the problem structuring
• Carry out divergent thinking techniques to aid in the problem structuring
• Carry out divergent thinking strategies to help move past blocks in order to generate ideas
• Recognize how perceptual blocks can hinder problem structuring and problem solving
• Recognize the role of metacognition in divergent thinking

3. Diagrams in problem solving

At the end of this section, students will be able to:
• Recall and understand the general structure and functions of diagrams.
• Recall and understand the limitations of complimentary diagrams, specifically the keyhole effect.
• Synthesize contexts in which diagrams can be used effectively.
• Recall and understand the general structure of Ishikawa, Interrelationship, and Duncker diagrams and their applications in terms of metacognition
• Recall and understand general morphological analysis and its applications to problem solving

4. Examples and extreme cases

At the end of this section, students will be able to:
• Remember different kinds of examples and understand how they are applicable to problem solving.
• Identify relevant examples and describe their application to problem solving.
• Understand the process of example driven modeling
• Analyze science research within the framework of example driven modeling.
• Apply example driven modeling to solve problems

5. Analogical reasoning
At the end of this section, students will be able to:
- Recall and understand the structure and uses of analogies.
- Apply analogical reasoning techniques to solve a well-defined problem.
- Recall theories of analogy and associated dimensions of an analogy's quality.
- Evaluate different theories of analogy.
- Analyze communication for analogies and their structure.
- Synthesize an analogy to communicate a problem definition or problem domain and evaluate its quality.

**Evaluation:**

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>60%</td>
</tr>
<tr>
<td>Course Project</td>
<td>30%</td>
</tr>
<tr>
<td>Attendance and Participation</td>
<td>10%</td>
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</tbody>
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To obtain a passing grade in the course, a mark of 50% or more must be achieved on the course project; such a mark < 50% will result in a final course grade of 48% or less.

**Assignments:** The course will include four homework assignments, submitted online or in class.

**Participation:** Participation will constitute 10% of the course grade. Participation marks will be based on a combination of attendance, in-class participation in discussion, a divergent thinking design challenge, and an in-class presentation in the 3rd module (Diagrams). Students will receive midterm feedback on their participation after the fourth week of class.

**Course project:** Students will have the option of either completing a) a grant proposal or b) a business model. This assignment should tie together most if not all of the concepts taught in this class. The assignment will include three parts: a short proposal, a full write-up, and a document justifying the choices made.
Attendance, Participation and Other Policies:

The course is designed to be interactive and having peer-feedback in improving presentation skills is vital for the class. Communication is the transfer of information between two people. Part of the skills being learned is that of asking questions; as such active participation is encouraged in the lectures and feedback sessions for the presentations. If for some legitimate reason you cannot attend a particular lecture, please contact the course co-ordinator immediately with the reason for your absence.

Attendance Policy:
All classes, laboratories, and tutorials are mandatory, unless otherwise stated. Any student who, in the opinion of the course co-ordinator is absent too frequently from class or laboratory periods in any course, will receive a failing grade after due warning has been given in writing from the course co-ordinator and Graduate Chair.

Cheating and Plagiarism Policy:
Students are encouraged to work together, but each student must take total responsibility for his/her submitted work. Students must write their laboratory reports and final projects in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If a student is caught cheating, there will be no second warning. All written reports and projects may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All reports will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (http://www.turnitin.com).

See the School of Graduate and Postdoctoral Studies Scholastic Offence Policy: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

Use of Electronic Devices Policy:
No electronic devices (e.g., cell phones, MP3 players) may be used during lectures or examinations. The use of non-programmable calculators is permitted during examinations; programmable calculators are prohibited during examinations.

OWL Internet/Bulletin Board Policy:
It is the student’s responsibility to read the course website posted on Western’s on-line learning management system, OWL (https://owl.uwo.ca/portal). This includes the course bulletin board and all information and/or assignments posted about the course. If the
student fails to act on information that has been posted on the course site and does so without a legitimate explanation (i.e., those covered under the illness/compassionate form), then there are NO grounds for an appeal.

**Request for Assignments Extensions:**
Students are advised to inform the course co-ordinator as soon as possible regarding an extension for assignment submissions due to medical reasons or other compassionate reasons. Extensions will only be granted by the course co-ordinators at their discretion.

**Absence Due to Medical Illness:**
Students must familiarize themselves with the Policy on Accommodation for Medical Illness: [https://studentservices.uwo.ca/secure/index.cfm](https://studentservices.uwo.ca/secure/index.cfm)
If you are unable to meet a course requirement due to illness or other serious or compassionate circumstances, you must provide valid medical or other supporting documentation to the course coordinator immediately. It is the student's responsibility to make alternative arrangements with the coordinator to complete missing course requirements.

A student requiring academic accommodation due to illness, should use the Student Medical Certificate: [http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf) when visiting an off-campus medical facility or request a Record's Release Form for visits to Student Health Services. The form is available at: [http://www.health.uwo.ca/services/students/policies.html](http://www.health.uwo.ca/services/students/policies.html). The release form will allow the course co-ordinator to confirm with Student Health Services that a student’s absence from regular attendance or inability to meet scheduled course commitments is due to medical reasons. The nature of the illness will not be divulged by Student Health Services.

**Graduate Students’ Mental Health and Physical Wellness:**
As part of a successful graduate student experience at Western, students are encouraged to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western’s Campus Recreation Centre: [http://www.uwo.ca/campus_life/athletics.html](http://www.uwo.ca/campus_life/athletics.html)

All facets of extracurricular campus life in which graduate students can participate are available on this URL: [http://www.uwo.ca/campus_life/arts_culture.html](http://www.uwo.ca/campus_life/arts_culture.html)

Information regarding health and wellness-related services available to students may be found at [http://www.health.uwo.ca](http://www.health.uwo.ca). Students seeking help regarding mental health concerns are advised to speak to someone in whom they feel comfortable confiding, such as their graduate supervisor, their program director (Graduate Chair), or other relevant administrators in their unit. Campus mental health resources may be found at:
Accessibility to the Course and Course Materials:
Please contact the course co-ordinator if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.