

## Proposed UG Thesis Topics – Fall 2023

Please review the list of topics provided below. In some instances, professors have identified specific thesis topics. In other instances, professors have indicated that they are willing to work with you to develop a topic that is related to one of the topic areas that is listed. You are encouraged to contact professors to learn more about the projects listed – and to secure the topic that most interests you as topics are typically assigned on a first-come basis.

### **J. Ackerman** (Strawbale Building) (204-261-0930) ([Joe.Ackerman@umanitoba.ca](mailto:Joe.Ackerman@umanitoba.ca))

Note: Dr. Ackerman is the recently-appointed Manager & Research Associate for our new Sustainability-in-Action Facility (SiAF). He is willing to supervise theses related to the following topics:

1. **Plastic recycling:** Problems with current recycling stream and alternative modes of collection, sorting, processing, and usage.
2. **Regenerative agriculture and carbon sequestration:** Parameters in soil carbon storage. Techniques and methods of measurement and affecting change. Biochar as an amendment.
3. **Uses for post-consumer glass:** From a recycling perspective, glass is cheap, heavy and boring. This could explain why there are no industries using glass cullet in Manitoba. What are potential uses for recycled glass in Manitoba?

### **W. Blunt** (EITC E1-310) (204-474-7144) ([Warren.Blunt@umanitoba.ca](mailto:Warren.Blunt@umanitoba.ca))

Research focus: microbial processes for valorization of value-added bio-products from waste materials. Some suggested projects below, but willing to accommodate other ideas (within the general space) that students may wish to pursue.

- **Towards a CO<sub>2</sub>-based biorefinery:** Application of H<sub>2</sub>-oxidizing (autotrophic) microorganisms for microbial carbon capture and conversion to biopolymers.
  - **Literature review** – microbial strains, processes, products
- **Microbial valorization of pea starch** Production of value-added commodities from starchy fractions associated with processing MB field peas
  - **Literature review** – strains featuring inherent starch degradation enzymes, associated products, processes for enzymatic hydrolysis.
  - **Experimental** – assessing rheological effects of pea starch in aqueous fermentation medium, and consequent effects on mass transfer in a bioreactor environment
- **Utilization of C5/C6 sugar mixtures.** Microbial processes to convert sugars from lignocellulosic sources into a spectrum of value-added bioproducts.
  - **Literature review** – biochemical pathways for xylose degradation and associated products

### **Y. Chen** (E1-349 EITC) (204-474-6292) ([Ying.Chen@umanitoba.ca](mailto:Ying.Chen@umanitoba.ca))

1. An indigenous technique of companion planting in agriculture - the Three Sisters system
2. Properties of biodegradable and renewable materials: corn husk fibers

### **N. Cicek** (256 Agriculture) (204-474-6082) ([Nazim.Cicek@umanitoba.ca](mailto:Nazim.Cicek@umanitoba.ca))

No specific topics suggested, but Dr. Cicek's research program is focused on utilization of waste products and waste treatment (anaerobic digestion of dairy manure, engineered wetlands for wastewater treatment, removal of antibiotics from wastewater, value-added uses of waste streams from industrial and agricultural applications, bioenergy and renewable energy technologies).

### **F. Delijani** (E3-374 EITC) (204-474-8613) ([farhoud.delijani@umanitoba.ca](mailto:farhoud.delijani@umanitoba.ca))

1. Green and sustainable buildings

2. Structural insulated panels
3. Alternative building materials
4. Fabric formwork for concrete
5. Prefabricated building components
6. Modular homes

**C. Erkinbaev** (E1-344 EITC) (204-474-6977) ([Chyngyz.Erkinbaev@umanitoba.ca](mailto:Chyngyz.Erkinbaev@umanitoba.ca))

1. Design of an IoT-based mini-spectrometer for prediction of fruit/vegetable ripeness in the field
2. Spectral imaging for grain quality control

**S. Hladik** (326 Stanley Pauley) (204-474-6972) ([stephanie.hladik@umanitoba.ca](mailto:stephanie.hladik@umanitoba.ca))

Research focus: engineering education. Dr. Hladik conducts qualitative and design-based research into engineering education in a variety of settings (K-12 schools, post-secondary institutions, museums, library makerspaces, after-school technology clubs, etc.). She is particularly interested in projects that address historical and existing inequities in STEM education. Potential topics include but are not limited to:

1. Engineering education in K-12 education
2. Informal engineering education (e.g., outreach programs, museum programs)
3. EDI in engineering education
4. Experiences of graduate teaching assistants in engineering
5. Engineering identity

**F. Jian** (E1-532 EITC) (204-474-7965) ([Fuji.Jian@umanitoba.ca](mailto:Fuji.Jian@umanitoba.ca))

1. Atmospheric freeze drying of canola.
2. Mathematical modeling of airflow resistance through grain bulks.
3. Airflow resistance through grain bulks.
4. Grain respiration and CO2 monitoring.

**D. Levin** (E1-354 EITC) (204-474-7429) ([David.Levin@umanitoba.ca](mailto:David.Levin@umanitoba.ca))

1. Physical-mechanical-thermal properties, applications, and biodegradability of renewable biodegradable polymers, such as Polyhydroxyalkanoates (PHAs and PLA)
2. Physical-mechanical-thermal properties, applications, and biodegradability of petroleum-based, biodegradable polymers, such as Polyethylene succinate (PES), Polybutylene succinate (PBS), Polycaprolactone (PCL), and Polybutylene Adipate Terephthalate (PBAT)
3. Polystyrene degradation by mealworms
4. Biodegradation of coffee cups by red wriggler worms

**S. Liu** (W581 Duff Roblin Bldg) (204-474-9616) ([Song.Liu@umanitoba.ca](mailto:Song.Liu@umanitoba.ca))

1. Antiviral coatings;
2. Biosensor for detecting pathogenic bacteria;
3. Smart, multi-layered food packaging films from biodegradable polymers and natural functional additives

**D. Mann** (E2-376B EITC) (204-474-7149) ([Danny.Mann@umanitoba.ca](mailto:Danny.Mann@umanitoba.ca))

Please contact Dr. Mann if you have a project idea related to human factors engineering or safety engineering. My research program focuses on the challenges associated with remotely supervising autonomous agricultural machines; I would be happy to discuss potential projects related to this topic.

**E. Morris** (E1-330 EITC) (204-474-7919) ([Ella.Morris@umanitoba.ca](mailto:Ella.Morris@umanitoba.ca))

1. Investigation of surface mounted cylinder in turbulent flow – literature review

**J. Morrison** (E1-356 EITC) (204-474-8496) ([Jason.Morrison@umanitoba.ca](mailto:Jason.Morrison@umanitoba.ca))

Please contact Dr. Morrison for projects related to his research expertise listed below.

Biofibre collection, separation, and grading of all stages using imaging, spectroscopy and mechanical assessment. Material properties assessment of biologically sourced and/or bio-compatible materials.

**J. Paliwal** (E1-342 EITC) (204-474-8429) ([J.Paliwal@umanitoba.ca](mailto:J.Paliwal@umanitoba.ca))

- Simulation of background inconsistencies in micro-CT imaging using Matlab
- Proof of concept design of a floatation vest or wearable alerting device for grain entrapment
- Design of a data collection system for volume and moisture at the GSRL's grain elevator pit
- Quantifying the variations in canola's electrical permittivity as a function of oil content
- Evaluating the effect of magnetic field stimulation on germination of grains
- A comparative study to evaluate the movement of insects toward artificial pheromones in pulse flours.
- Microstructural analysis of breads and spaghetti made from different blends of wheat-pulse flours

**M. Rahman** (W583 Duff Roblin Bldg) (204-474-8509) ([Mashiur.Rahman@umanitoba.ca](mailto:Mashiur.Rahman@umanitoba.ca))

1. NIR dyed fabrics for defence uses.
2. Controlled retting for canola stems.
3. Compostable coffee cups.
4. Microplastics release from the facemasks – a literature review.
5. Herzberg's two-factor theory for engineers (literature review).
6. Environmental effects of and CO<sub>2</sub> emission from textile processing (literature review)

**J. Seniuk Cicek** (333 Stanley Pauley) (204-474-9698) ([Jillian.SeniukCicek@umanitoba.ca](mailto:Jillian.SeniukCicek@umanitoba.ca))

**Research focus:** Engineering Education

Engineering education research is a field of study that focuses on engineering epistemologies (ways of knowing), learning mechanisms, learning systems, diversity and inclusiveness, and assessment, asking questions about the characteristics of engineering learning and knowing, and the preparation of engineers for their roles in today's complex world. Researchers employ the theories, frameworks, methodologies, and practices of the learning, education, neuro, and social sciences, for the ultimate purpose of describing and improving the training and education of engineers and advancing knowledge in the field.

Research topics include, but are not limited to:

1. Indigenous experiences, initiatives, methodologies & pedagogies in engineering education, and their impact on students' learning
2. Sociotechnical thinking, education & practices
3. Pedagogical (teaching) practices & competency development in engineering education
4. Engineering student identity, culture, diversity & perspectives
5. The development of the field of engineering education research in Canada

**R. Sri Ranjan** (E1-346 EITC) (204-474-9344) ([Sri.Ranjan@umanitoba.ca](mailto:Sri.Ranjan@umanitoba.ca))

1. Building and optimizing the operation of aeroponic systems for growing herbs/vegetables indoors

**Q. Zhang** (E1-399 EITC) (204-474-9819) ([Qiang.Zhang@umanitoba.ca](mailto:Qiang.Zhang@umanitoba.ca))

1. Smart sensors for vertical farming
2. Determining energy consumption in vertical farming systems
3. Hydroponic vertical growing systems
4. Effects of mechanical vibration on animals/humans.

**W. Zhong** (W579 Duff Roblin Bldg) (204-474-9913) ([Wen.Zhong@umanitoba.ca](mailto:Wen.Zhong@umanitoba.ca))

1. Development of conductive hydrogels for biosensors.
2. Functional nanofibers for biomedical applications.

**K. Zacharias** (334 Stanley Pauley) ([kari.zacharias@umanitoba.ca](mailto:kari.zacharias@umanitoba.ca))

Research focus: engineering education and science and technology studies. Dr. Zacharias is a qualitative researcher who studies the ways that engineers and engineering students learn, think, do, and make. She is open to supervising a variety of projects in this area. Potential topics include but are not limited to:

1. Technological stewardship for engineers
2. Indigenous pedagogies in engineering (e.g. land-based learning)
3. STEAM / engineering, technology, and the arts
4. Inter- / transdisciplinarity and engineering
5. Symbols and structures of colonialism within Canadian engineering