# AI Program Stakeholder Consultation

MADAN BHANDARI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Proposal by Suresh Manandhar

# Objectives

- Leverage benefits of AI to leapfrog other disciplines into developing AI enabled cutting edge technology
- The program enables students to study AI and apply cutting edge research into problems relevant for Nepal
- Develop distinctive PhD and MSc programs relevant for economic development
- Provide a platform for Nepali diaspora to contribute and collaborate

# Proposal for Research Projects, PhD and MSc programs

Summary

- Background/Context
- Overview of Research Directions
- MSc Programs Overview
- PhD Program Overview
- Q & A

# Context and Background

3 Departments to be initiated in MBUST

- AI and IoT
- Agriculture
- Forestry and Hill economy

# Proposal for Research Projects

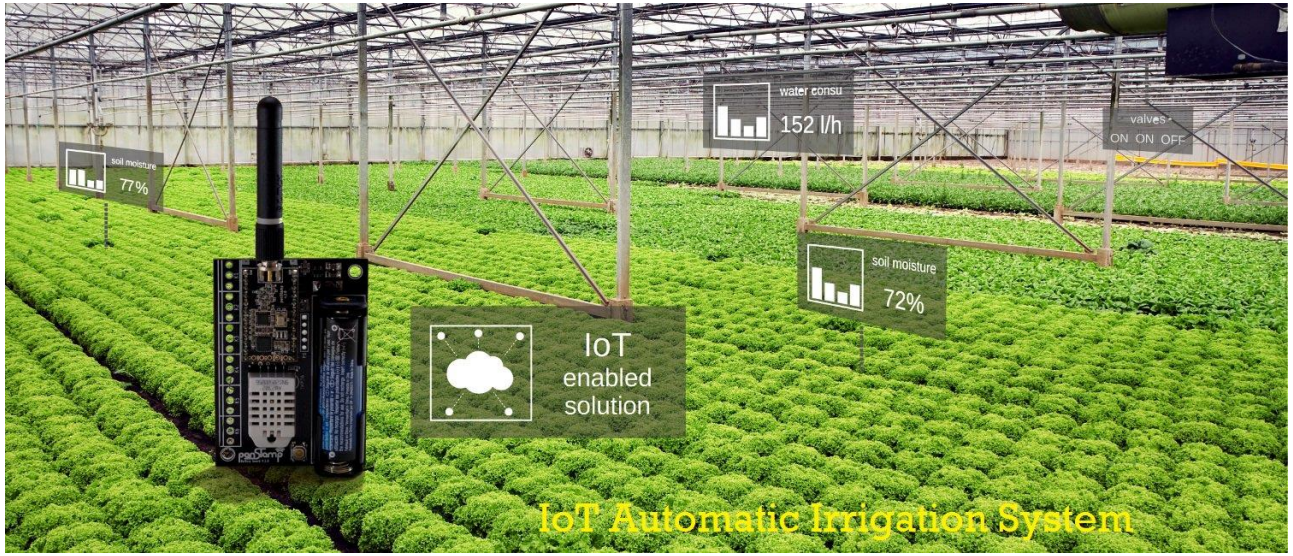
Focus on synergy across departments and relevance for Nepal

- AI driven Agriculture
- AI applications in Forestry
- Herbal medicine and drug discovery
- Resource allocation, Supply chain management and planning

# Why AI is gaining prominence?

- Increased digitization means that there is huge amount of data available
- AI can learn human decision making and mimic this
- This in turn results in massive efficiency gains and better service delivery

# AI in Agriculture




**IOT sensor integrating with monitoring (for disease, pest, plant health etc)**

https://www.cropin.com/iot-internet-of-things-applications-agriculture/
https://www.mckensoftware.com/

# AI in Agriculture

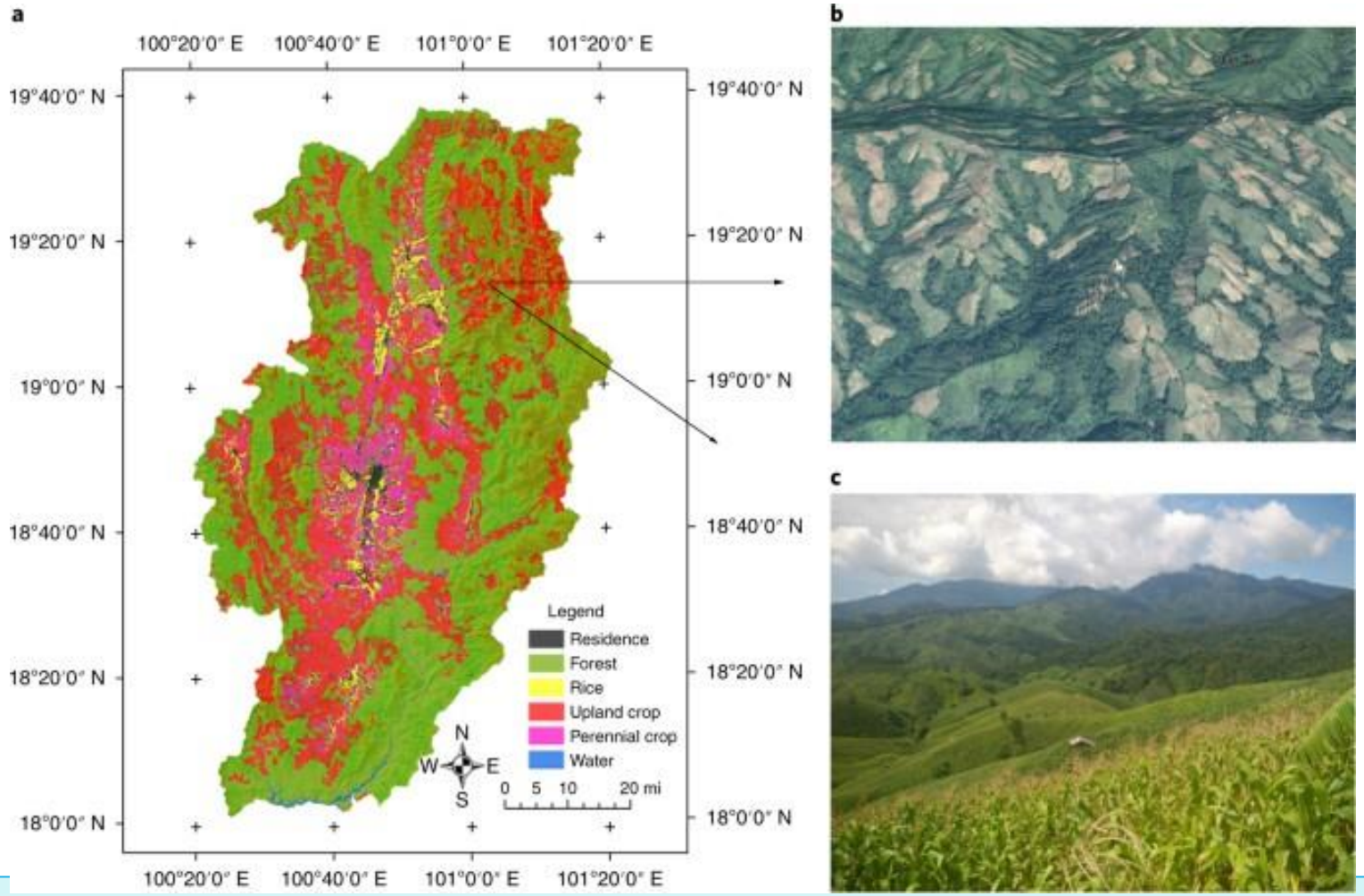
Drone based monitoring and pesticide spreading

https://medium.com/@droni_tech/drones-are-revolutionizing-the-future-of-agriculture-farming-88eefd8091e
https://www.youtube.com/watch?v=P2YPG8P09JU

# Satellite Monitoring

**Using satellite data for:**

- Crop identification and yield forecasting
- Disease spread monitoring
- Land use monitoring
- Water usage monitoring




Satellite based large scale agriculture monitoring

https://www.nature.com/articles/s41561-018-0166-9

# Lost cost AI for Agriculture

- IoT Sensor integration with monitoring
- Plant disease detection using mobile phones
- Phone based services (e.g. Satellite based large scale agriculture monitoring)
- Low cost robotics

# Optimizing the agriculture value chain

- Agro Chemicals
- Water
- Farm Equipment
- Agri Processing
- Government
- Agri Finance
- Farmer
- Retailer
- Supply Chain

Current State

- Precision chemical usage
- IoT & Weather driven usage
- Low cost robotic equipment
- AI imaging for sorting/packaging
- Optimal resource allocation
- AI driven credit risk scoring
- Agriculture analytics and profit estimation
- Demand forecast and pricing/profit
- Data fusion and analytics

Future State

# Applications in Herbal Medicine

- Using Natural Language to understand from texts in traditional medicine
- Understanding the molecular structure of herbal medicines for drug discovery
- AI applications in Forestry

# MSc and PhD Programs in AI

## MADAN BHANDARI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Proposal by Suresh Manandhar

# Key Elements of MSc and PhD Programs

- Strong mathematical and theoretical foundations
- Embedded training in research writing, communicating and entrepreneurship
- Multidisciplinary collaboration across other departments
- Fully funded MSc and PhD programs

# MSc in AI Structure

MADAN BHANDARI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Proposal by Suresh Manandhar

## MSc in Artificial Intelligence (at a glance)

| | Credits |
|---|---|
| Core Topics | 28 |
| Subject Specialisation | 12 |
| Research Methodology, Plagiarism, Ethics | 1 |
| Paper Reading and Presentation | 1 |
| Mini Project | 3 |
| Dissertation | 15 |
| **Total** | **60** |

1 Cr. Hour = 1 hour in classroom and 2 hours outside classroom per week.
1 Cr. hour thesis is equivalent to 3 hours student work per week.
Workload per week is 45-48 hours. One semester is 15 Cr and 16 weeks.

# Structure for MSc in AI

## Semester 1

| Subject | Credits |
|---|---|
| Advanced Python Programming | 4 |
| Linear Algebra -- I | 2 |
| Probability Theory -- I | 2 |
| Machine Learning Theory - I | 2 |
| Subject Specialisation Theme 1 - I | 2 |
| Subject Specialisation Theme 2 - I | 2 |
| Research Methodology, Plagiarism, Ethics | 1 |

# Structure for MSc in AI

## Semester 2

| Subject | Credits |
|---|---|
| Deep Learning in Practice | 4 |
| Linear Algebra -- II | 2 |
| Probability Theory -- II | 2 |
| Machine Learning Theory - II | 2 |
| Subject Specialisation Theme 1 - II | 2 |
| Subject Specialisation Theme 2 - II | 2 |
| Paper reading and Presentation | 1 |

# Structure for MSc in AI

## Semester 3

| Subject | Credits |
|---|---|
| Advanced topics in Deep Learning | 4 |
| Bayesian Machine Learning | 4 |
| Subject Specialisation Theme 1 - III | 2 |
| Subject Specialisation Theme 2 - III | 2 |
| Mini Project | 3 |

# Structure for MSc in AI

## Semester 4

| Subject | Credits |
| --- | --- |
| Dissertation Project | 15 |

# Mandatory aspects for Graduate Students

- Research methodology, plagiarism and ethics
- Entrepreneurship and innovation partnerships
- Communication, writing and leadership
- Partnership in teaching course modules with internal and external professors and experts
- Participation & presentation in seminars, course projects

# Masters program requirements

- All courses will be run as guided study combined with project-based learning
- Mini projects and thesis projects are strongly encouraged to be problem focussed and collaborative
- Paper suitable for peer reviewed publication assessed by the examination committee

# MSc by Research Programs

## MADAN BHANDARI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Proposal by Suresh Manandhar

# Generic structure for MSc by Research across disciplines

- Applicable to all taught MSc programs
- All taught MSc programs can potentially have a MSc by Research Programs
- The requirements for MSc by Research programs will be standardised across disciplines
- MSc by Research Structure:
  - Complete Taught MSc Program with a minimum GPA of 2.0
  - Complete additional 1 Year pure Research Project
  - The 1 year Research Project will run like a mini PhD program
  - The 1 year Research Project will expand on the dissertation project

# Research Degrees Program Structure

MADAN BHANDARI UNIVERSITY OF SCIENCE AND TECHNOLOGY

Proposal by Suresh Manandhar

# Core aspects of Research degrees (MSc and PhDs)

- Research integrity and Ethics
- Supervisor(s)
- Thesis Advisory Board
- Progression points and success criteria
- Thesis Structure
- External courses
- External co-supervisors and collaborators
- Review of supervision and mitigation
- Teaching and Research Assistantships
- Publications
- Networking
- Seminars
- Conferences
- Nomination of External Examiner
- Viva
- Career paths and training
- Grant proposal writing and projects

# Research integrity and Ethics

- Every researcher needs to have full understanding of research ethics & research integrity
- Dual use nature of most scientific inventions
- Follow strict guidelines for academic conduct – referencing, acknowledgements, data ethics and privacy, laws governing experiments
- Understand academic misconduct and how to avoid this
- Ethical approval process – this needs to be designed and made available to all researchers
- Conscious or unconscious bias and how to avoid this
- Replicability of experimental results
- Reporting principles for scientifically validated reporting of experimental results

# Thesis Advisory Board

- **Responsibility**:
  - Provide broader research support to the research student and supervisor
  - Provide oversight in the progress of the research student
  - Provide networking help
  - Monitor research progress and validate progress against university procedures
  - Understand issues facing student and supervisor – assess research supervision
  - Suggest mechanisms for mitigation of issues
  - Advisory board members, excluding supervisor(s), cannot collaborate in the research project as this generates a conflict of interest
- **Meeting times:**
  - Meet at regular intervals at agreed times following University procedures
  - Be available for the student and supervisor when advisory assistance is neede
- **Membership:**
  - All members must be specialist within the broader subject area but not necessarily in the narrower research topic
  - All members need to be approved by the Graduate Research Chair in the respective department
  - Supervisor will fill in a nomination form provided by the University
  - MRes: Supervisor(s) + 1 additional Advisory Board member
  - PhD:  Supervisor(s) + at least 2 additional Advisory Board members

# Progression Points and success criteria (PhD)

## 1. Literature Review Report and Literature Review Seminar (Month 4)

**Literature Review Report should contain**:

- Critical review of literature within the chosen domain
- Clear identification of research gaps
- How this builds on MSc dissertation
- Identification of knowledge needed to conduct the research
- Identification of student and supervisor gaps in knowledge
- Identification of any training needs or external supervisor help

**Success criteria**:

- Review is critical, written in authoritative academic style, clearly identifies the current progress in the field
- Research gaps has been identified and clearly specified
- Comparison with MSc dissertation is provided and how new work merits a PhD is clearly identified.
- Does the student have the knowledge to carry out this research
- Does the supervisor have the knowledge to carry out this research
- If there is gap in required knowledge, has training needs and time required been clearly identified. Similarly, has external supervisor been clearly identified if needed.
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (MRes)

## 1. Literature Review Report and Literature Review Seminar (Month 2)

**Literature Review Report should contain**:

- Critical review of literature within the chosen domain
- Clear identification of research gaps
- How this builds on MSc dissertation
- Identification of knowledge needed to conduct the research

**Success criteria**:

- Review is critical, written in authoritative academic style, clearly identifies the current progress in the field
- Research gaps has been identified and clearly specified
- Comparison with MSc dissertation is provided and how new work merits a PhD is clearly identified.
- Does the student have the knowledge to carry out this research
- Does the supervisor have the knowledge to carry out this research
- For MRes, both supervisor and student need to have sufficient background to complete proposed research
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (PhD)

## 2. Research Proposal Report and Research Proposal Seminar (Month 6)

**Research Proposal Report should contain**:

- Cleary defined research proposal that proposes to address a significant gap in current research within the chosen topic area
- Justification of why the proposed approach is going to be novel
- Justification of why the proposed approach is simply not incremental and would not be already published by other researchers
- Justification that the proposed research would represent a step change in enhancing our knowledge of the field
- Research Plan with milestones and timelines have been provided in a chart
- Clearly defined subjective and objective success criteria
- Identification of how the research will impact the field

**Success criteria**:

- Addressed research gaps is significant and not incremental
- Proposed approach is sufficiently novel and has potential to generalise over current approaches
- Success criteria for measuring success of the project has been clearly specified and meets currently used criteria within the field
- Research plan is realistic and achievable
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (MRes)

## 2. Research Proposal Report and Research Proposal Seminar (Month 3)

**Research Proposal Report should contain**:

- Cleary defined research proposal that proposes to address a significant gap in current research within the chosen topic area
- Justification of why the proposed approach is going to be novel
- Clearly defined subjective and objective success criteria
- Research Plan with milestones and timelines have been provided in a chart
- Identification of how the research will impact the field

**Success criteria**:

- Addressed research gaps are novel
- Proposed approach is sufficiently novel
- Research Plan is realistic and achievable
- Success criteria for measuring success of the project has been clearly specified and meets currently used criteria within the field
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (PhD)

## 3. First Year Report and First Year Research Seminar (Month 12)

**First Year Report should contain**:

- Summary of Literature review
- Research Plan (including any agreed changes)
- Description of research milestones for the first year
- Report on the research carried out and results obtained against the set milestones
- Measurement of success/failure
- Publication plan
- Changes to the research plan and milestones resulting from the research

**Success criteria**:

- Has agreed research targets been achieved ?
- Are these research targets still significant taking into consideration new developments in the field ?
- Are changes to the research needed as a result? If yes, has these been provided with revised milestones and timelines? Are these achievable and still significant to merit a PhD degree?
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (MSc)

## 3. MSc by Research Thesis and Research Seminar (Month 12)

**Report should contain**:

- Critical Literature review
- Goals of the research
- Summary research objectives and milestones
- For each contribution Chapter:
  - Report on the research carried out and results obtained against the set milestones
  - Evaluation results
- Summary of research outcomes
- Publication plans

**Success criteria**:

- Has agreed research targets been achieved ?
- Does the results obtained merit a MSc by Research? If not what remedial measures need to be carried out. How much extra time will be needed. Can the MSc by Research
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (PhD)

## 4. Second Year P1 Report and Second Year P1 Research Seminar (Month 18)

**Second Year P1 Report should contain**:

- Summary of Literature review
- Research Plan (including any agreed changes)
- Description of research milestones for Second Year P1
- Report on the research carried out and results obtained against the set milestones
- Measurement of success/failure
- Publication plan
- Changes to the research plan and milestones resulting from the research

**Success criteria**:

- Has agreed research targets been achieved ?
- Are these research targets still significant taking into consideration new developments in the field ?
- Are changes to the research needed as a result? If yes, has these been provided with revised milestones and timelines? Are these achievable and still significant to merit a PhD degree?
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (PhD)

## 5. Second Year P2 Report and Second Year P2 Research Seminar (Month 24)

**Second Year P2 Report should contain**:

- Summary of Literature review
- Research Plan (including any agreed changes)
- Description of research milestones for Second Year P2
- Report on the research carried out and results obtained against the set milestones
- Measurement of success/failure
- Publication plan
- Changes to the research plan and milestones resulting from the research

**Success criteria**:

- Has agreed research targets been achieved ?
- Are these research targets still significant taking into consideration new developments in the field ?
- Are changes to the research needed as a result? If yes, has these been provided with revised milestones and timelines? Are these achievable and still significant to merit a PhD degree?
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (PhD)

## 6. Third Year P1 Report and Third Year P1 Research Seminar (Month 30)

**Third Year P1 Report should contain**:

- Summary of Literature review
- Research Plan (including any agreed changes)
- Description of research milestones for Third Year P1
- Report on the research carried out and results obtained against the set milestones
- Measurement of success/failure
- Publication plan
- Changes to the research plan and milestones resulting from the research

**Success criteria**:

- Has agreed research targets been achieved ?
- Are these research targets still significant taking into consideration new developments in the field ?
- Are changes to the research needed as a result? If yes, has these been provided with revised milestones and timelines? Are these achievable and still significant to merit a PhD degree?
- Good delivery and answering questions raised during the seminar

# Progression Points and success criteria (PhD)

## 7. PhD Thesis Seminar (Month 35)

**PhD Thesis Seminar should contain**:

- Overview of research topic and research goals
- For each contribution Chapter:
  - Description of research carried out and results obtained
  - Evaluation against current state of the art
- Publications and Publication plan

**Success criteria**:

- Has agreed research targets been achieved ?
- Are these research targets still significant taking into consideration new developments in the field ?
- Does the research conducted merit a PhD?
- Good delivery and answering questions raised during the seminar

# PhD Thesis Structure

## 8. PhD Thesis Submission (Month 36)

**PhD Thesis Structure**:

- Overview of research topic and research goals
- Critical Literature Review
- For each contribution Chapter:
  - Description of research carried out and results obtained
  - Evaluation against current state of the art
- Summary and Conclusions

# External courses, co-supervisors and collaborators

## External courses

- The supervisor and student has the primary responsibility to identify external (online) courses needed to fill in any identified knowledge gaps
- These should be completed as early as possible during the PhD

## External co-supervisors and collaborators

- External co-supervisors and collaborators may be needed depending upon the research topic
- Having external co-supervisors and collaborators should be actively encouraged to build research partnerships both nationally and globally
- There needs to be a University policy document on such engagements
- The University needs to be supportive of such arrangement
- The University to initiate visiting faculty programs to encourage external links and collaborations

# Teaching and Research Assistantships

## Teaching Assistantships

- Students who have already completed their MSc and demonstrated competence in specific subjects should be encouraged to take up teaching assistantships
- Teaching assistants support running labs and assisting in classrooms
- Teaching assistants are not expected to teach
- Teaching assistants can also support some easy marking tasks while the responsibility of marking quality will rely solely on the lecturer/examiner

## Research Assistantships

- Research assistantships are generally only recommended for PhD students whose research topic aligns well with a research project.
- In such cases, the PhD thesis could be an outcome of the research project or directly supported by a research project.
- Since, doing is PhD is a full time activity, a PhD student cannot be involved in research that is not part of the PhD study.
- In all cases, departmental approval will be needed for PhD students to engage in any research projects.

# Publications

## Policy on publications

- All students are actively encouraged in publishing their research
- PhD students will be expected to publish their papers in established conferences and journals in their respective fields.
- Annual  Science Workshop:
  - The University will run an annual science workshop
  - The workshop will be annual event to celebrate the achievements of its staff and students
  - All research students will be required to present their work in Annual Science workshop that showcases research to businesses, government and other academics

## Mentoring scheme and Annual Science Workshop

- All students submitting posters or papers to the annual science workshop will be assigned an academic mentor
- The mentor will assist the student in improving the quality of the submitted paper
- Annual classes on paper writing will be provided

# Networking

- The University recognises that modern research is very collaborative
- Collaboration is key for multidisciplinary and interdisciplinary research
- An open environment of idea sharing is essential to generate new research ideas
- Supervisors will be expected to link their students with collaborators both nationally and globally
- The University will conduct regular networking workshops on focussed interdisciplinary themes with the aim of generating grant applications or responding specific call for proposals

# Seminars and conference

## Seminars

- Students and faculty are expected to attend and present in seminars
- Each department will run a regular seminar series

## Conference

- All PhD students are expected to attend at least one conference to present their research during their PhD
- The University will need to provide funding pool for staff/student to present their work

## Summer School

- All PhD students are highly encouraged to attend summer/winter schools in their respective discipline as most of these are now available online
- The University will need to provide funding for students to attend such schools

# Nomination of External Examiner

## Procedure for nominating external examiner

- For research degrees, to maintain high research standards, it is critical to nominate external examiners that have substantial research experience and are leaders in their respective fields
- For this reason, the university will need to follow strict procedures for nominating external examiners
- Steps:
  - External examiners will be initially proposed by the Supervisor at least 3 months prior to thesis submission
  - Nominated external examiner will be vetted by a University Graduate Research Committee to ensure that the examiner meets the University requirements
  - The supervisor will contact the examiner to ensure that the examiner is willing to conduct the examination within a specified time limit
  - The University will contact the external examiner to initiate an external examiner form
  - Once the form is signed, the thesis will be sent to the external examiner

# Career paths and training

## Career path beyond a PhD

- The purpose of a PhD program is not just to complete a PhD thesis but also to produce an independent researcher with a diverse set of skills that include:
  - good communication
  - ability to mentor others
  - team working
  - paper writing
  - teaching and course design
  - networking with others in the field
  - leadership in research and teaching
  - organising and running seminars
  - organising and running workshops
  - working with companies
  - grant writing
- To achieve the above objectives the University must take a holistic approach and put together structures and targeted activities to enable this transition

# Career paths and training

## Career path beyond a PhD

- All PhD students will be expected and encouraged to:
  - do regular seminar presentations within their department, other departments and within the community
  - work as TAs
  - assist in course design
  - mentor other PhDs
  - openly communicate new ideas in seminars and group meetings
  - organise internal seminars
  - organise or assist in organising workshops
  - engage in industrial/commercial projects where appropriate
  - initiate grant writing in the final year of PhD
- It will be the responsibility of the supervisor to actively mentor, connect and enable the PhD student towards achieving the above.

# Your feedback is very welcome !