MADAN BHANDARI
UNIVERSITY OF
SCIENCE AND TECHNOLOGY

Chitlang, Thaha Municipality Ward 9, Bagmati Province, Nepal

Curriculum

Graduate Programs in

Artificial Intelligence

September 2024

1. Program Description

Artificial intelligence has become an important part of our society. It has created opportunities to transform existing structures and models in businesses, the public sector, and society. Machine learning, an important component for building AI applications, is gaining popularity in automated decision-making with the availability of large-scale data and affordable infrastructure. With these developments, skilled AI and ML engineers and data scientists are in high demand with a wide range of career opportunities everywhere. The program aims to give fundamental knowledge and practical skills needed to design, build, and apply AI systems in a chosen area of specialization.

Designing application that delivers an impact and contributes to sustainable development is an important aspect of the training. Students will undertake projects relevant to one or more Sustainable Development Goals (SDGs). Furthermore, these goals are introduced in the elective courses along with core courses where AI has had an impact.

This graduate program has been developed to fill the gap in the availability of skilled AI scientists and engineers in Nepal. The program will offer rigorous training in the foundations and application-oriented artificial intelligence. Graduates of this program will have explored a variety of domains such as agriculture, healthcare, industry automation and social media to contribute to economies and societies. They will be capable of undertaking careers in the industry as well as academia.

2. Learning outcomes and career opportunities

Students who complete the program will be able to demonstrate the ability to integrate AI in various social and organizational contexts. Furthermore, they can design and evaluate AI innovations. They will possess competence and skills to integrate knowledge, analyse complex situations with limited information, identify and creatively address critical issues, plan and execute advanced tasks within set time frames, evaluate their work, effectively communicate findings both nationally and internationally, and possess the skills needed for research, development, or qualified employment. Specific learning objectives of the program include:

- Understand the fundamentals of artificial intelligence, machine learning, natural language processing and computer vision
- Hands-on knowledge of the state-of-the-art tools for real-world problem solving
- Analyse and critically discuss ethical issues within AI and that arise from the application of AI
- Review and criticize scientific literature
- Account for the current situation and prospects of AI for some domains such as agriculture, healthcare, IoT, industrial automation and social media

The graduates will be equipped to take roles such as:

- AI scientists at technology companies working on cutting-edge technologies
- Analyst and scientist working in banking, finance, telecommunication, health, agriculture, and other sectors that require a systematic understanding of AI and the context
- Entrepreneurs of technology-based business start-ups

3. Eligibility and Selection Criteria

Student selection will be based on academic credentials, research statement, personal statement, referee's feedback, interview etc.

A. Master of Applied Sciences

- 4-year Bachelor's degree in science/engineering/technology fields from recognized universities with CGPA of 2.75 out of 4.0 (or international equivalent)
- Applicants with demonstrable good programming skills, a strong mathematical background, and knowledge of algorithms are preferable.
- List of publication if applicable.

B. PhD

- Master's in Engineering/Technology/Science fields from recognized universities with CGPA of 3.0 out of 4.0 (or international equivalent)
- Applicants with demonstrable good programming skills, a strong mathematical background, and knowledge of algorithms are preferable.
- List of publication if applicable.

4. Courses

A. Core courses

S. No.	Course code	Course title	Credit
1	AI-CR-501	Machine learning	3
2	AI-CR-502	Practical Data Science with Python	2
3	AI-CR-503	Project in People-Centred AI	2
4	AI-CR-504	Research methods for intelligent systems	1
5	AI-CR-550	Computer Vision	3
6	AI-CR-551	Natural Language Processing	3
7	AI-CR-601	Advanced Topics in Deep Learning	3
8	GC-CR-501	Development Policy	3

B. Non-Credit Compulsory Courses

S. No.	Course code	Course title	Credit
1	GC-NC-550	Entrepreneurship, Scientific Communication and Leadership (4 hours)	0
3	AI-NC-553	Case studies in ethics and fairness in AI (1 hour)	0

C. Technical Elective Courses

S. No.	Course Code	Course Title	Credit
1	AI-EL-561	Reinforcement Learning	2
2	AI-EL-562	Artificial Intelligence and Multi-Agent Systems	2
3	AI-EL-563	Graphical Models	2
4	AI-EL-564	AI for Agriculture	2
5	AI-EL-565	Data, Algorithm and Society	2
6	AI-EL-566	AI and Internet of Things	2
7	AI-EL-567	Applied Health Care and AI	2
8	AI-EL-568	Industrial AI and Automation	2
9	AI-EL-569	Social Media Analysis for Social Good	2
10	AI-EL-570	Signal processing for music information retrieval	2

5. Course Framework

A. Master of Applied Science in Artificial Intelligence
Duration of the course: 2 years

Semester I				Semester II		
Course Code	**Course Title**	**Credit**		**Course Code**	**Course Title**	**Credit**
AI-CR-501	Machine learning	3		AI-CR-550	Computer Vision	3
AI-CR-502	Practical Data Science with Python	2		AI-CR-551	Natural Language Processing	3
AI-CR-503	Project in People-Centred AI	2		AI-EL-561~570	Elective 1	2
AI-CR-504	Research Methods for intelligent Systems	1		GC-CR-501	Development Policy	3
GC-NC-550	Entrepreneurship, Scientific Communication and Leadership (4 hours)	0		AI-NC-553	Case Studies in Ethics and Fairness in AI (1 hour)	0
				AI-TH-699	Thesis	4
Semester III				**Semester IV**		
Course Code	**Course Title**	**Credit**		**Course Code**	**Course Title**	**Credit**
AI-CR-601	Advanced Topics in Deep Learning	3		AI-TH-699	Thesis	13
AI-TH-699	Thesis	13				

Total credit hours for thesis = 30; total credit hours for core and elective courses not less than 20.

B. PhD in Artificial Intelligence
Duration of the course: 3 years

Semester I				**Semester II**		
Course Code	**Course Title**	**Credit**		**Course Code**	**Course Title**	**Credit**
AI-CR-501	Machine learning	3		AI-CR-550	Computer Vision	3
AI-CR-502	Practical Data Science with Python	2		AI-CR-551	Natural Language Processing	3
AI-CR-503	Project in People-Centred AI	2		AI-EL-561~570	Elective 1	2
AI-CR-504	Research Methods for Intelligent Systems	1		GC-CR-501	Development Policy	3
GC-NC-550	Entrepreneurship, Scientific Communication and Leadership (4 hours)	0		AI-NC-553	Case Studies in Ethics and Fairness in AI (1 hour)	0
				AI-TH-699	Thesis	4
Semester III				**Semester IV**		
Course Code	**Course Title**	**Credit**		**Course Code**	**Course Title**	**Credit**
AI-CR-601	Advanced Topics in Deep Learning	3		AI-TH-699	Thesis	12
AI-EL-561~570	Elective II	2		AI-EL-561~570	Elective III	2
AI-TH-699	Thesis	12				

Semester V				Semester VI		
Course Code	**Course Title**	**Credit**		**Course Code**	**Course Title**	**Credit**
AI-TH-699	Thesis	11		AI-TH-699	Thesis	11
Total credit hours for thesis = 50; total credit hours for core and elective courses not less than 25.						

6. Timeline

Master of Applied Science in Artificial Intelligence

Semester I	Semester II	Semester III	Semester IV
• 4 Core Course • 1 Non-Credit Course • Group formation, project assignment and initiation of project	• 3 Core Course • 1 Non-Credit Course • 1 Technical Elective • Continuation and Submission of Group project • Thesis proposal submission and research initiation	• Thesis work • Thesis progress presentation	• Thesis work • Thesis defense

PhD in Artificial Intelligence

Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI
• 4 Core Course • 1 Non-Credit Course • Project assignment and initiation of project	• 3 Core Course • 1 Non-Credit Course • 1 Technical Elective • Continuation and submission of project • Thesis proposal submission and research initiation	• 1 Core Course • 1 Technical Elective • Thesis work • Thesis Progress Presentation	• 1 Technical Elective • Thesis work • Thesis Progress Presentation	• Thesis work • Thesis Progress Presentation	• Thesis work • Thesis Defense

6. Evaluation System (Grade Descriptors)

Numerical Score Band (%)	Letter Grade	Grade Point	Explanation
96 and above	A+	4.0	Outstanding
84 and below 96	A	3.6	Excellent
72 and below 84	B	2.8	Good
60 and below 72	C	2.0	Satisfactory
50 and below 60	D	0.0	Certificate of attendance
	F	0.0	Fail

7. Evaluation of Course Work

Item	Assignments (Five)	Mid-term examination	Final examinations	All
Weightage %	35	15	50	100

8. Course Descriptions

Course code	Course Title	Description
AI-CR-501	Machine Learning	Decision-making under uncertainty, optimization, generalization, probabilistic methods in machine learning, information theory in machine learning, neural networks, kernel methods, ensemble methods, deep learning.
AI-CR-502	Practical Data Science with Python	Handling data of different sizes and formats such as time series, spatial and text, implementation and use of computer architectures for large-scale data analysis, data structure and algorithms for efficient computation with large-scale data, visualization.
AI-CR-550	Computer vision	Principles of Computer Vision, filters, edge detection, SIFT, SURF, deep learning models for object detection, image segmentation and image/video classification
AI-CR-551	Natural Language Processing	Syntax and Semantics, entity recognition, relation extraction, word embeddings, dialogue systems, large language models
AI-CR-503	Project in People-Centered - AI	Software engineering perspective for AI/ML systems, agile methods, interaction with stakeholders, critical evaluation of solutions, communication with technical and non-technical audiences
AI-CR-601	Advanced Topics in Deep Learning	GANs, Graph convolutional networks, Graphical Neural Networks, generative and diffusion models for GNNs, score-based models
AI-TH-699	Thesis	Undertake research in AI or research on a real-world problem and deliver solutions with measurable impact