

NATIONAL BOARD FOR TECHNICAL EDUCATION

HIGHER NATIONAL DIPLOMA (HND)

ARTIFICIAL INTELLIGENCE (AI)

CURRICULUM AND COURSE SPECIFICATIONS

August, 2023

PLOT B, BIDA ROAD, P.M.B. 2239, KADUNA – NIGERIA

www.nbte.gov.ng

Foreword

The Higher National Diploma (HND) Artificial Intelligence Curriculum is designed to be used by training institutions to produce manpower to boost the practice of Artificial Intelligence in Nigeria.

Given that Artificial Intelligence is an emerging area in Nigeria, there is acute shortage of professionally-trained manpower in this sector. There is therefore the need to produce professional practitioners with good ethics and prospects for career progression, through the acquisition of desirable knowledge and skills. This necessitated the production of this National Curriculum.

It is my belief that this curriculum and course specifications, which is the minimum required to produce technologists with sound knowledge and skills in Artificial Intelligence, if properly implemented with the required resources along with qualified candidates being admitted into the programme, will lead to the production of competent and skilled technologists who will anchor the Design and Deployment of Artificial Intelligence Models for enhanced foreign exchange earnings.

I sincerely appreciate all those who made the development of this Curriculum possible. The invaluable contributions of all the members of the committee and resource persons during the pre-critique and National critique workshops are appreciated.

I hope that the Curriculum would be properly implemented so as to produce the required Work Force of our dream.

Prof. Idris M. Bugaje Executive Secretary, NBTE, Kaduna

TABLE OF CONTENTS

Contents

Foreword	2
TABLE OF CONTENTS	3
GENERAL INFORMATION	6
CURRICULUM TABLE	. 11
YEAR ONE SEMESTER ONE COURSES	. 15
COMPUTER ARCHITECTURE	. 16
Python Programming Language	. 25
Artificial Intelligence	. 40
Theories of Computation and Algorithm	. 46
Mathematics and Statistics for AI	. 62

Ethical and Professional Practice in Artificial Intelligence (AI)	70
YEAR ONE SEMESTER TWO COURSES	76
Machine Learning	
Computer Vision	86
Data Science for AI	95
AI Development Frameworks	105
Neural Computation and Bioinformatics	113
Natural Language Processing	119
Research Methodology in AI	127
YEAR TWO SEMESTER ONE COURSES	136
Deep Learning	137
Soft and Quantum Computing	145

AI Computing Solutions	151
AI Project Management	161
YEAR TWO SEMESTER TWO COURSES	171
Networks Security for AI	172
Robotics and Intelligent System	179
Web and Mobile Application Development	189
List of Tools/Equipment for HND Artificial Intelligence (AI) Laboratory	202
LIST OF PARTICIPANTS PRE-CRITIQUE WORKSHOP	205
LIST OF PARTICIPANTS FINAL CRITIOUE WORKSHOP	206

GENERAL INFORMATION

1.0 TITLE OF THE PROGRAMME:

Higher National Diploma Artificial Intelligence (AI)

2.0 **GOAL AND OBJECTIVES**:

2.1 **GOAL**: To enable students to create technology that allows computers and machines to work independently and intelligently.

2.2 **OBJECTIVES OF THE PROGRAMME**

A diplomate of HND Artificial Intelligence (AI) should be able to:

- i. Partake in AI project planning and solution design
- ii. Develop a system that process natural language
- iii. Develop algorithms for solving different problems
- iv. Innovate solutions to societal problems
- v. Apply AI techniques to solve complex problems across various industries
- vi. Implement algorithms that generate intelligent behavior on a Robot
- vii. Use appropriate methods to describe and analyse the performance of algorithms and system components
- viii. Create synergy between AI and Humans
- ix. Set up and manage a business.

3.0 **ENTRY REQUIREMENTS**

The general entry requirements for the HND Artificial Intelligence (AI) Programme are:

- (a) In addition to the entry requirement for National Diploma.
- (b) ND Computer Science or Nigerian Skills Qualification (NSQ) levels 3-5
- (C) One (1) year relevant industrial training

(d) ND diplomats with a pass (CGPA of 2.0-2.49) in the ND examination with two or more years of cognate experience in the specific field may be considered.

4.0 CURRICULLUM

- 4.1 The curriculum of the HND programme consists of four main components. These are:
 - I. General studies/education
 - II. Foundation courses
 - III. Professional courses
- 4.2 The General Education component shall include courses in

English Language

Communication

Mathematics

Citizenship (the Nigerian Constitution),

Entrepreneurship

- 4.3 The General Education component shall account for not more than 15% of total contact hours for the programme.
- 4.4 **Foundation Courses** include courses in Mathematics, and Statistics etc. The number of hours will vary with the programmes and may account for about 10 −15% of the total contact hours.
- 4.5 **Professional Courses** are courses, which give the student the theory and practical skills he needs to practice his field of calling at the technical/technologists level.

5.0 STRUCTURE OF PROGRAMME

This is a two-year Programme i.e. four semesters of classroom, laboratory, field and workshop activities in the institution. Each semester shall be of 17 weeks duration made up as follows: 15 Contact weeks of teaching, i.e. recitation, practical exercises, quiz, tests, etc and 2 weeks for examination and registration.

6.0 EVALUATION SCHEME

The HND AI Examination must be externally moderated. In grading the students, theory shall constitute 40% while practical and project are 60% respectively.

7.0 ACCREDITATION

Each Programme offered at the HND level shall be accredited by the NBTE before the Diplomates can be awarded the Higher National Diploma certificates. Details about the process of accrediting a Programme for the award of the HND are available from the Executive Secretary, National Board for Technical Education, Plot B, Bida Road, P.M.B. 2239, Kaduna, Nigeria.

8.0 CONDITIONS FOR THE AWARD OF HND ARTIFICIAL INTELLIGENCE (AI)

Institutions offering this Programme will award the HND certificate to candidates who successfully completed the Programme after passing prescribed course work, examinations, Project and must have been certified by ICT industrial organization as recognized by NBTE. Such candidates should have completed a minimum of 76 to 80 credit units.

A candidate with Recognition of Prior Learning (RPL) equivalent and NSQ can proceed to graduate upon achieving the required credit units specified above.

8.1 GRADING OF COURSES: Courses shall be graded as follows:

MARKED RANGE	LETTER GRADE	WEIGHTING
75% and above	A	4.00
70% – 74%	AB	3.50
65% – 69%	В	3.25
60% – 64%	BC	3.00
55% – 59%	С	2.75
50% – 54%	CD	2.50
45% – 49%	D	2.25
40% – 44%	Е	2.00

8.2 CLASSIFICATION OF DIPLOMAS: Higher National Diploma Certificates shall be awarded based on the following classifications:

Distinction - CGPA 3.50-4.00 Upper Credit - CGPA 3.00-3.49 Lower Credit - CGPA 2.50-2.99 Pass - CGPA 2.00-2.49

9.0 **OUALIFICATION OF TEACHERS:**

- 9.1 Holders of B.Sc/HND qualifications in Computer Science related disciplines.
- 9.2 In addition, teachers of this programme should have been trained and certified by recognized industrial bodies in AI or posseses higher degree or its equivalent in AI related discipline.

10.0 GUIDANCE NOTES FOR TEACHERS OF THE PROGRAMME

- 10.1 The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy on Education which stresses the need to introduce the semester credit units which will enable a student who so wish to transfer the units already completed in an institution of similar standard from which he is transferring.
- 10.2 As the success of the credit unit system depends on the articulation of programmes between the institutions and industry, the curriculum content has been written in behavioral objectives, so that it is clear to all the expected performance of the student who successfully completed some of the courses or the diplomats of the programme. There is a slight departure in the presentation of the performance-based curriculum which requires the conditions under which the performance is expected to be carried out and the criteria for the acceptable levels of performance. It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance.
- 10.3 The Academic Board of the institution may vet departmental submission on the final curriculum. Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the Technical and Vocational Education (TVE) system. The teaching of the theory and practical work should, as much as possible, be

integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory to practical in the ratio of 30:70.

11.0 Mandatory Skills Qualification

CURRICULUM TABLE YEAR I SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	P	CU	СН
1	AIT 311	Computer Architecture	2	2	3	4
2	AIT 312	Python Programming Language	2	4	4	6
3	AIT 313	Artificial Intelligence	2	2	3	4
4	AIT 314	Theories of Computation and Algorithm	2	2	3	4
5	AIT 315	Mathematics and Statistics for AI	2	2	3	4
6	AIT 316	Ethical and Professional Practice in AI	2	0	2	2
7	GNS 301	Use of English III	2	0	2	2
	Total	1	14	12	20	26

YEAR I SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	P	CU	СН
1	AIT 321	Machine Learning	2	2	3	4
2	AIT 322	Computer Vision	2	2	3	4
3	AIT 323	Data Science for AI	2	2	3	4
4	AIT 324	AI Development Framework	2	2	4	4
5	AIT 325	Neural Computation and Bioinformatics	2	2	3	4
6	AIT 326	Natural Language Processing	2	2	3	4
7	AIT 327	Research Methodology in Artificial Intelligence	2	2	2	4
8	AIT 328	Mandatory Skills Qualification I	0	4	4	4
9	ENT 326	Practice of Entrepreneurship I	2	2	2	4
10	GNS 302	Communication in English III	2	0	2	2
	Total	ı	18	20	29	38

YEAR II SEMESTER I

S/N	COURSE CODE	COURSE TITLE	L	P	CU	СН
1	AIT 411	Seminar	2	0	2	2
2	AIT 412	Deep Learning	2	4	3	6
3	AIT 413	Soft and Quantum computing	2	2	3	4
4	AIT 414	AI Computing Solutions	2	4	4	6
5	AIT 415	AI Project Management	2	2	2	4
6	AIT 416	Mandatory Skills Qualification II	-	4	4	4
7	ENT 416	Practice of Entrepreneurship II	2	2	4	4
8	GNS 401	Communication in English IV	2	0	2	2
	Total	1	14	18	24	32

YEAR II SEMESTER II

S/N	COURSE CODE	COURSE TITLE	L	P	CU	СН
1	AIT 421	Networks Security for AI	2	2	2	4
2	AIT 422	Robotics and Intelligent Systems	2	2	3	4
3	AIT 423	Web and Mobile Application Development	2	2	2	4
4	AIT 424	Project	-	6	6	6
	Total		6	12	13	18

YEAR ONE SEMESTER ONE COURSES

COMPUTER ARCHITECTURE

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE						
COURSE TITLE Computer Architecture	COURSE CODE: AIT 311	Contact Hours: 4 Hours/ Week				
CREDIT UNITS: 3	PRE- REQUISITE: Nil	Theoretical: 2 Hours/Week				
SEMESTER: ONE	YEAR: ONE	Practical: 2 Hours/Week				

GOAL: This course is designed to enable students to acquire basic knowledge of Computer Organization

General Objectives: On completion of the course, the student should be able to:

- 1.0 Understand Basic Computer Architecture Concepts
- 2.0 Comprehend Processor Performance
- 3.0 Design Digital Logic and Micro-architectural Level Components
- 4.0 Understand Different Types of Memory and Storage
- 5.0 Comprehend Instruction Level Parallelism
- 6.0 Understand Multiprocessors and Thread-Level Parallelism
- 7.0 Apply Knowledge to Real-world Situations

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE					
COURSE: COMPUTER ARCHITECTURE COURSE CODE: AIT 311 Contact Hours: 4 Hours/ Week					
CREDIT UNITS: 3	PRE- REQUISITE: Nil	Theoretical: 2 Hours/Week			
		Practical: 2 Hours/Week			

GOAL: This course is designed to provide the student with a thorough understanding of the key concepts and principles of computer architecture

COURSE SPECIFICATION: Theoretical Contents: General Objective: 1.0 Understand Basic Computer Architecture Concepts						
WEEK	Specific Learning Outcomes	Teachers Activities	Learning Resources	Specific Learning Outcomes	Teachers Activities	Evaluation
1-2	1.1 Explain the basic structure of a computer and its components 1.2 Explain how data flows within a computer system	Explain the basic structure of a computer and its components including the CPU, memory, and I/O devices. Explain how data flows within a computer system, including the	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts etc.	Disassemble and reassemble a computer system	Guide students to disassemble and reassemble a computer system to understand its components.	Explain the basic structure of a computer and its components including the CPU, memory, and I/O devices
	1.3 Describe the functions of the main components of a computer system	concept of a bus, memory hierarchy, and I/O communication. Describe the role and functioning of the control unit, arithmetic		Trace the data flow within a computer system	Guide students to trace the data flow within a computer system during a specific	

	1.4 Explain the basic concepts related to Instruction Set Architecture 1.5 Explain the principle of instruction pipelining and its impact on CPU performance.	logic unit, and registers within the CPU. Explain the basic concepts related to Instruction Set Architecture, including instruction types, formats, and addressing modes. Discuss the principle of instruction pipelining and its impact on CPU performance.		Write and execute a simple program to understand instruction types and formats.	operation or process. Guide students to write and execute simple programs to understand instruction types and formats.	
3-4	2.1 Explain the metrics used in measuring processor performance. 2.2 Explain the factors affecting processor performance	Explain the metrics used in measuring processor performance such as speed, power, and throughput. Explain the factors affecting processor performance such as architecture design, clock speed, instruction set complexity, and parallel processing capabilities.	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts etc.	Measure the speed, power, and throughput of a processor. Run a processor benchmark on a computer system and interpret the results.	Guide students to measure the speed, power, and throughput of a processor. Guide students to run a processor benchmark on a computer	Explain the metrics used in measuring processor performance such as speed, power, and throughput. Explain the factors affecting processor performance

	 2.3 Explain the concept of processor benchmarking and the use of benchmarking software. 2.4 Explain the effects of cache memory and virtual memory on processor performance. 2.5 Explain current 	Discuss the concept of processor benchmarking and the use of benchmarking software. Describe the effects of cache memory and virtual memory on processor performance. Discuss current trends and future directions in		Monitor and analyze the effects of cache memory and virtual memory on processor performance.	system and interpreting the results. Guide students to monitor and analyze the effects of cache memory and virtual memory on processor performance.	such as architecture design, clock speed, instruction set complexity, and parallel processing capabilities. Explain the concept of
	trends and future directions in processor performance and	and future directions in processor performance and technology.			performance.	processor benchmarking and the use of benchmarking
	technology.	 esign Digital Logic and Mi	cro architectural I ex	el Components		software.
5-6	3.1 Explain the concept	Discuss the concepts of	Marker board,	Design and test	Guide	Explain the
	of digital logic	digital logic design including Boolean algebra, gates, and combinational circuits.	Markers, Documentary films, Multimedia Projector and Screen, Case	simple sequential circuits.	students to design and test simple sequential circuits.	concepts of digital logic design including Boolean algebra, gates,
	3.2 Explain the design of sequential circuits	Describe the design of sequential circuits	studies, Power point slides, Internet, Textbooks,	Design a simple digital system	Guide students to	and combinational circuits.

		including flip-flops,	Computer, Flip	using schematic	design a	
	3.3 Explain simple	counters, and registers.	charts etc.	diagrams or	simple digital	Explain simple
	digital systems using			hardware	system using	digital systems
	schematic diagrams	Discuss simple digital		description	schematic	using schematic
	and/or hardware	systems using schematic		languages	diagrams or	diagrams
	description	diagrams and/or			hardware	and/or
	languages.	hardware description			description	hardware
	ininguages.	languages.			languages.	description
	3.4 Explain the	ininguages.			iangaages.	languages
	fundamentals of	Discuss the				
	micro-architecture	fundamentals of micro-			Guide	
	unit	architecture including			students	
		datapath and control unit		Design simple	design and	
		design.		micro-	simulate	
	3.5 Explain the	8		architectural	simple micro-	
	considerations and	Discuss the		component.	architectural	
	constraints in digital	considerations and		1	component.	
	system design	constraints in digital			1	
		system design such as				
		speed, power, cost, and				
		complexity.				
	General Objectives: 4.0 U	Inderstand Different Types	of Memory and Stor	age		
7-9	4.1 Explain the hierarchy	Discuss the hierarchy	Marker board,	Use simulation	Guide	Explain how
	of different types of	and characteristics of	Markers,	software to	students to	data is stored
	memory and storage	different types of	Documentary films	visualize how	use simulation	and retrieved in
	devices	memory and storage	Multimedia	data is stored and	software to	different
		devices (RAM, ROM,	Projector and	retrieved in	visualize how	memory types.
		Hard disk, SSD, Cache	Screen, Case studie	different	data is stored	
		etc.).	Power point slides,	memory types.	and retrieved	
			Internet, Textbooks		in different	

	4.2 Explain the	Discuss how data is	Computer, Flip		memory	
	characteristics of	stored and retrieved in	charts etc.		types.	
	different types of	different memory types.				
	memory and storage			Use a computer	Guide	
	devices			system to explore	students to	
				the use of virtual	use a	
	4.3 Explain how data is	Discuss performance		memory.	computer	
	stored and retrieved	differences among			system to	
	in different memory	various types of memory			explore the	
	types.	and storage devices.			use of virtual	
					memory.	
				Use operating		
	4.4 Explain the	Discuss the use of		system	Guide	
	performance	virtual memory in		simulation	students to	
	differences among	computer systems.		software to	use operating	
	various types of			explore memory	system	
	memory and storage	Discuss the concept of		management.	simulation	
	devices.	memory management in			software to	
		operating systems.			explore	
	4.5 Explain the use of				memory	
	virtual memory in				management.	
	computer systems.					
	4.6 Explain the concept					
	of memory					
	management in					
	operating systems.					
		omprehend Instruction Leve		T		T
10-11	5.1 Explain the concept	Explain the concept of	Marker board,	Use different	Guide	Explain the
	of Instruction Level	Instruction Level	Markers,	techniques to	students to	impact of ILP

	Parallelism (ILP) and its importance in increasing computing performance. 5.2 Explain hardware and software techniques used to increase ILP. 5.3 Explain the impact of ILP on pipeline performance. 5.4 Explain the concepts of out-of-order execution and speculative execution in the context of ILP. 5.5 Explain the implications of dependencies between instructions	Parallelism (ILP) and its importance in increasing computing performance. Discuss the hardware and software techniques used to increase ILP. Discuss the impact of ILP on pipeline performance. Describe the concepts of out-of-order execution and speculative execution in the context of ILP.	Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts etc.	increase ILP using simulation software. Use simulation software to explore the concepts of out-of-order execution and speculative execution	use different techniques to increase ILP using simulation software. Assist students to use simulation software to explore the concepts of out-of-order execution and speculative execution.	on pipeline performance. Describe the concepts of out-of-order execution and speculative execution in the context of ILP.
	in the context of ILP.	Discuss the implications of dependencies between instructions in the context of ILP.				
General	Objective 6.0: Understand	Multiprocessors and Thread				
12-13	6.1 Explain the basic concepts of multiprocessors and thread-level parallelism.	Discuss the basic concepts of multiprocessors and thread-level parallelism.	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides,	Use different architectures of multiprocessor systems, such as symmetric multiprocessing	Assist students to use different architectures of multiprocesso	Explain the basic concepts of multiprocessors and thread-level parallelism.

	6.2 Explain the different architectures of multiprocessor systems 6.3 Explain the importance of cache coherence and memory consistency in multiprocessor systems. 6.4 Explain the role of parallel programming, and how to exploit threadlevel parallelism. 6.5 Explain the performance implications and scalability of multiprocessor	Discuss the different architectures of multiprocessor systems, such as symmetric multiprocessing (SMP) and massively parallel processing (MPP). Discuss the importance of cache coherence and memory consistency in multiprocessor systems. Explain the role of parallel programming, and how to exploit thread-level parallelism. Discuss the performance implications and scalability of	Internet, Textbooks, Computer, Flip charts etc.	(SMP) and massively parallel processing (MPP). Carry out parallel programming, and exploit thread-level parallelism.	r systems, such as symmetric multiprocessi ng (SMP) and massively parallel processing (MPP). Guide students to carry out parallel programming, and exploit thread-level parallelism.	Discuss the different architectures of multiprocessor systems, such as symmetric multiprocessing (SMP) and massively parallel processing (MPP). Explain the performance implications and scalability of multiprocessor systems.
	systems.	scalability of				
Genera	 l Objective 7.0 Apply Know	multiprocessor systems.	ions.			
14-15	7.1 Explain the requirements of a given use case or application. 7.2 Explain principles and theories in the design of computer systems to	Discuss the requirements of a given use case or application. Discuss principles and theories in the design of computer systems to	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case	Design computer systems using appropriate software tools based on specific use cases.	Guide students to design computer systems using appropriate software tools	Explain principles and theories in the design of computer systems to meet

meet the specified	meet the specified	studies, Power		based on	the specified
requirements. 7.3 Explain computer system performance, scalability, cost, and power consumption.	requirements. Discuss computer system performance, scalability, cost, and power consumption.	point slides, Internet, Textbooks, Computer, Flip charts etc.	Validate a designed system using appropriate techniques	specific use cases. Assist students to validate their system designs using specific techniques and tools.	requirements.

Python Programming Language

rython Frogramming Language							
PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
COURSE TITLE: Python Programming	Course Code: AIT 312	Contact Hours: 6 Hours/ Week					
Language							
CREDIT UNIT: 4	PRE-REQUISITE: Nil	Theoretical: 2 Hours/Week					
SEMESTER: ONE	YEAR: ONE	Practical: 4 Hours/Week					
GOAL: This course is designed to provide	students with the knowledge and	skills of Python programming for Artificial					
Intelligence							
General Objectives: On completion of th	e course, the student should be abl	e to:					
l	1.0 Understand Python Fundamentals						
2.0 Understand Data Manipulation and An	alysis						
3.0 Comprehend A.I. Algorithms Implementation							

- 3.0 Comprehend AI Algorithms Implementation
- 4.0 Understand Python Object Oriented Programming (OOP)
- 5.0 Understand Python Data Visualization for AI
- 6.0 Apply real world AI Development Projects

PROGR	PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE								
	E: Python Programming Lar		COURSE COD				Contact Hours: 6 Hours/ Week		
CREDIT	TUNITS: 4		PRE- REQUISI	TE: N	il	7	Theoretical:	2 Hours/Week	
						I	Practical: 4 I	Hours/Week	
	This course is designed to p			wledge				ng for Artificial Inte	lligence
COURS	E SPECIFICATION: Theo				Practical Co	ontents	s:		
	General Objective: 1.0 U	Inderstand	Python fundamen						
WEEK	Specific Learning	Teachers	s Activities	Lear	ning Resource	_	1	Teachers Activitie	Evaluation
	Outcomes					Outco	omes		
1-3	1.1 Explain the main features of Python. 1.2 Explain Python Data Structures 1.3 Explain control structures such as conditional statements(if-else) and loops (for, while) 1.4 Explain the	features Explain	Data Structures les types ttors control s:	proje Pyth	imedia ector. on preter te	on a syste	e a simple	Assist student to install Python on a computer system Guide students to write a simple python program Assist students to organize code	Explain the importance of organizing code and promoting reusability
	importance of organizing code and promoting reusability 1.5 Explain the concept of Object-Oriented Programming (OOP)	- Logica Discuss Object- Progran Explain	the concept of Oriented nming (OOP) the relevance of programming to			code organ to aid Analy	onstrate iization and reusability yse and g common	to aid reusability Guide students to analyse and debug common errors in Python codes	

xplain Data
re-
rocessing
υ
I
re

2.5 Explain correlation and its implications in data analysis 2.6 Explain Data manipulation techniques 2.7 Explain methods of data analysis	SortingGrouping operations	Create data visualizations, including histograms, scatter plots, and bar charts.	and standardization Guide students to create data visualizations, including histograms, scatter plots, and bar charts.	
2.8 Explain how to Interpret and communicate results		Interpret visualizations to draw meaningful conclusions from data.	Guide students to interpret visualizations to draw meaningful conclusions from data.	
		Calculate Measures of central tendency Interpret Measures of central tendency	Guide students to calculate and interpret measures of central tendency such as mean, median and mode	
		Apply filtering, sorting, and grouping	Guide students to apply data manipulation techniques	

_	,				
			operations on		
			data.		
			Use functions	Guide students	
			for data	to use functions	
			aggregation,		
			merging, and	for data	
				aggregation,	
			reshaping.	merging, and	
			D 0 1	reshaping.	
			Perform data		
			slicing and	Guide students	
			indexing to	to perform data	
			extract relevant	slicing and	
			information	indexing to	
				extract relevant	
			Perform	information	
			hypothesis		
			testing to draw	Guide students	
			inferences about	to perform	
			data	hypothesis	
				testing to draw	
			populations.	inferences about	
			. 1		
			Apply .	data	
			regression	populations.	
			analysis to		
			explore	Guide students	
			relationships	to apply	
			between	regression	
			variables	analysis to	
				explore	
				relationships	
				between	
				variables	
				variaules	

				Use popular data analysis tools like Python's Pandas, R, or SQL. Utilize libraries for data manipulation, such as NumPy, Pandas, or dplyr.	Guide students to use popular data analysis tools like Python's Pandas, R, or SQL. Guide students to utilize libraries for data manipulation, such as NumPy, Pandas, or dplyr	
6-7	3.1 Define fundamental concepts in artificial intelligence 3.2 Differentiate between supervised, unsupervised, and reinforcement learning approaches 3.3 Explain linear regression 3.4 Explain decision trees 3.5 Explain support vector machines.	omprehend AI Algorithms In Discuss the fundamental concepts in artificial intelligence: - machine learning - deep learning - neural networks.	PC and a multimedia projector. Python Interpreter White board.	Use reinforcement learning algorithms, such as Q- learning. Apply techniques like cross-validation to estimate model generalization. Interpret the predictions and decisions made by AI models.	Guide students to use reinforcement learning algorithms Guide students to apply techniques like cross-validation to estimate model generalization. Guide students to interpret the predictions and	Explain support vector machines.

	3.6 Explain the working principles of basic neural network architectures, including feedforward neural networks and convolutional neural networks (CNNs). 3.7 Explain backpropagation for training neural networks. 3.8 Explain reinforcement learning and its applications in different domains.	Inderstand Python Object O	riented Programming	Analyze model outputs to identify strengths, limitations, and potential biases Apply AI algorithms to solve real-world problems in diverse domains. Adapt and modify AI models to fit specific application requirements.	decisions made by AI models. Guide students to analyze model outputs to identify strengths, limitations, and potential biases Guide students to apply AI algorithms to solve real-world problems in diverse domains. Guide students to adapt and modify AI models to fit specific application requirements.	
0.10		Jnderstand Python Object On		_ ` /		E 1 '
8-10	4.1 Define the principles of Object-Oriented Programming	Discuss the principles of Object-Oriented Programming, including classes, objects,	PC and a multimedia projector. Python Interpreter	Create classes and objects	Guide students to create classes and objects	Explain Functions and function parameters.

4.2 Explain the benefits	inheritance, and	White	Use access	Guide students
and importance of using	polymorphism.	board.	modifiers	to use access
OOP in Python.		Jupyter notebook	(public, private,	modifiers
4.2 Explain data encapsulation	Discuss special methods (also known as dunder methods) like init, str,	Visual Studio code Anaconda Google colab	protected) to control access to class members.	(public, private, protected) to control access to class
4.2 Evaloin Inhanitanaa	repr, etc.			members.
4.3 Explain Inheritance. 4.4 Explain Abstraction	Explain how to customize the behavior		Encapsulate	Guide students
4.5 Explain special methods	of classes for specific operations, such as addition or comparison.		data and behavior within classes to	to encapsulate data and behavior within classes to
4.6 Customize the behavior of classes for specific operations	Explain design patterns like Singleton, Factory, and Observer.		enhance data integrity and security.	enhance data integrity and security.
 4.7 Explain Exception Handling in OOP 4.8 Explain design patterns 4.9 Explain organize 			Create class hierarchies and establish parent-child relationships using inheritance.	Guide students to create class hierarchies and establish parent-child relationships using inheritance.
code using OOP:			Use method overriding and method overloading to	Guide students to use method overriding and method overloading to

, , , , , , , , , , , , , , , , , , , ,		
	create versatile create vers	
	class behaviors. class behav	viors.
	Apply abstract classes and Guide stud	
	interfaces to to apply ab	
	define blueprints interfaces to define blue	0 prints
	for related define blue for related classes	prints
	Implement Guide stud	
	lo impieme	
	angura abstract me	ethods
	to ensure	
	la di avian Consistent	
	behavior	
	Use exception Guide stud	ents
	handling to use exce	ption
	techniques to handling	
	manage errors techniques	to
	in object- manage er	ors in
	oriented code. object-orie	nted
	code.	
	Raise and catch Guide stud	ents
	exceptions to to raise and	1
	handle catch exce	
	unexpected to handle	
	situations	

				Implement design patterns to solve specific programming challenges	unexpected situations Guide students to Implement design patterns to solve specific programming challenges	
				Design modular and maintainable code structures using OOP principles.	Guide students to design modular and maintainable code structures using OOP principles.	
				Apply OOP concepts to build larger applications with clear separation of concerns	Guide students to apply OOP concepts to build larger applications with clear separation of concerns	
	General Objective: 5.0: U	Inderstand Python Data Visu	alization for AI			
11-13	5.1 Explain the importance of data	Discuss the importance of data visualization in AI and data analysis.	PC and a multimedia projector.	Create basic visualizations like line plots, scatter plots, and	Guide students to create basic visualizations like line plots,	List different type of

visualization in AI and data analysis.		Python Interpreter	bar charts using Matplotlib.	scatter plots, and bar charts using	Instruction set
	Discuss the principles of	White		Matplotlib.	SCI
5.2 Explain the principles of effective data visualization. 5.3 Explain 3D Data Visualization: 5.4 Explain how to use	effective data visualization, including choosing appropriate chart types and colors.	board.	Customize plot aesthetics, labels, and annotations for better data representation	Guide students to customize plot aesthetics, labels, and annotations for better data representation	Enumerate the merits and demerits of charts and diagram
3D plots to convey complex data patterns 5.5 Explain how to visualize machine Learning model performance:			Use Seaborn library to generate statistical visualizations like distribution plots, box plots, and violin plots.	Guide students to use Seaborn library to generate statistical visualizations like distribution plots, box plots, and violin plots.	
			Apply faceting and grouping techniques to analyze data patterns efficiently	Guide students to apply faceting and grouping techniques to analyze data patterns	
			Create 3D visualizations of data using libraries like	Guide students to create 3D visualizations of data using	

General	Objective 6.0: Apply real wo	orld AI Development Project		Matplotlib or Plotly. Compare and visualize model results to make informed decisions during model selection.	libraries like Matplotlib or Plotly. Guide students to compare and visualize model results to make informed decisions during model selection.	
14-15	6.1 Explain AI project requirements 6.2 Explain Data Acquisition and Preprocessing 6.3 Explain suitable machine learning or deep learning algorithms based on the project's problem domain and data characteristics. 6.4 Explain the strengths and weaknesses of different AI models for specific tasks. 6.5 Explain how to optimize AI models by tuning hyperparameters	Explain AI project requirements Explain Data Acquisition and Preprocessing Explain suitable machine learning or deep learning algorithms based on the project's problem domain and data characteristics. Explain the strengths and weaknesses of different AI models for specific tasks. Explain how to optimize AI models by tuning hyperparameters	PC and a multimedia projector. Python Interpreter White board.	Collect and preprocess data from various sources to prepare it for AI modeling. Handle data cleaning, missing values, and data transformations as needed for the project.	Guide students to collect and preprocess data from various sources to prepare it for AI modeling. Guide students to handle data cleaning, missing values, and data transformations as needed for the project.	Differentiate between Synchronous and Asynchronou s Buses Explain different Bus Arbitrations

6. en in accordance of an accordance of accordance	5.6 Explain Ensemble nethods 5.7 Explain how ensembles can help improve predictive accuracy and reduce overfitting. 5.8 Describe considerations for calability, performance, and security 5.9 Explain how to nonitor and maintain AI systems	Explain ensemble methods like bagging, boosting, or stacking Explain how ensembles can help improve predictive accuracy and reduce overfitting. Explain considerations for scalability, performance, and security Explain how to monitor and maintain AI systems	Evaluate model performance using appropriate metrics to ensure effectiveness Optimize AI models by tuning hyperparameters to achieve better performance. Use techniques like grid search or random search to find optimal parameter values.	Guide students to evaluate model performance using appropriate metrics to ensure effectiveness Guide students to optimize AI models by tuning hyperparameters to achieve better performance Guide students to use techniques like grid search or random search to find optimal parameter values.	
			Apply ensemble methods like bagging, boosting, or stacking	Guide students to apply ensemble methods like bagging,	

	Interpret model predictions and analyze the factors contributing to AI model decisions.	boosting, or stacking Guide students to interpret model predictions and analyze the factors contributing to AI model decisions.	
	Use techniques like feature importance and model interpretation methods to gain insights. Implement monitoring solutions to track AI model performance in real-time.	Guide students to use techniques like feature importance and model interpretation methods to gain insights. Guide students to implement monitoring solutions to track AI model performance in real-time.	

		Create a	Guide students	
		maintenance	to create a	
		plan to address	maintenance	
		issues and	plan to address	
		ensure model	issues and	
		performance	ensure model	
		over time	performance	
			over time	

Artificial Intelligence

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
COURSE TITLE: Artificial Intelligence	Course Code: AIT 313	Contact Hours: 4 Hours/ Week					
CREDIT UNITS: 3	Pre-requisite:	Theoretical: 2 Hours/Week					
SEMESTER: TWO	YEAR: ONE	Practical: 2 Hours/Week					
GOAL: This course is designed to provide	e students with a comprehensive u	inderstanding of AI its theoretical foundations,					
practical applications, and implications							
General Objectives: On completion of the	e course, the student should be ab	le to:					
1.0 Understand the foundational prin	ciples and concepts of AI.						
2.0 Comprehend AI Algorithms and	Techniques.						
3.0 Explore the fundamentals of mac	hine learning						
4.0 Understand forms of learning							
5.0 Comprehend Machine Learning A	Algorithms						
6.0 Understand the Different Artificia	al Intelligent Agents						

7.0 Understand concept of Deep Learning

PROGR	AMME: HIGHER NATIO	NAL DIF	PLOMA ARTIFI	CIAL I	NTELLIGEN	CE			
COURS	E: Artificial Intelligence		COURSE COD	E: AIT	313		Contact Ho	urs: 4 Hours/ We	eek
CREDIT	Γ UNITS: 3		PRE- REQUIS	ITE: N	il		Theoretical:	2 Hours/Week	
	Practical: 2 Hours/Week								
GOAL:	This course is designed to p	rovide stu	dents with a comp	rehensi	ve understandi	ng c	of AI its theore	etical foundation	s, practical
	ons, and implications								
COURS	E SPECIFICATION: The	oretical C	ontents:		Practical Cor	nten	its:		
	General Objective 1.0: U	Inderstan	d the Fundamen	tal Cor	cept and Prin	cipl	es of AI	_	
WEEK	Specific Learning	Teacher	s Activities	Leari	ning	Sp	ecific	Teachers	Evaluation
	Outcomes			Resou	ırces		earning utcomes	Activities	
1-2	1.1 Explain the concept of AI 1.2 Explain the principles of AI 1.3 Explain the history of AI 1.4 Explain the subfields of AI	concept of Print Con - AI	the fundamental of AI: nciples & ncept of AI History & finitions of AI	multin Project MAT SPSS	etor LAB, WEKA,				Explain the AI Origin, a Techniques, and subfields of AI
_	General Objective 2.0: (Comprehe	nd AI Algorithms	and Tec	hniques.				
3-4	2.1 Explain formal language 2.2 Explain informal language 2.3 Explain AI Algorithms	- Pati - Sea - Kno repr - Kno	AI Algorithms tern recognition rch algorithms owledge resentation, owledge soning,	mult Proje MAT SPSS	te Board. imedia ector LAB, WEKA,	in to an vi	se iteractive iteractive ools or nimations to isually emonstrate ow AI	Assist students to implement basic AI algorithms, such as search	Explain how to solve simple AI problem

		- Knowledge planning		algorithms work.	algorithms (e.g., BFS, DFS), sorting algorithms, or simple machine learning algorithms (e.g., k- nearest neighbors)	
5-6	3.1 Explain the concept of machine learning 3.2 Explain the types of machine learning 3.3 Explain the differences between the types of machine learning	Discuss machine learning and its types: - Supervised - Semi- Supervised - Unsupervised Distinguish between supervised, semisupervised and unsupervised	Google Colab, Kaggle Kernels, or DataCamp. Scikit-learn, TensorFlow, and PyTorch	Use supervised, unsupervised, and reinforcement learning algorithms using popular libraries Apply machine learning techniques to analyze realworld datasets, make predictions, or perform clustering.	Guide students to use supervised, unsupervised and reinforcement learning algorithms using popular libraries Assist students to apply machine learning techniques in analyzing real-world datasets, make	Demonstrate how to determine specifications and create SRS documents?

					predictions, or perform clustering.	
	•	Inderstand Forms of Learning	Ÿ	1	T	
7	 4.1 Define Learning 4.2 Explain Forms of Learning 4.3 Explain the key characteristics and principles underlying different forms of learning 	Discuss forms of learning: - (Decision Trees and the ID3 - Algorithm, - Statistical learning Discuss the key characteristics and principles underlying different forms of learning	White board, multi-media devices, WEKA, TANAGRA, 11ANTS, PROLOG, LISP, Etc.			Discuss learning and learning characteristics
	<u> </u>	omprehend Machine Learning	 			
8-10	5.1 Explain how to select appropriate machine learning algorithms 5.2 Explain different types of data characteristics 5.3 Explain the various types of machine learning algorithms	Discuss different machine learning algorithms, discussing their working principles, strengths, and weaknesses. Discuss the suitability machine learning algorithms for different types of data and tasks Explain the various types of machine	Devices, Kaggle Datasets and Notebooks, Machine Learning Projects Scikit-learn or TensorFlow	Carry out Machine learning projects	Guide students to carry out machine learning projects where they must choose appropriate algorithms, preprocess data, and evaluate model	Explain different types of data characteristics
	5.4 Explain the strengths and	types of machine learning algorithms			model performance	

Gene 11-13	weaknesses of different machine learning algorithms ral Objective 6.0: Understa 6.1 Explain different types AI Agents. 6.2 Explain the structure of Intelligence agents. 6.3 Explain agent environment. 6.2 Explain Test Phases	- Classification - Regression, - Clustering Explain the strengths and weaknesses of different machine learning algorithms and the Different Artificial Intelligence agents, their characteristics, and how they interact with the environment. Explain Test Phases: - Unit testing - Integration testing, - System testing, etc.	ntelligence Agents Devices, Kaggle Datasets and Notebooks, Machine Learning Projects Scikit-learn or TensorFlow	Simulate: - Agent - Agent Implementati on Projects - Agent Interactions Agent Behaviour Analysis	Guide students to draw up testing schedule and perform the testing accordingly	Evaluate students' AI agent projects based on their design, functionality, and performance in solving the designated problem
General	Objective 7.0 Understand	concept of Deep Learning		L	<u>l</u>	<u>l</u>
14-15	7.1 Explain deep learning concept and architectures. 7.2 Explain the historical development and evolution of deep learning and its	Discuss concepts of deep learning, neural networks, and various architectures Explain the historical development and evolution of deep learning and its	Deep Learning Libraries Documentation Such as; TensorFlow and /or PyTorch	Design Deep learning projects	Assign practical projects where students develop deep learning models to	Evaluate students' AI agent projects based on their design, functionality, and performance in

of a 7.3 fun blo net lay act	gnificance in the field Cartificial intelligence 3 Explain the ndamental building ocks of deep neural etworks, such as input yers, hidden layers, etivation functions, and atput layers	significance in the field of artificial intelligence Explain the fundamental building blocks of deep neural networks, - Input layers, - Hidden layers, - Activation functions - Output layers	Carry out Model Tuning and Optimization.	solve image recognition and natural language processing tasks. Challenge students to optimize model hyperparamet ers and improve model	solving the designated problem
				improve	

Theories of Computation and Algorithm

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
COURSE TITLE: Theories of Computation and Algorithm	Course Code: AIT 314	Contact Hours: 4 Hours/ Week					
CREDIT UNIT: 3	PRE-REQUISITE:	Theoretical: 2 Hours/Week					
SEMESTER: ONE	YEAR: ONE	Practical: 2 Hours/Week					

GOAL: This course is designed to acquaint students with knowledge and skills in Theories of Computation and Algorithm

General Objectives: On completion of the course, the student should be able to:

- 1.0 Understand mathematical models of computations
- 2.0 Understand automata theory, formal language theory, computability theory and complexity theory
- 3.0 Understand the connection between finite automata and regular language
- 4.0 Comprehend non-computability and undecidability issues
- 5.0 Understanding Fundamental Concepts of Algorithms Data Structures and Sorting Algorithms
- 6.0 Comprehend Algorithm Analysis and Complexity, Sorting, and Searching
- 7.0 Comprehend Symbol Tables and Search Trees, Graph Algorithms, Maximum Flow, Minimum Cut, and Tries
- 8.0 Comprehend Performing Substring Search, Regular Expression, and Data Compression

PROGR	AMME: HIGHER NATIO	NAL DIPLOMA ART	TIFICIAL INTELLIC	GENCE		
COURS	E: Theories of Computation	and COURSE (CODE: AIT 314	Contact Hou	urs: 4 Hours/ We	ek
Algorith						
CREDIT	ΓUNITS: 3	PRE- REQ	UISITE: Nil	Theoretical:	2 Hours/Week	
				Practical: 2	Hours/Week	
GOAL:	This course is designed to ac	equaint students with th	e knowledge of compu	itational theory an	d Algorithm	
COURS	E SPECIFICATION: Theo	oretical Contents:	Practical Contents:			
General	Objective: 1.0 Understand	mathematical models of	of computations			
WEEK	Specific Learning	Teachers Activities	Learning	Specific	Teachers	Evaluation
	Outcomes		Resources	Learning	Activities	
				Outcomes		
1-3	1.1 Explain mathematical	Explain different	Marker board,	Use visual	Guide student	Define formal
	models of computations	formal languages	Markers,	aids, diagrams,	to use visual	languages
		and automata models	Documentary	and animations	aids,	Define
	1.2 Define formal	(e.g., finite	films, Multimedia	to explain the	diagrams, and	automata
	languages	automata, pushdown	Projector and	workings of	animations to	model
		automata, Turing	Screen, Case	finite	explain the	
	1.3 Define automata	machines).	studies, Power	automata,	workings of	Differentiate
	model		point slides,	pushdown	finite	between
		Explain the concepts	Internet,	automata, and	automata,	formal
	1.5 Differentiate between	of regular, context-	Textbooks,	Turing	pushdown	language and
	formal language and	free grammar, and	Computer, Flip	machines.	automata, and	automata
	automata model	recursively	charts etc.		Turing	model
		enumerable			machines.	
	1.5 Explain the concepts	languages and their				Explain the
	of regular expressions,	relationships.				concepts of
	context-free grammar,					regular,
	and recursively				Guide	context-free,
					students to	and recursively

1.6 Enumerate languages and their relationships.			Create automata for specific languages.	create automata for specific languages.	
Objectives: 2 0: Understan	d automata thaamy farms	al language theory as	moutability the sem	y and aamplayity	thoomy
2.1 Explain the concepts of automata theory, 2.2 Explain formal language theory, 2.3 Explain computability theory 2.4 Explain complexity theory	Describe the concepts of automata theory, Discuss formal language theory, Discuss computability theory Discuss complexity theory	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts etc.	Set automaton diagrams and ask them to Identify the type of automaton (e.g., finite automata, pushdown automata).	Guide student to set of automaton diagrams and ask them to Identify the type of automaton (e.g., finite automata, pushdown automata).	Explain complexity theory
2.5 Explain how to compare the computational capabilities of different automata models.2.6 Explain context-free grammars to describe	Compare the computational capabilities of different automata models. Discuss context-free grammars to		Create a visual representation of different automata types using software tools.	Guide students to create visual representation of different automata types using software tools.	
	and their relationships. Objectives: 2.0: Understand 2.1 Explain the concepts of automata theory, 2.2 Explain formal language theory, 2.3 Explain computability theory 2.4 Explain complexity theory 2.5 Explain how to compare the computational capabilities of different automata models. 2.6 Explain context-free	and their relationships. Objectives: 2.0: Understand automata theory, form 2.1 Explain the concepts of automata theory, Describe the concepts of automata theory, 2.2 Explain formal language theory, Discuss formal language theory, Discuss formal language theory, Discuss computability theory Discuss computability theory Discuss computability theory Discuss computability theory Compare the computational capabilities of different automata models. Discuss complexity theory	and their relationships. Objectives: 2.0: Understand automata theory, formal language theory, co 2.1 Explain the concepts of automata theory, of automata theory, 2.2 Explain formal language theory, 2.3 Explain computability theory 2.4 Explain complexity theory 2.5 Explain how to compare the computational capabilities of different automata models. Cobjectives: 2.0: Understand automata theory, formal language theory, co Describe the concepts of automata theory, formal language theory, on the projector and screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts etc.	and their relationships. Objectives: 2.0: Understand automata theory, formal language theory, computability theory 2.1 Explain the concepts of automata theory, concepts of automata theory, oncepts of automata theory, language theory, 2.2 Explain formal language theory, 2.3 Explain computability theory 2.4 Explain complexity theory 2.5 Explain how to compare the computational capabilities of different automata models. Compare the computational capabilities of different automata models. 2.6 Explain context-free grammars to describe Describe the concepts of automata theory, formal language theory, omputability theory. Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts etc. Create a visual representation of different automata models. Create a visual representation of different automata models.	and their relationships. automata for specific languages.

syntactic structures of	structures of	Create	Guide
languages.	languages.	automata for	students to
		specific	create
		languages.	automata for
			specific
			languages.
		Distinguish	Guide student
		different types	to distinguish
		of automata	different types
		(finite	of automata
		automata,	(finite
		pushdown	automata,
		automata,	pushdown
		Turing	automata,
		machines	Turing
			machines) and
			their
			capabilities in
			recognizing or
			generating
			languages.
		Demonstrate	Guide student
		how languages	to demonstrate
		can be	how
		recognized by	languages can be recognized
		different	by different
		automaton	by different
		 systems	

	Analyze the expressive power of each model	automaton systems Guide students to analyse the expressive power of each model.
	Apply real-world computational capabilities of different automata models play a role	Engage students to apply real- world applications where the computational capabilities of different automata models play a role, such as in programming languages and natural language processing.

	al Objective 3.0: Understand					
6-7	3.1 Define finite	Define finite	Marker board,	Design and	Guide	Define finite
	automata	automata	Markers,	draw finite	students to	automata,
	3.2 Explain the components of finite automata 3.4 Explain the regular languages 3.5 Explain the significance of the correspondence between finite automata and regular languages in computer science and formal language theory.	Discuss the components of finite automata Discuss the regular languages Discuss the significance of the correspondence between finite automata and regular languages in computer science and formal language	Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts etc.	automata that recognize each language.	design and draw finite automata that recognize each language.	List the components of finite automata Discuss the regular languages
		theory.				
	General Objectives: 4.0:	Comprehend non-comp	utability and undecidal	bility issues		
8	4.1 Explain the concepts	Explain the concepts	Marker board,	Use reduction	Guide	Explain the
	of non-computability and	of non-computability	Markers,	proofs to	students to use	concepts of non-
	undecidability	and undecidability.	Documentary films,	establish	reduction	computability ar
	4.2 Define the faller-in-		Multimedia Projector	undecidability	proofs to	undecidability
	4.2 Define the following	Explain the	and Screen, Case		establish	
	terms:	following terms:	studies, Power point		undecidability.	
	- Computable	- Computable	slides, Internet,			
	- Algorithm	- Algorithm	Textbooks, Compute		Guide	
	- Decision problem	- Decision problem	Flip charts etc.		students	

	4.3 Explain the origins of non-computability and undecidability concepts	Discuss the origins of non-computability and undecidability concepts, including foundational work by figures such as Kurt Gödel and Alan			through reduction examples, such as reducing the halting problem to other	
	4.4 Explain famous	Turing. Explain with			problems.	
	undecidable problems	examples of famous undecidable problems, such as the halting problem and the Entscheidungs problem.				
	General Objective: 5.0: U	1	 Concepts of Algorith	l ms Data Structure	l s and Sorting Alg	orithms
9-10	5.1 Define algorithm	Explain algorithm	Textbooks: Softwares:	Make a sandwich,	Guide students to	Define algorithm
	5.2 Explain the role of algorithm in problemsolving.	Explain the role of algorithm in problem-solving.	LeetCode, HackerRank Codecademy	solving a Rubik's cube	make a sandwich, solving a Rubik's cube	Explain its role in computer
	5.3 Explain algorithms,	Discuss algorithms,	Curate video lectures or	Create	Guide	science and problem-
	data structures, and problem-solving	data structures, and problem-solving	tutorials that cover the	algorithmic art by specifying a	students to create	solving.
	techniques	techniques	definition of	sequence of	algorithmic	

		algorithms and	steps to create	art by	
		their role.	patterns or	specifying a	Discuss its
5.6 Explain algorithmic	Discuss algorithmic	Platforms like	designs using	sequence of	role in
complexity.	complexity, e.g Big	Khan Academy,	paper and	steps to create	computer
	O notation and	Coursera, edX,	colors.	patterns or	science and
	time/space	and <i>YouTube</i>		designs using	problem-
	complexity analysis.	offer relevant		paper and	solving.
		content.		colors.	
5.7 Explain the	Discuss the				
differences between	differences between		Sort out	Guide	
algorithms, data	algorithms, data		different	students to	
structures, and problem-	structures, and		sorting (e.g.,	sort out	
solving techniques	problem-solving		bubble sort,	different	
	techniques		merge sort).	sorting (e.g.,	
				bubble sort,	
5.8 Explain the impact of	Discuss the impact			merge sort).	
algorithmic complexity	of algorithmic				
on efficiency	complexity (time		Determine	Guide	
	and space) on		when and why	students	
	efficiency		to use different	determine	
			data structures	when and why	
			(e.g., arrays,	to use	
			linked lists,	different data	
			trees)	structures	
				(e.g., arrays,	
				linked lists,	
				trees)	
			Use online	Guide student	
			algorithm	to use online	

				visualization tools to demonstrate how different algorithms work with specific data input	algorithm visualization tools to demonstrate how different algorithms work with specific data	
				Interact with algorithm tools and observe the impact of algorithmic choices on efficiency.	input Guide students to interact with algorithm tools and observe the impact of algorithmic	
					choices on efficiency.	
	General Objective 6.0: Pe	erform Algorithm Analy	sis and Complexity, So	orting, and Search		<u> </u>
11-12	6.1 Explain how to implement stack and queue data structures.	Discuss how to implement stack and queue data structures.	Marker board, Markers, Documentary films, Multimedia Projector and	Use advanced sorting algorithms, including merge sort,	Guide students to use advanced sorting algorithms,	Compare and contrast the efficiency of different sorting and
	6.2 Explain elementary sorting algorithms	Discuss elementary sorting algorithms (e.g., bubble sort, insertion sort,	Screen, Case studies, Power point slides, Internet, Textbooks,	•	including merge sort, quicksort, and radix sorts.	searching algorithms.

	6.3 Explain the efficiency of different sorting and searching algorithms. 6.4 Explain how to apply algorithm analysis to determine the most appropriate algorithm for a given problem. General Objective 7.0: Control of the control	selection sort) and analyze their time complexity. Discuss the efficiency of different sorting and searching algorithms. Explain how to apply algorithm analysis to determine the most appropriate algorithm for a given problem.	Computer, Flip charts etc.	Analyze the time and space complexity of algorithms using Big O notation.	Guide students to analyze the time and space complexity of algorithms using Big O notation.	Explain how to apply algorithm analysis to determine the most appropriate algorithm for a given problem.
	and Tries	omprehena symbor rab	ies and Search Trees,	Stapii Aigorianiis	, Maximum 1 10w	, iviiiiiiuiii Cut,
13-14	7.1 Explain elementary symbol tables.7.2 Explain hash tables and balanced search trees	Discuss elementary symbol tables. Discuss hash tables, balanced search trees (e.g., AVL trees, Red-Black trees), and their applications.	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Compute Flip charts etc.	Create visual representation of symbol table data structures, such as arrays or linked lists.	Guide students to create visual representation of symbol table data structures, such as arrays or linked lists.	Explain hash tables and balanced search trees

7.3 Explain time and	Discuss time and	Implement	Guide	
space complexity of	space complexity of	elementary	students to	
algorithms using Big O	algorithms using Big	symbol tables	implement	
notation.	O notation.	using a	elementary	
		programming	symbol tables	
7.4 Explain the efficiency	Discuss the	language.	using a	
of different sorting and	efficiency of		programming	
searching algorithms.	different sorting and		language.	
	searching			
	algorithms.	Perform basic	Guide	
	_	operations	students to	
7.5 Explain how to apply	Discuss how to	(insertion,	perform basic	
algorithm analysis to	apply algorithm	deletion, search)	operations	
determine the most	analysis to determine	on the symbol	(insertion,	
appropriate algorithm for	the most appropriate	table.	deletion,	
a given problem.	algorithm for a given		search) on the	
	problem.		symbol table.	
7.6 Explain the				
applications of hash	Discuss the			
tables, balanced search	applications of hash			
trees (e.g., AVL trees,	tables, balanced			
Red-Black trees)	search trees (e.g.,			
	AVL trees, Red-			
	Black trees)			
7.7 Explain the	Discuss the			
differences between	differences between			
directed and undirected	directed and			
graphs.	undirected graphs.			

7.8 Explain algorithms	Discuss algorithms		
for minimum spanning	for minimum		
trees	spanning trees (e.g.,		
	Prim's, Kruskal's)		
7.9 Explain graph-related	and shortest paths		
terminologies	(e.g., Dijkstra's,		
	Bellman-Ford).		
	,		
7.10 Explain how to	Explain how to		
apply graph algorithms to	apply graph		
solve problems.	algorithms to solve		
	problems.		
7.11 Define key terms	Discuss graph-		
such as worst-case, best-	related terminologies		
case, and average-case	(e.g., nodes, edges,		
complexity	cycles) and apply		
	graph algorithms to		
	solve problems.		
7 12 Evalaia Dia O	Describe Dia O		
7.12 Explain Big O	Describe Big O notation, breaking		
notation, breaking down its components and how	down its		
it represents the upper	components and		
bound of an algorithm's	how it represents the		
growth rate.	upper bound of an		
giowai iaic.	algorithm's growth		
	rate.		
7.13 Define key terms			
related to sorting			

	algorithms (e.g.,	Define key terms				
	comparison-based	related to sorting				
	sorting, non-comparison-	algorithms (e.g.,				
	based sorting) and	comparison-based				
	searching algorithms	sorting, non-				
	searching argorithms	comparison-based				
	7.14 Explain factors to	sorting) and				
	consider, such as time	searching algorithms				
	complexity, space	searching algorithms				
	complexity, and practical	Discuss factors to				
	performance.	consider, such as				
		time complexity,				
		space complexity,				
		and practical				
		performance.				
General	Objective 8.0: Comprehend	Substring Search, Reg	ular Expression, and D	Data Compression		
15		Discuss on	Marker board,	Use code		Discuss on
	8.1 Explain substring	substring search	Markers,	snippets and	Use code	substring
	search algorithms their	algorithms their	Documentary	interactive	snippets and	search
	significance and	significance and	films, Multimedia	coding	interactive	algorithms
	applications.	applications.	Projector and	environments	coding	their
			Screen, Case	to demonstrate	environments	significance
		Explain the basic	studies, Power	how the KMP	to demonstrate	and
	8.2 Explain the basic	concepts behind the	point slides,	and Boyer-	how the KMP	applications.
	concepts behind the	Knuth-Morris-Pratt	Internet,	Moore	and Boyer-	
	Knuth-Morris-Pratt	(KMP) and Boyer-	Textbooks,	algorithms	Moore	Explain the
	(KMP) and Boyer-Moore	Moore algorithms,	Computer, Flip	work.	algorithms	basic concepts
	algorithms	including their	charts etc.		work.	behind the
		motivations and				Knuth-Morris-
		advantages.				Pratt (KMP)

8.3 Explain step-by-step	Discuss step-by-step	Demonstrate	Guide	and Boyer-
walkthroughs of the	walkthroughs of the	algorithmic	students to	Moore
KMP and Boyer-Moore	KMP and Boyer-	behaviour	demonstrate	algorithms,
algorithms using	Moore algorithms	when	algorithmic	including their
examples and diagrams.	using examples and	searching for	behaviour	motivations
	diagrams.	substrings in	when	and
		different text	searching for	advantages.
8.4 Explain the	Explain the	inputs.	substrings in	
differences between	differences between		different text	
KMP and Boyer-Moore	KMP and Boyer-		inputs.	
algorithms in terms of	Moore algorithms in			
efficiency, preprocessing,	terms of efficiency,	Implement the	Guide	
and text searching	preprocessing, and	KMP and	students to	
strategies.	text searching	Boyer-Moore	implement the	
	strategies.	algorithms in a	KMP and	
		programming	Boyer-Moore	
		language of	algorithms in	
8.5 Explain the time	Discuss the time	their choice.	a	
complexity and space	complexity and		programming	
complexity of the KMP	space complexity of		language of	
and Boyer-Moore	the KMP and Boyer-		their choice.	
algorithms.	Moore algorithms.			
		Use substring	Guide	
8.6 Explain the trade-offs	Discuss the trade-	search	students to	
between the two	offs between the two	algorithms in	Use substring	
algorithms in terms of	algorithms in terms	text	search	
preprocessing time,	of preprocessing	processing,	algorithms in	
memory usage, and	time, memory usage,	DNA	text	
search efficiency.	and search	sequencing, or	processing,	
	efficiency.		DNA	

		plagiarism	sequencing, or	
8.7 Define key terms,	Define key terms,	detection.	plagiarism	
symbols, and concepts	symbols, and		detection.	
related to regular	concepts related to			
expressions, such as	regular expressions,	Solve above	Guide	
metacharacters, patterns,	such as	problems using	students to	
and matching.	metacharacters,	the KMP and	solve above	
	patterns, and	Boyer-Moore	problems	
	matching.	algorithms.	using the	
8.8 Explain regular			KMP and	
expression components	Discuss regular		Boyer-Moore	
using real-world	expression		algorithms	
examples.	components using			
	real-world examples.	Develop text	Guide	
8.9 Explain data		processing	students to	
compression techniques	Discuss data	projects that	develop text	
(e.g., Huffman coding)	compression	involve real-	processing	
and their implementation	techniques, focusing	world	projects that	
	on Huffman coding	scenarios.	involve real-	
	as a specific example.		world	
	cxampic.		scenarios,	
			such as data	
			extraction	
			from a website	
			or analyzing	
			log files.	
		Solve specific	Guide	
		text processing	students to	
		tasks, such as	solve specific	

		extracting	text	
		email	processing	
		addresses or	tasks, such as	
		validating	extracting	
		phone	email	
		numbers, using	addresses or	
		regular	validating	
		expressions.	phone	
			numbers,	
			using regular	
			expressions.	

Mathematics and Statistics for AI

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE								
COURSE TITLE: Mathematics and	Course Code: AIT 315	Contact Hours: 4 Hours/ Week						
Statistics for AI								
CREDIT UNITS: 3	PRE-REQUISITE:	Theoretical: 2 Hours/Week						
YEAR: ONE	SEMESTER: ONE	Practical: 2 Hours/Week						
		n in mathematics and statistics to enable them apply						
mathematical and statistical methods to Al	0 11							
General Objectives: On completion of the	ne course, the student should be ab	ple to:						
1.0 Understand Mathematical Found	ations							
2.0 Comprehend Statistical Data Ana	alysis.							
3.0 Understand Optimization Technic	ques							
4.0 Understand Probability and Baye	esian Methods							
5.0 Comprehend Linear Algebra for A	5.0 Comprehend Linear Algebra for AI							
6.0 Understand multivariate Calculus	6.0 Understand multivariate Calculus							
7.0 Apply Real-world Mathematical	solutions in AI							

	RAMME: HIGHER NATIO							
	E: Mathematics and Statisti	cs for AI		COURSE CODE: AIT 315		Contact Hours: 4 Hours/ Week		
CREDIT	ΓUNITS: 3		PRE- RI	EQUISITE: Nil	Theoretical	2 Hours/Week		
					Practical: 2	Hours/Week		
GOAL:	This course is designed to p	rovide students wi	th a solid	foundation in mathema	tics and statistics	s to enable them a	apply	
mathema	atical and statistical methods	to AI algorithms,	models, an	nd applications				
COURS	E SPECIFICATION: The	oretical Contents	;	Practical Cor	itents:			
	General Objective 1.0: U	nderstand Mathen	natical Fou	ındations				
WEEK	Specific Learning	Teachers Activi	ties	Learning Resources	Specific	Teachers	Evaluation	
	Outcomes				Learning	Activities		
					Outcomes			
1-2	 1.1 Explain Calculus and Its application in AI 1.2 Explain Linear Algebra for AI 1.3 Explain Data Representation for AI 1.4 Explain Probability Theory in AI Modeling 	Discuss the fund concept of AI - Principles & Concept of - AI History Definitions - Subfields o	& AI &	White Board. multimedia Projector MATLAB, WEKA, SPSS, TANAGRA,	Apply Probability Theory in AI Modeling Use linear algebra techniques for data representation in AI.	Guide students to apply Probability Theory in AI Modeling Guide students to use linear algebra techniques for data representation in AI.	Explain Probability Theory in AI Modeling	
					Use probability theory to evaluate	Guide students to use probability		

	General Objective 2.0: (Comprehend Statistical Data	Analysis	uncertainty model in AI	theory to evaluate uncertainty model in AI	
3-4	2.1 Explain Hypothesis Testing in AI 2.2 Explain Applications of hypothesis testing in AI 2.3 Explain Regression Analysis for AI Predictions 2.4 Explain methods of Application of Data Visualization in AI Insights 2.5 Describe Probability Distributions in AI Modeling 2.6 Explain Statistical Analysis in AI Decision- making	Discuss the concept of Hypothesis Testing in AI and its applications	White Board. multimedia Projector MATLAB, WEKA, SPSS, Data visualization tools and software for AI	Use regression analysis techniques in AI prediction tasks. Implement basic AI algorithms,	Guide students to use regression analysis techniques in AI prediction tasks. Guide students to implement basic AI algorithms, such as search algorithms (e.g., BFS, DFS), sorting algorithms, or simple machine learning algorithms (e.g., k-nearest neighbors)	Explain Applications of hypothesis testing in AI

	General Objective 3.0	: Understand Optimization	Techniques			
5-6	3.1 Explain Gradient Descent in AI Optimization 3.2 Explain Applications of Gradient Descent in AI optimization 3.3 Explain Convex Optimization for AI Models 3.4 Explain application of stochastic gradient descent in AI Training 3.5 Explain the concept of Optimization Algorithms in AI Tasks	Discuss Gradient Descent in AI Optimization Discuss Applications of Gradient Descent in AI optimization Discuss Convex Optimization for AI Models Describe Application of Stochastic Gradient Descent in AI Training Discuss the Optimization Algorithms in AI Tasks	White Board. multimedia Projector MATLAB, WEKA, SPSS, Data visualization tools and software for AI			Explain Convex Optimization for AI Models
		Understand Probability and I	Bayesian Methods	1		1
7-8	4.1 Explain Probability Theory for AI Reasoning 4.2 Explain the application of Bayesian Methods in AI Decision-making	Discuss Probability Theory for AI Reasoning Discuss the application of Bayesian Methods in AI Decision-making Discuss Probabilistic Models in AI Applications	White Board. multimedia Projector MATLAB, WEKA, SPSS, Data visualization tools and software for AI	Apply uncertainty modeling using probability and Bayesian methods.	Guide students to apply uncertainty modeling using probability and Bayesian methods.	Explain Probabilistic Models in AI Applications

	4.3 Explain Probabilistic Models in AI Applications 4.4 Explain Bayesian Inference for AI Parameter Estimation 4.5 Explain the application of Uncertainty Modeling in AI General Objective: 5.0: O	Discuss Bayesian Inference for AI Parameter Estimation Explain Application of Uncertainty Modeling in AI Comprehend Linear Algebra	for AI			
9-10	5.1 Explain Matrix Operations for AI Data Manipulation 5.2 Explain the application of Eigenvectors in AI Dimensionality Reduction 5.3 Explain Linear Transformations in AI Modeling 5.4 Explain linear Algebra Application in AI Optimization	Discuss Matrix Operations for AI Data Manipulation Describe Application of Eigenvectors in AI Dimensionality Reduction Discuss matrix representations for AI algorithms and model design.	White Board. multimedia Projector MATLAB, WEKA, SPSS, Data visualization tools and software for AI	Demonstrate eigenvectors' role in AI dimensionality reduction. Optimize AI algorithms using techniques of linear algebra	Guide students to demonstrate eigenvectors' role in AI dimensionalit y reduction. Guide students to apply linear algebra techniques to optimize AI algorithms.	Describe Application of Eigenvectors in AI Dimensionality Reduction

General	Objective 6.0: Understand	multivariate Calculus				
11-13	6.1 Explain the concept of Multivariate Calculus 6.2 Describe Application of Partial Derivatives in AI Function Optimization 6.3 Explain gradient vectors in neural Network 6.4 Explain the significance of Hessian Matrices in AI Optimization 6.5 Explain the Applications of Hessian Matrices in AI Optimization 6.6 Explain multivariate calculus in Complex AI Model Optimization	Explain the concept of Multivariate Calculus Describe Application of Partial Derivatives in AI Function Optimization Discuss gradient vectors in neural Network Discuss the significance of Hessian Matrices in AI Optimization Discuss the Applications of Hessian Matrices in AI Optimization Discuss multivariate calculus in Complex AI Model Optimization	White Board. multimedia Projector MATLAB, WEKA, SPSS, Data visualization tools and software for AI	Use partial derivatives in AI function optimization Apply multivariate calculus techniques to optimize complex AI models	Guide students to use partial derivatives in AI function optimization. Guide students to apply multivariate calculus techniques to optimize complex AI models.	Explain the concept of Multivariate Calculus
Genera 14-15	al Objective 7.0: Apply Real 7.1 Explain Statistical	-world Mathematical solution Discuss Statistical	Statistical	Apply Linear	Guide	Explain
	Modeling in AI Predictive Analytics	Modeling in AI Predictive Analytics	modeling tools and libraries for AI	Algebra in AI Data Analysis	students to Apply Linear Algebra in	Statistical Modeling in AI Predictive Analytics

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		Assessment	
		using	
		probability	

Ethical and Professional Practice in Artificial Intelligence (AI)

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE									
COURSE TITLE: Ethical and Professional Practice in Artificial Intelligence (AI)	Course Code: AIT 317	Contact Hours: 2 Hours/ Week							
CREDIT UNITS: 2	PRE-REQUISITE:	Theoretical: 2 Hours/Week							
SEMESTER: ONE	YEAR: ONE	Practical: 0 Hours/Week							

GOAL: This course is designed to enable students to acquire knowledge and skills to navigate the ethical challenges that arise in the rapidly evolving field of artificial intelligence

General Objectives: On completion of the course, the student should be able to:

- 1.0 Understand ethical awareness related to the design, development, and deployment of AI technologies.
- 2.0 Know ethical decision-making when working with AI technologies.
- 3.0 Comprehend AI systems that adhere to ethical principles.
- 4.0 Comprehend the importance of safeguarding user privacy and personal data in AI applications.
- 5.0 Comprehend potential biases in AI algorithms and strategies to mitigate bias.
- 6.0 Explore the societal and legal implications of AI technologies.
- 7.0 Comprehend professional ethics and responsible conduct in AI development and research

PROGR	AMME: HIGHER NATIO	ONAL DIPI	LOMA ARTIFIC	CIALI	NTELLIGEN	CE		
COURSE: Ethical and Professional Practice in		COURSE CODE: AIT 317		Contact H	Contact Hours: 2 Hours/ Week			
	Intelligence (AI)							
CREDIT	ΓUNITS: 2		PRE- REQUIS	SITE: I	Nil		al: 2 Hours/Week	
							0 Hours/Week	
	This course is designed to e		nts to acquire kno	wledge	e and skills to n	avigate the ethi	cal challenges th	at arise in the
	volving field of artificial int				,			
COURS	E SPECIFICATION: The				Practical Con			
	General Objective 1.0: U	Inderstand e	thical Awareness	related	l to the design,	levelopment, a	nd deployment o	f AI technologies
WEEK	Specific Learning	Teachers	Activities	Leari	ning Resources	Specific	Teachers	Evaluation
	Outcomes					Learning	Activities	
						Outcomes		
1-2	1.1 Explain Ethical	Discuss pr	rinciples and					Explain Ethical
	Principles in AI		evant to AI					Dilemmas in
		developm	ent.					AI
	1.2 Explain Ethical							Applications
	Dilemmas in AI		hical dilemmas					
	Applications	in AI appl	ications.					
	1.3. Explain the Impact	Discuss A	I's societal					
	of AI on Society and	impact.	15 50 010 001					
	Individuals	T						
	1.4. Explain how to	Discuss pr	rivacy and data					
	examine Privacy and	protection	regulations in					
	Data Protection in AI	AI.						
	1.5 Explain how to							
	evaluate Bias and	Discuss B	ias and					
	Fairness in AI	Fairness in	n AI					

	General Objective 2.0:	Know ethical decision-makir	g when working with	AI technologies.	
3-4	2.1. Explain Ethical	Discuss ethical decision-			Explain ethical
	Decision-making in AI	making principles and			decision-making
	_	methodologies.			principles and
	2.2. Analyze Ethical				methodologies.
	Dilemmas in AI	Discuss ethical dilemmas			
	Applications	in AI applications.			
	2.3. Explain ethical	Discuss ethical			
	Considerations in AI	considerations in AI			
	Research	research projects.			
	2.4. Explain Impact on	Discuss the impact of AI			
	Stakeholders in AI	decisions on			
	Decisions	stakeholders.			
	2.5. Explain Ethical	Discuss ethical			
	Frameworks in AI	frameworks applicable			
	Decision-making	to AI decisions.			
		Comprehend AI systems that	adhere to ethical princi	ples.	'
5-6	3.1. Explain Ethical	Discuss Ethical			Discuss how to
	Principles in AI	Principles in AI			promote
	Development	Development			Fairness and
					Transparency in
	3.2. Explain how to	Discuss how to promote			AI Algorithms
	promote Fairness and	Fairness and			
	Transparency in AI	Transparency in AI			
	Algorithms	Algorithms			
	3.3. Explain	Discuss Accountability			
	accountability in AI	in AI Decision-making			
	Decision-making				

		Explain ethical Data				
	3.4. Explain ethical Data	Collection and Usage in				
	Collection and Usage in	Concetion and Osage in				
	AI					
		Comprehend the importance	l of safeouarding user n	l rivacy and nerson	l al data in Al ann	lications
7-8	4.1. Explain Privacy and	Discuss Privacy and Data	or sureguarding user p	Trucy and person	ат ааса тт т т арр	Explain ethical
7-0	Data Protection	Protection Principles				use of User
		Frotection Finiciples				Data in AI
	Principles					
						Applications
	4.2. Explain Privacy	Discuss Privacy				
	Regulations in AI	Regulations in AI				
	4.3. Explain Data	Discuss Data				
	Minimization and	Minimization and				
	Consent in AI	Consent in AI				
	4.4. Explain how to	Discuss how to Secure				
	Secure Data Storage and	Data Storage and				
	Transmission in AI	Transmission in AI				
	4.5. Explain ethical use	Discuss the ethical Use				
	of User Data in AI	of User Data in AI				
	Applications	Applications				
		omprehend potential biases i	n AI algorithms and st	trategies to mitiga	te bias.	
9-10	5.1. Explain AI Bias and					Explain Biases
	Its Impact	Discuss AI Bias and Its				in AI
	1	Impact				Algorithms
	5.2. Explain Biases in	1				
	AI Algorithms	Discuss Biases in AI				
	5	Algorithms				
	5.3. Explain how to					
	1					
	evaluate Fairness					

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	Metrics for AI Decision-	Discuss how to evaluate				
	making	Fairness Metrics for AI				
	5.4. Explain Strategies to	Decision-making				
	Mitigate Bias in AI	Explain Strategies to				
	Applications	Mitigate Bias in AI				
		Applications				
	5.5. Explain ethical					
	Considerations in AI Bias	Discuss ethical				
	and Fairness	Considerations in AI Bias				
		and Fairness				
General	Objective 6.0: Explore the		ns of AI technologies			
11-12	6.1. Explain the Social	Discuss the Social				Explain ethical
11-12	-					Considerations
	Impact of AI	Impact of AI				
	(25 1: 1 1	D: 1 1				in AI
	6.2 Explain Legal	Discuss Legal				Applications
	Implications of AI	Implications of AI				
	6.3 Explain AI's Impact	Discuss AI's Impact on				
	on Privacy Laws	Privacy Laws				
	6.4. Explain ethical	Discuss ethical				
	Considerations in AI	Considerations in AI				
	Applications	Applications				
	6.5. Explain AI's Impact	Discuss how to address				
	on Human Rights	AI's Impact on Human				
		Rights				
General	Objective 7.0 Comprehend	l professional ethics and resp	oonsible conduct in AI	development and	research	
13-15				•		Explain
	7.1. Explain	Discuss Professional				transparency
	Professional Ethics in AI	Ethics in AI				and
						accountability
	1					are summering

7.2. Explain how to promote Responsible AI	Discuss how to promote responsible AI		in AI Development
Development	development		_
7.3. Adhere to Ethical Guidelines in AI	Discuss Ethical Guidelines in AI		
Research	Research		
7.4. Explain	Discuss transparency and		
transparency and accountability in AI	accountability in AI Development		
Development	Discuss ethical Decision-		
7.5. Explain ethical	making in AI		
Decision-making in AI Applications	Applications		

YEAR ONE SEMESTER TWO COURSES

Machine Learning

Programme: Higher National Diploma	Artificial Course Code: AIT 321	Contact Hours: 4 Hours/Week
Intelligence		
Course Title: Machine Learning	Credit Units: 3	Theoretical: 2 hour /week
Year: 1 Semester	: 2 Pre-requisite: AIT 313	Practical: 2 hour /week

Goal: The goal of this course is to cultivate an in-depth understanding of machine learning principles and applications, enabling students to solve real-world problems.

General Objectives:

On completion of this course the student should be able to:

- 1.0 Understand machine learning basics.
- 2.0 Understand the processes of machine learning.
- 3.0 Recognize model parameters and hyperparameters in machine learning experiments.
- 4.0 Utilize common machine learning algorithms, applying feature selection and dimensionality reduction techniques for optimization.
- 5.0 Apply machine learning to real-world cases across various industries
- 6.0 Understand the ethical implications of machine learning in ensuring responsible AI development.
- 7.0 Recognize how to foster a culture of continuous learning and adaptation of latest machine learning advancements.

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
Course: Machine Learning COURSE CODE: AIT 321 Contact Hours: 4 Hours/Week							
Credit Units: 3	Pre-requisite: AIT 313	Theoretical: 2 hour /week					
Practical: 2 hour /week							

Goal: The goal of this course is to cultivate an in-depth understanding of machine learning principles and applications, enabling students to solve real-world problems.

	solve real-world problems.										
COURS	E SPECIFICATION: T			Contents:							
	General Objective: 1.0 Understand machine learning basics										
WEEK	Specific Learning	Teachers Activities	Learning	Specific	Teachers	Evaluation					
	Outcomes		Resources	Learning	Activities						
				Outcomes							
1-2	1.1 Explain the basics	Discuss machine	Textbooks, Online	Implement basic	Guide students to	Explain the					
	of machine	learning basics	articles, Video	models using	implement basic	differences and					
	learning		lectures, Python with	Python and	models.	applications of					
		Discuss the	Scikit-Learn,	Scikit-Learn.		supervised,					
	1.2 Explain the	applications and	TensorFlow, Real-			unsupervised,					
	differences and	differences between	world datasets.	Create a project	Guide students to	and					
	applications of	supervised,	Lectures, Online	utilizing	create a project	reinforcement					
	supervised,	unsupervised, and	tutorials, Python	supervised,	utilizing	learning					
	<u> </u>	reinforcement	with Scikit-Learn,	unsupervised,	supervised,						
	unsupervised, and	learning.	TensorFlow, Real-	and	unsupervised, and						
	reinforcement		world datasets.	reinforcement	reinforcement						
	learning		Python tutorials,	learning models	learning models						
			Code samples,								
	1.3 Explain the	Discuss the	Python with Scikit-		Guide students to						
	performance of	performance of	Learn, TensorFlow,		develop basic						
	supervised,	different machine	Real-world datasets.	Develop basic	models of						
	unsupervised, and	learning types, guiding	Python tutorials,	models of	supervised,						
	reinforcement	students in analyzing	Code samples,	supervised,	unsupervised, and						

	learning models	the strengths and	Python with Scikit-	unsupervised,	reinforcement	
	_	weaknesses of each.	Learn, TensorFlow,	and	learning	
	1.4 Explain the		Real-world datasets.	reinforcement		
	differences and		Project-based	learning	Guide students to	
	applications of the		learning guides,		analyze the	
	three types of machine		Python tutorials,		performance of	
	learning		Code samples,	Analyze the	implemented	
	_		Python with Scikit-	performance of	models and	
			Learn, TensorFlow,	implemented		
			Real-world datasets.	models and		
	General Objectives:2.0	Understand the processe	es of machine learning			
3-5	2.1 Explain the	Discuss the complete	Textbooks, Online	Implement the	Guide students to	Explain the
	process of machine	process of machine	articles, Video	complete process	implement the	complete process
	learning	learning from problem	lectures, Python with	of machine	process of	of machine
		identification to model	Scikit-Learn,	learning to solve	machine learning	learning from
		evaluation.	TensorFlow, Real-	a given problem	to a given	problem
			world datasets.		problem	identification to
	2.2 Explain the	Discuss the	Lectures, Online			model
	significance of each	importance of each	tutorials, Python	Develop a	Guide students to	evaluation.
	step in the machine	step such as data	with Scikit-Learn,	machine learning	develop machine	
	learning process	collection,	TensorFlow, Real-	project from	learning projects.	
		preprocessing,	world datasets.	scratch,		
		algorithm selection,	Python tutorials,	following the		
		model training and	Code samples,	complete process		
		evaluation	Python with Scikit-	and using		
			Learn, TensorFlow,	different		
			Real-world datasets.	algorithms		
	2.3 Explain how to	Discuss how to apply	Python tutorials,	(Creating).		
	apply the machine	the machine learning	Code samples,			
	learning process to a		Python with Scikit-			

	specific problem using	process to a specific	Learn, TensorFlow,			
	Python	problem using Python.	Real-world datasets.			
			Project-based			
			learning guides,			
			Python tutorials,			
			Code samples,			
			Python with Scikit-			
			Learn, TensorFlow,			
			Real-world datasets.			
	General Objective 3.0:	Recognize model parame	eters and hyperparamete	ers in machine learn	ing experiments.	
6-8	3.1 Explain the	Discuss model	Textbooks, Online	Implement	Guide students to	Explain how to
	concepts of model	parameters and	articles, Video	different values	adjust	analyze the
	parameters and	hyperparameters, and	lectures, Python with	of	hyperparameters	performance of
	hyperparameters in	their differences	Scikit-Learn,	hyperparameters	in given machine	machine learning
	machine learning		TensorFlow, Real-	in provided	learning models.	models with
		Discuss the roles that	world datasets.	machine learning		different
	3.2 Explain the roles	parameters and	Lectures, Online	models		hyperparameters
	of model parameters	hyperparameters play	tutorials, Python		Guide students to	
	and hyperparameters	in the training of	with Scikit-Learn,	Develop	develop their own	
	in machine learning	machine learning	TensorFlow, Real-	optimized	optimized	
	experiments	models	world datasets.	machine learning	machine learning	
			Python tutorials,	models by tuning	models through	
	3.3 Explain different	Discuss how to adjust	Code samples,	hyperparameters	hyperparameter	
	values of	hyperparameters in a	Python with Scikit-		tuning.	
	hyperparameters in a	machine learning	Learn, TensorFlow,			
	given machine	model using Python.	Real-world datasets.	Analyse machine	Guide students to	
	learning model.		Python tutorials,	learning models'	analyse machine	
			Code samples,	performance	learning models'	
	3.4 Explain	Explain the process of	Python with Scikit-	with different	performance with	
	Optimization of	hyperparameter tuning		hyperparameters		

	machine learning	for optimizing	Learn, TensorFlow,		different	
	models by tuning	machine learning	Real-world datasets.		hyperparameters	
	hyperparameters	models.	Project-based			
			learning guides,			
	3.5 Explain the impact	Discuss the impact of	Python tutorials,			
	of different	different	Code samples,			
	hyperparameters on	hyperparameters on	Python with Scikit-			
	the performance of	the performance of	Learn, TensorFlow,			
	given machine	given machine	Real-world datasets.			
	learning models	learning models				
		D: 1				
		Discuss on the				
		performance analysis				
		of machine learning				
		models with different				
	G 1011 11 10	hyperparameters.		1 : 2	1 1 1	
	_	: Utilize common machi	ne learning algorithms	, applying feature s	selection and dimens	sionality reduction
0.44	techniques for optimizat		m 1 1 0 1	T		T 1 1 1
9-11	4.1 Explain common	Discuss various	Textbooks, Online	Implement	Guide students to	Explain the
	machine learning	machine learning	articles, Video	feature selection	apply learned	concept and
	algorithms and	algorithms and	lectures, Python with	and	techniques on	benefits of
	dimensionality	dimensionality	Scikit-Learn,	dimensionality	datasets.	feature selection
	reduction techniques	reduction techniques.	TensorFlow, Real-	reduction		and
			world datasets.	techniques on		dimensionality
	4.2 Explain the	Discuss the concepts	Lectures, Online	provided datasets		reduction
	concept and benefits	of feature selection	tutorials, Python			
	of feature selection	and dimensionality	with Scikit-Learn,	Evaluate the	Guide students to	
	and dimensionality	reduction and their	TensorFlow, Real-	impact of feature	evaluate the	
	reduction	benefits with examples	world datasets.	selection and	impact of feature	
				dimensionality	selection and	

	4.3 Explain the	Explain how to apply	Python tutorials,	reduction on	dimensionality	
	-	Explain how to apply	•		reduction on	
	process of creating	feature selection and	Code samples,	given machine		
	optimized machine	dimensionality	Python with Scikit-	learning models	given machine	
	learning models using	reduction techniques	Learn, TensorFlow,		learning models	
	feature selection and	on datasets using	Real-world datasets.			
	dimensionality	Python.	Python tutorials,	Develop	Guide students to	
	reduction techniques.		Code samples,	optimized	develop their own	
			Python with Scikit-	machine learning	optimized	
	4.4 Explain the	Discuss the	Learn, TensorFlow,	models using	machine learning	
	performance of	performance analysis	Real-world datasets.	feature selection	models.	
	machine learning	of machine learning	Project-based	and		
	models after applying	models.	learning guides,	dimensionality		
	feature selection and		Python tutorials,	reduction		
	dimensionality		Code samples,	techniques		
	reduction		Python with Scikit-	_		
			Learn, TensorFlow,			
			Real-world datasets.			
	General Objective: 5.0	Apply machine learning	to real-world cases acro	ss various industrie	S.	
12-13	5.1 Explain how	Discuss the	Textbooks, Online	Create machine	Guide students on	Evaluate the
	machine learning can	application of machine	articles, Video	learning	how to match	effectiveness of
	be applied in various	learning across	lectures, Software	solutions for	suitable machine	machine learning
	industries	different sectors such	like Python with	real-world	learning solutions	solutions in
		as healthcare, finance,	libraries (Scikit-	problems in	to real-world	given case
		transportation, and	Learn, TensorFlow,	various	problems.	studies
		more.	etc.), Real-world	industries		
			datasets.		Guide students to	
	5.2 Explain how to	Discuss different real-	Case studies, Online	Analyze the	develop their own	
	identify suitable	world scenarios where	tutorials, Research	results of applied	machine learning	
	machine learning	machine learning can	papers, Software like	machine learning	solutions for real-	
			Python with libraries		world problems.	
				l .	1 .	

solutions for given	be used to solve	(Scikit-Learn,	in real-world	
real-world problems	problems.	TensorFlow, etc.),	cases	
		Real-world datasets.		
		Academic journals,		
5.3 Explain the results	Explain real-world	TED Talks, Expert		
of applied machine	machine learning	interviews, Software		
learning in real-world	applications	like Python with		
cases		libraries (Scikit-		
		Learn, TensorFlow,		
5.3 Explain the	Discuss methods for	etc.), Real-world		
effectiveness of	evaluating the	datasets.		
machine learning	effectiveness of	Coding tutorials,		
solutions in given case	machine learning	Algorithm design		
studies	solutions in real-world	books, Online course		
	applications.	materials, Software		
		like Python with		
		libraries (Scikit-		
		Learn, TensorFlow,		
		etc.), Real-world		
		datasets.		
		Project-based		
		learning guides,		
		Comprehensive		
		tutorials, Industry		
		case studies,		
		Software like Python		
		with libraries		
		(Scikit-Learn,		
		TensorFlow, etc.),		
		Real-world datasets.		

General	Objective 6.0: Understar	nd the ethical implications	s of machine learning ir	ensuring responsib	le AI development.	
14	6.1 Explain key	Discuss ethical	Textbooks, Online	Apply ethical	Guide students to	Explain how to
	ethical considerations	considerations in	articles, Video	principles into	apply ethical	incorporate
	in machine learning	machine learning	lectures.	the design of a	principles to their	ethical
		including bias,	Case studies, Online	machine learning	machine learning	considerations
	6.2 Explain the ethical	privacy,	tutorials, Lectures.	project	projects.	into the design of
	implications of	accountability, and	Python tutorials,			a machine
	machine learning and	transparency.	Code samples,			learning project.
	AI		Python with Scikit-	Assess the	Guide students to	
		Discuss how to	Learn, TensorFlow,	impact of ethical	assess the impact	
	6.3 Explain ethical	incorporate ethical	Real-world datasets.	and unethical	of ethical and	
	principles to machine	considerations into the	Case studies,	practices in real-	unethical	
	learning project design	design of a machine	Lectures, Online	world machine	practices.	
		learning project.	resources.	learning cases		
			Python tutorials,			
		Discuss ways to	Code samples,			
		address potential	Python with Scikit-	Develop	Guide students to	
		biases, ensure privacy,	Learn, TensorFlow,	strategies to	formulate	
		and enhance	Real-world datasets.	mitigate ethical	strategies to	
		transparency.		issues in their	address ethical	
	6.4 Explain the impact			machine learning	issues in their	
	of ethical and	Discuss about the		projects	projects.	
	unethical practices in	impact of ethical and				
	machine learning	unethical practices in				
		machine learning				
		using real-world				
		examples.				
	6.5 Explain the	Explain strategies to				
	strategies to	mitigate ethical issues				

	mitigate ethical	in machine learning				
	issues in machine	projects				
	learning projects					
	al Objective 7.0 Recogniz	e how to foster a culture	of continuous learning a	and adaptation of lat	est machine learning	advancements.
15	7.1 Explain recent	Discuss latest	Textbooks, Online	Develop a	Guide students to	Explain the
	advancements in the	advancements and	articles, Video	project that	use the latest	differences
	field of machine	trends in machine	lectures, Research	incorporates the	tools and	between new
	learning	learning.	papers.	latest	techniques in	advancements
			Case studies, Online	advancements in	machine learning	and existing
	7.2 Explain impacts	Discuss the potential	tutorials, Lectures,	machine learning	projects.	methods
	and applications of	impacts and	Research papers.			
	these advancements	applications of the	Python tutorials,			
		latest advancements in	Code samples,			
		machine learning.	Python with Scikit-			
			Learn, TensorFlow,			
	7.3 Explain the	Discuss the	Real-world datasets,			
	differences between	differences between	Latest ML libraries.			
	new advancements	new advancements	Textbooks, Online			
	and existing methods	and existing methods	articles, Video			
			lectures, Research			
			papers.			
			Project-based			
			learning guides,			
			Python tutorials,			
			Code samples,			
			Python with Scikit-			
			Learn, TensorFlow,			
			Real-world datasets,			
			Latest ML libraries.			

Computer Vision

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
COURSE TITLE: Computer Vision	COURSE TITLE: Computer Vision Course Code: AIT 322 Contact Hours: 4 Hours/Week						
CREDIT UNITS: 3	PRE-REQUISITE: Nil	Theoretical: 2 hour /week					
YEAR: ONE SEMESTER: TWO Practical: 2 hour /week							

GOAL: This course is designed to provide students with a comprehensive understanding of the concepts, methodologies, and prevalent practices in computer vision.

General Objectives: On completion of the course, the student should be able to:

- 1.0 Comprehend fundamental concepts, principles, and theories underlying computer vision.
- 2.0 Implement key computer vision techniques and algorithms for image analysis and understanding.
- 3.0 Apply computer vision techniques for feature detection, object recognition, image segmentation, and scene reconstruction.
- 4.0 Comprehend major computer vision libraries and tools such as OpenCV effectively.
- 5.0 Integrate machine learning algorithms, including deep learning, to improve vision tasks.
- 6.0 Evaluate the performance and efficiency of various computer vision algorithms.
- 7.0 Design a computer vision system for a real-world application, demonstrating the practical application of learned theories and techniques.

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE						
Course: Computer Vision COURSE CODE: AIT 322 Contact Hours: 4 Hours/Week						
CREDIT UNITS: 3	PRE- REQUISITE: Nil	Theoretical: 2 Hours/Week				
		Practical: 2 Hours/Week				

GOAL: This course is designed to provide students with a comprehensive understanding of the concepts, methodologies, and prevalent practices in computer vision.

COURS	E SPECIFICATION: The	oretical Contents:	Practical C	Contents:		
	General Objective: 1.0 C	Comprehend fundamental cor	ncepts, principles, a	nd theories underlyir	ng computer vision	1.
WEEK	Specific Learning	Teachers Activities	Learning	Specific Learning	Teachers	Evaluation

WEEK	Specific Learning	Teachers Activities	Learning	Specific Learning	Teachers	Evaluation
	Outcomes		Resources	Outcomes	Activities	
1-2	1.1 Explain computer vision and its application in various industries.1.2 Explain the structure	Discuss computer vision and its application with real-life examples. Discuss the human visual	White Board PC Projector or digital whiteboard for delivering lectures,	Demonstrate digital image formation and representation.	Guide students to experiment with digital image formation and representation	Explain the fundamentals of digital image formation and representation.
	and function of the human visual system as a foundation for understanding computer vision.	system, its workings, and comparison with computer vision systems.	Computer lab with workstations installed with appropriate	Use image processing and enhancement techniques.	Guide students to apply image processing and enhancement techniques to	
	1.3 Explain the fundamentals of digital image formation and representation.1.4 Explain the concept of image processing	Discuss digital image formation and representation using various visual aids. Discuss image processing and	image processing software, Sample digital images for demonstrations and practice, Software tools for	Identify various image features and their extraction methods.	different feature extraction methods on various types of images.	

	and enhancement techniques. 1.5 Explain various image features and their extraction methods.	enhancement techniques with examples. Discuss image features and their extraction methods and showcase their application in computer vision.	demonstrating image processing techniques, such as MATLAB or OpenCV.			
	General Objectives: 2.0 In	nplement key computer visi	on techniques and al	gorithms for image	analysis and under	standing.
3-4	2.1 Explain image segmentation techniques.	Discuss the principles of image segmentation using relevant software tools.	Computer lab with workstations equipped with software tools	Implement image segmentation techniques.	Guide students to implement image segmentation techniques.	Describe machine learning methods in computer
	2.2 Explain Application of object recognition algorithms in different scenarios.	Discuss various object recognition algorithms	for image analysis (like MATLAB, OpenCV). Projector or	Apply object recognition algorithms to real-world scenarios.	Guide students to apply object recognition algorithms to real-world	vision for pattern classification and recognition.
	2.3 Explain machine learning methods in computer vision for pattern classification and recognition.2.4 Explain	Explain the applications of machine learning in computer vision, provide relevant examples. Discuss convolutional neural networks, their	digital whiteboard for teaching and demonstrating concepts. Datasets of images for	Use convolutional neural networks for image processing and	Guide students to use convolutional neural networks for image processing and	
	convolutional neural networks for image processing and analysis.	architecture and usage in image analysis.	hands-on practice in class.	analysis.	analysis.	

		nition, image segm	entation, and Explain
etection es, and their on in computer equipped with software tools for computer vision, such as OpenCV or MATLAB. Datasets of images and	Apply various feature detection techniques in computer vision. Apply image segmentation techniques. Execute scene reconstruction using computer vision techniques.	to apply feature detection techniques to real-world examples. Guide students to apply image segmentation techniques. Assist students as they execute image segmentation techniques on various images.	various feature detection techniques in computer vision.
	the different etection es, and their equipped with software tools for computer vision, such as OpenCV or MATLAB. Datasets of images and videos for experimentation and practice. Projector or smartboard for teaching and demonstration purposes the principles gmentation es and their	the different etection est, and their on in computer vision, such as OpenCV or MATLAB. Datasets of images and videos for experimentation and practice. Projector or smartboard for teaching and demonstration purposes the principles generation as and their Computers equipped with software tools for computer vision, such as OpenCV or MATLAB. Apply image segmentation techniques. Execute scene reconstruction using computer vision techniques.	equipped with software tools for computer vision, such as OpenCV or MATLAB. Datasets of images and videos for experimentation and practice. Projector or smartboard for teaching and demonstration purposes the principles gmentation as and their equipped with software tools for computer vision, such as OpenCV or MATLAB. Datasets of images and videos for experimentation and practice. Projector or smartboard for teaching and demonstration purposes Execute scene reconstruction using computer vision techniques. Execute scene reconstruction using computer vision techniques. Execute scene reconstruction using computer vision techniques. Assist students as they execute image segmentation techniques on various images.

8-9	General Objectives: 4.0 Cl 4.1 Explain the basic functionalities and modules of OpenCV. 4.2 Explain OpenCV functions for image and video processing tasks. 4.3 Explain computer vision algorithms using OpenCV. 4.4 Explain how to solve common issues and errors in OpenCV programming	Discuss the process of scene reconstruction using real-world examples and case studies. Comprehend major computer Discuss guided exploration of OpenCV's functionalities and modules. Discuss the application of OpenCV functions for image and video processing. Discuss the implementation of computer vision algorithms using OpenCV. Discuss common issues in OpenCV programming and show how to troubleshoot them.	White Board PC, Multimedia Projector User Interface prototyping software (like Pencil, Axure RP, Wireframe, Rapid UI, Design Sketch, etc.)	tools such as Openor Use the basic functionalities and modules of OpenCV Apply OpenCV functions for image and video processing tasks Implement computer vision algorithms using OpenCV.	CV effectively. Guide students to use the basic functionalities and modules of OpenCV Guide students apply OpenCV functions for image and video processing tasks Guide students to implement computer vision algorithms using OpenCV in hands-on activities.	Explain OpenCV functions for image and video processing tasks
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	Canaval Objectives 5 0 Ju	itegrate machine learning al		Resolve common issues and errors in OpenCV programming.	Guide students to troubleshoot common issues they encounter during OpenCV programming Guide students to work on projects involving image and video processing using OpenCV.	
10-11	5.1 Explain the applications of machine learning and deep learning algorithms in computer vision. 5.2 Explain machine learning algorithms to improve image classification, object detection, and other vision tasks.	Discuss the role of machine learning and deep learning in computer vision. Discuss the implementation of machine learning algorithms in computer vision tasks.	White Board PC Multimedia Projector User Interface prototyping software (like Pencil, Axure RP, Wireframe, Rapid UI, Design Sketch, etc.)	Apply deep learning techniques to enhance complex vision tasks. Demonstrate the implementation of machine learning algorithms in computer	Guide students to apply deep learning techniques to complex vision tasks Guide students to implement machine learning algorithms in computer vision tasks.	Explain the applications of machine learning and deep learning algorithms in computer vision.

	5.3 Explain deep learning techniques to enhance complex vision tasks.5.4 Explain the performance of machine learning and deep learning models in computer vision tasks.	Discuss applications of deep learning techniques to complex vision tasks. Discuss the performance of different machine learning and deep learning models in computer vision tasks.		Implement machine learning algorithms to improve image classification, object detection, and other vision tasks.	Guide students to evaluate the performance of machine learning and deep learning models in computer vision tasks.	
				Evaluate the performance of machine learning and deep learning models in computer vision tasks.	Guide students to evaluate the performance of machine learning and deep learning models in computer vision tasks	
	Objective 6.0: Evaluate the	*			T	
12-13	6.1 Explain the metrics for evaluating the performance of computer vision algorithms.	Discuss the key performance metrics used in computer vision.	Computers with software for implementing and evaluating computer vision	Apply the metrics for evaluating the performance of computer	Guide students to apply performance metrics to computer	Analyze and interpret the results of performance evaluation.
	6.2 Explain metrics above in practice to various computer vision algorithms.	Discuss how to apply these metrics to evaluate computer vision algorithms.	algorithms (such as Python with OpenCV, TensorFlow).	practice to compare various computer vision algorithms.	vision algorithms.	

	6.3 Explain the results of		Variety of		Assist students	
	6.3 Explain the results of performance evaluation.6.4 Explain computer vision optimization concepts	Discuss various scenarios of performance evaluation results and their implications. Discuss optimization computer vision algorithms based on performance results	Variety of datasets to test the performance of algorithms. Projector or smartboard for teaching and demonstration.	Analyze and interpret the results of performance evaluation. Optimize computer vision algorithms based on the evaluation results	Assist students in analyzing and interpreting their evaluation results. Guide students through the process of optimizing a computer vision	
	Objective 7.0 Design a co	mputer vision system for a	real-world applicat	ion, demonstrating	algorithm based on their evaluation results.	cation of learned
14-15	7.1 Explain the process of designing a computer vision system. 7.2 Explain relevant machine learning algorithms for computer vision system. 7.3 Explain the concept of computer vision system testing	Discuss the steps and considerations in designing a computer vision system. Discuss how to implement a simple computer vision system. Explain the concept of computer vision system testing	Computers with software for implementing computer vision and machine learning algorithms (such as Python with OpenCV, TensorFlow). Variety of datasets to test	Apply knowledge of computer vision techniques to implement a functional system. Implement a simple computer vision system	Guide students to test and optimize the system for a chosen real- world application Guide students to implement their computer vision systems.	Explain the process of designing a computer vision system

7.4 Explain system	Explain system	the performance	Incorporate	Guide students
optimization for a chosen	optimization for a	of the designed	relevant machine	to incorporate
real-world application	chosen real-world	system.	learning	machine
	application	Projector or	algorithms into	learning
7.5 Explain the process		smartboard for	the system.	algorithms into
of incorporating machine	Explain the process of	teaching and		their systems.
learning algorithms into	incorporating machine	demonstration.		
the system.	learning algorithms into		Test and optimise	Guide students
the system.	the system.		their computer	to test and
			vision systems	optimise
				computer
				vision systems
				their systems.

Data Science for AI

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE						
COURSE TITLE: Data Science for AI	Course Code: AIT 323	Contact Hours: 4 Hours/ Week				
CREDIT UNITS: 3	PRE-REQUISITE:	Theoretical: 2 Hours/Week				
YEAR: ONE	SEMESTER: TWO	Practical: 2 Hours/Week				

GOAL: This course is designed to equip students with the knowledge and skills required to apply data science concepts and techniques in artificial intelligence.

General Objectives: On completion of the course, the student should be able to:

- 1.0 Understand the fundamentals of data science and its intersection with artificial intelligence.
- 2.0 Comprehend the concepts of business intelligence and big data analytics in modern business decision-making.
- 3.0 Apply data science techniques to extract meaningful insights from large and complex datasets.
- 4.0 Use machine learning algorithms to build predictive models for various business scenarios.
- 5.0 Utilize data visualization tools to effectively communicate data-driven insights to both technical and non-technical audiences.
- 6.0 Understand the ethical and privacy issues related to the use of big data in artificial intelligence.
- 7.0 Design a data science project that addresses a real-world business problem.

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE						
Course: Data Science for AI COURSE CODE: AIT 323 Contact Hours: 4 Hours/Week						
CREDIT UNITS: 3	PRE- REQUISITE: Nil	Theoretical: 2 Hours/Week				
		Practical: 2 Hours/Week				

	GOAL: This course is designed to equip students with the knowledge and skills required to apply data science concepts and techniques in						
	l intelligence.	ti1 Ctt	D., 42 1	Conton			
COURS	SE SPECIFICATION: The General Objective: 1.0 U			Contents:	ith artificial into	lligango	
WEEK	9	Teachers Activities	Learning Resources	Specific Learning Outcomes	Teachers Activities	Evaluation	
1-2	1.1 Explain the key concepts and terminologies in data science and artificial intelligence. 1.2 Explain the role of data science in artificial intelligence and its application across various industries. 1.3 Explain the data science process, from data collection and preprocessing to modeling and evaluation.	Discuss key concepts and terminologies in data science and artificial intelligence. Discuss data science intersects with artificial intelligence across various industries. Discuss the data science process using real-world examples. Facilitate class discussions on each stage.	Slide presentations, textbooks, and online resources for lectures. Access to case studies and research papers on data science and AI. Computer with data analysis software (e.g., Python with libraries like pandas, NumPy, scikit-learn) for demonstrating the data science process. Python with TensorFlow, Keras)	Use data science process, from data collection and preprocessing to modeling and evaluation. Use the basics of machine learning, including supervised and	Assign students with a dataset and guide them through the data science process, from cleaning and preprocessing the data to modeling and interpreting the results. Provide students with exercises in implementing basic machine	Explain the key concepts and terminologies in data science and artificial intelligence.	

1.1 Explain the key concepts, tools, and applications of business intelligence (BI) and big data analytics. 1.2 Explain the role of BI and big data analytics in driving business decisions. 1.3 Explain the processes involved in BI and big data analytics, including data mining, data warchousing, and data visualization. 1.3 Explain the processes involved in BI and big data analytics, including data mining, data warchousing, and data visualization. Discuss the tools and applications of BI and big data analytics on business decision— Discuss the impact of BI and big data analytics on business decision— Discuss the ethical considerations and challenges in BI and big data analytics including data mining, data warchousing, and data visualization. Discuss the ethical considerations and challenges in BI and big data analytics including data mining, data warchousing, and data visualization. Discuss the ethical considerations and challenges in BI and big data analytics including data mining, data warchousing, and data visualization. Discuss the ethical considerations and challenges in BI and big data analytics including data warchousing, and data visualization. Discuss the ethical considerations in BI and big data analytics including data warchousing, and data visualization. Discuss the ethical considerations in BI and big data analytics Discuss the ethical considerations in BI and big data analytics Discuss the ethical considerations in BI and big data analytics Discuss the ethical considerations in BI and big data analytics Discuss the ethical considerations in BI and big data analytics Discuss the impact of BI and big data analytics. Access to BI software like Tableau and big data Articles and warchousing, and data visualization. Use the key Guide concepts, tools, and applications of business intelligence (BI) and big data analytics.		1.4 Explain the basics of machine learning, including supervised and unsupervised learning algorithms. General Objective 2.0 Cormaking	Discuss the basics of machine learning, include both theoretical concepts and practical examples.	usiness intelligence and	unsupervised learning algorithms.	learning algorithms using appropriate software. in modern busine	ess decision-
1.4 Explain the ethical	3-4	 1.1 Explain the key concepts, tools, and applications of business intelligence (BI) and big data analytics. 1.2 Explain the role of BI and big data analytics in driving business decisions. 1.3 Explain the processes involved in BI and big data analytics, including data mining, data warehousing, and data visualization. 	applications of BI and big data analytics. Include discussions on BI software like Tableau and big data platforms like Hadoop. Discuss the impact of BI and big data analytics on business decisionmaking. Discuss the ethical considerations and challenges in BI and big	textbooks, and online resources for lectures. Case studies on companies that effectively use BI and big data analytics. Access to BI software like Tableau and big data platforms like Hadoop. Articles and materials on ethical considerations in BI and big data	processes involved in BI and big data analytics, including data mining, data warehousing, and data visualization. Use the key concepts, tools, and applications of business intelligence (BI)	students to implement data mining, data warehousing, and data visualization techniques using BI software or big data platforms. Guide students to explore different BI tools and big	processes involved in BI and big data analytics, including data mining, data warehousing, and data

	T	T	T	T	T	
	considerations and					
	challenges in BI and					
	big data analytics,					
	such as privacy and					
	data security.					
	General Objective 3.0: Ap	ply data science techniques	to extract meaningful	insights from large	and complex data	asets.
5-7	3.1 Explain how to clean	Discuss data cleaning	Access to datasets	Apply big data	Guide	Describe various
	and preprocess large and	and preprocessing using	for cleaning and	techniques to	students to	data science
	complex datasets to make	real-world datasets.	preprocessing.	clean and	apply big data	techniques such
	them suitable for analysis.		Data science	preprocess large	techniques to clean and	as machine
			software and	datasets to make	preprocess	learning
	3.2 Explain various data	Discuss different data	platforms like	them suitable for	large datasets	algorithms,
	science techniques such as	science techniques	Jupyter Notebook,	analysis.	to make them	statistical
	machine learning	through step-by-step	Studio, or Tableau		suitable for	analysis, and
	algorithms, statistical	guided sessions.	for demonstrating		analysis	data
	analysis, and data		techniques.			visualization to
	visualization to derive		Resources for	Apply various	Guide	derive insights
	insights from data.		learning effective	data science	students to	from data.
			data	techniques such	apply various	
	3.3 Explain data science	Discuss data science	communication	as machine	data science	
	tools and programming	tools and programming	(videos, books,	learning	techniques	
	languages, such as	languages, such as	online courses).	algorithms,	such as	
	Python, R, SQL, and data	Python, R, SQL, and data visualization tools	Computers with	statistical	machine	
	visualization tools	effectively.	necessary data	analysis, and	learning	
	effectively.	Circuivery.	science software	data	algorithms,	
			and tools installed	visualization to	statistical	
			(Python, R, SQL,	derive insights	analysis, and	
			data visualization	from data.	data	
			tools).			

				Utilize data science tools and programming languages, such as Python, R, SQL, and data visualization tools effectively.	Guide students to utilize data science tools and programming languages, such as Python, R, SQL, and data visualization tools effectively. Guide students in coding tasks and projects to use Python, R, SQL, and data visualization tools.	
	General Objectives: 4.0 Us	se machine learning algorith	nms to build predictive	models for various	business scenari	
8-9	4.1 Explain the application of various machine learning algorithms (such as decision trees, support vector machines, k-nearest	Discuss different machine learning algorithms. Conduct guided sessions to demonstrate the	Computers equipped with machine learning software (like Python's scikit-	Apply various machine learning algorithms.	Guide students to implement different machine	Explain the application of various machine learning algorithms (such as decision trees,

	neighbors, and neural networks). 4.2 Explain the performance of predictive models. 4.3 Explain predictive model results	application of these algorithms on real-world business data. Discuss the concept of model evaluation and tuning techniques. Discuss how to present, interpret and communicate predictive model results.	learn, TensorFlow, PyTorch). Access to a variety of real-world business datasets for practicing machine learning. Access to resources on machine learning algorithms and techniques. Access to resources for effective data presentation and communication.	Apply the appropriate machine learning algorithm to a given business scenario for prediction tasks. Evaluate and tune the performance of the predictive models	learning algorithms. Guide students to apply appropriate machine learning algorithm to build a predictive model. Guide students to evaluate and improve their models using tuning	support vector machines, k- nearest neighbors, and neural networks).
	C LOI: # FAIL	11. 1 1	, CC , 1	1 . 1	techniques.	
10.11	General Objective: 5.0 Uti					D 1 1 1
10-11	5.1 Explain the principles	Discuss the principles of	Computers with	Apply data	Guide	Explain the
	of effective data	effective data	visualization	visualization	students to	principles of
	visualization.	visualization.	software installed	tools (such as Tableau,	use data visualization	effective data visualization.
	5.2 Explain data	Discuss the use of data	(such as Tableau, PowerBI, or	PowerBI, or	tools to	visualization.
	visualization and	visualization tools	Python's	Matplotlib in	present data.	
	communication style for	through live coding	Matplotlib/Seaborn	Python) to create	present data.	
	different audiences.	sessions or workshops.	libraries).	clear, accurate,		

		Discuss tailoring	Access to various	and compelling	Guide	
	5.3 Explain visualizations	visualizations and	datasets for	visualizations.	students to	
	for their clarity, accuracy,	communication to	visualization		adjust their	
	and ethical implications.	different audiences.	practice.	Analyze	visualizations	
	•		Course materials or	visualizations for	and	
		Discuss critical analysis	resources on	their clarity,	communicatio	
		of real-world data	principles of	accuracy, and	n style to suit	
		visualizations	effective data	ethical	different	
			visualization.	implications.	audiences.	
			Examples of real-			
			world data		Guide	
			visualizations for		students on	
			analysis.		how to	
					critically	
					evaluate real-	
					world data	
					visualizations	
	Objective 6.0: Understand			Artificial Intelliger		
12	6.1 Explain the ethical	Discuss ethical concerns	Course materials or	Apply principles	Guide	Address biases
	concerns and privacy	and privacy issues in	resources on data	of data ethics in	students to	in datasets and
	issues in data science and	data science and	ethics, privacy	various data	apply	machine learning
	artificial intelligence.	artificial intelligence.	issues, and bias in	science tasks.	principles of	algorithms
			AI.		data ethics in	
	6.2 Explain the principles	Discuss principles of	Case studies		various data	
	of data ethics in various	data ethics in real-world	highlighting ethical		science tasks.	
	data science tasks.	situations.	and privacy issues			
	6.3 Explain data	Discuss strategies for	in data science and	Implement	Guide	
	protection strategies.	data privacy protection	AI.	strategies for	students to	
		during practical coding	Computers with	protecting data	implement	
		sessions.	necessary software	privacy.	strategies for	

in e s	learning algorithms, including their potential effects and mitigation strategies	privacy protection. Datasets exhibiting different kinds of biases for discussion and analysis.	Address biases in datasets and machine learning algorithms	Guide students to identify, analyze, and mitigate biases in given datasets	
General Objective 7.0: Design a data s	science project that address	sses a real-world busin	ess problem		
7.1 Explain different business problems that can be handled by artificial intelligence 7.2 Explain the usage of AI in solving business problems 7.3 Explain the different types of biases in AI and their impacts. 7.4 Explain strategies for detecting and mitigating bias.	Discuss different business problems that can be handled by artificial intelligence Discuss the usage of AI in solving business problems Discuss the different types of biases in AI and their impacts. Explain strategies for detecting and mitigating bias. Organize group projects and presentations on ethical implications and	Access to relevant literature, industry reports, and databases for identifying business problems. Project management tools for planning and monitoring the project. Computers with necessary data science software installed for project implementation. Presentation tools and equipment for communicating the results.	Identify a real-world business problem that can be addressed using data science techniques. Formulate a research question and design a data science project plan to address the problem.	Guide students in identifying appropriate business problems and formulating research questions. Mentor students in the creation of project plans, ensuring they're feasible and methodologic ally sound.	Explain the usage of AI in solving business problems

T	1	 - 1	
	biases in real-world AI	Implement	Guide
	applications.	project on data	students to
		collection,	implement
		cleaning,	project on
		analysis,	data
		modeling, and	collection,
		interpretation of	cleaning,
		results.	analysis,
			modeling, and
			interpretation
			of results.
		Present the	Guide
		findings in a	students to
		clear and	communicate
		understandable	their findings
		manner to both	effectively
		technical and	
		non-technical	Guide
		audiences.	students to
		audiences.	brainstorm
			during project
			planning
			process.
			Guide
			students to
			implement
			project
			project

		Guide students to	
		present	
		project results	
		and assess	
		feedback	

AI Development Frameworks

Programme: Higher National Diploma Artificial	Course Code: AIT 324	Contact Hours: 4 hours/week
Intelligence		
Course Title: AI Development Frameworks	Semester: 2	Theoretical: 2 hours /week
Year: 1 Semester: 2	Pre-requisite: NIL	Practical: 2 hours/week
Credit Units: 4		

Goal: This course is designed to provide students with skills to utilize various artificial intelligence frameworks.

General Objectives:

On completion of this course the student should be able to:

- 1.0 Understand AI Development Frameworks
- 2.0 Comprehend AI Development Frameworks Concepts and Principles
- 3.0 Apply AI Development Frameworks.
- 4.0 Analyze the Performance of AI Models
- 5.0 Evaluate AI Development Framework Suitability
- 6.0 Solve Real World Problems Using AI Development Frameworks.
- 7.0 Comprehend Adaptation of AI Development Frameworks.

PROGR	AMME: HIGHER NATIO	ONAL DIF	PLOMA ARTIFIC	CIALI	NTELLIGEN	CE				
Course: AI Development Frameworks			COURSE CODE: AIT 324				Contact Hours: 4 hours/week			
Credit Units:4			Pre-Requisite: Nil				Theoretical: 2 hours /week			
			•				Practical: 2 hours/week			
Goal: Th	nis course is designed to pro-	vide studei	nts with skills to u	tilize v	arious Artificia	ıl Inte	elligence fram	neworks		
COURSE SPECIFICATION: Theoretical Contents				Practical Contents						
General Objective: 1.0 Understand AI Development Frameworks										
WEEK	Specific Learning	Teachers Activities		Lear	Learning Specific		ecific	Teachers	Evaluation	
	Outcomes			Resources		Lea	arning	Activities		
						Ou	tcomes			
1	1.1 Describe the salient	1.1 Describe the salient Explain the f			rPoint slides,	Use	e the	Guide students	Explain the	
	features of		features of TensorFlow 2.0 and MindSpore.		e Course	-	mary	on how to	unique aspects	
	TensorFlow 2.0 and	2.0 and N			rial,		tures of	navigate and	of TensorFlow	
	MindSpore.	Explain the differences in use-cases between			orFlow 2.0		nsorFlow	interact with	2.0 and	
	_			softw	*	-	and	the	MindSpore.	
	1.2 Explain the `use-				MindSpore		ndSpore	TensorFlow		
	cases of TensorFlow 2.0		ow 2.0 and	softw	are			2.0 and		
	and MindSpore.	MindSpore					alyze the	MindSpore		
	_				studies,		ferences	frameworks on		
	1.3 Explain the unique aspects of TensorFlow 2.0 and MindSpore.		the unique		e Course		ween the	the computer.		
			ristics and		rial, Internet		-cases of			
		advantag			search		nsorFlow	Guide students		
			ow 2.0 and		orFlow 2.0		and	on how to		
		_	ore over other AI		nentation,	Mi	ndSpore	conduct		
		developr			Spore .			research and		
		framewo	rks.		nentation,		lize the	evaluate		
					e Course		que aspects	different use-		
				Mate	rial	of	TensorFlow	cases of		

				2.0 and MindSpore in a practical scenario.	TensorFlow 2.0 and MindSpore. Guide students to employ the unique aspects of TensorFlow 2.0 and MindSpore in solving an AI task.			
	General Objectives: 2.0 Comprehend AI Development Frameworks Concepts and Principles							
4-5	 2.1 Explain the key concepts and principles of TensorFlow 2.0 and MindSpore. 2.2 Explain the functionalities of TensorFlow 2.0 and MindSpore. 2.3 Classify different libraries associated with TensorFlow 2.0 and MindSpore. 	Explain principles and concepts of TensorFlow 2.0 and MindSpore. Discuss the major functionalities provided by TensorFlow 2.0 and MindSpore. Explain various libraries associated with TensorFlow 2.0 and MindSpore.	PowerPoint slides, Online Course Material, TensorFlow 2.0 software, MindSpore software TensorFlow 2.0 documentation, MindSpore documentation, Online Course Material TensorFlow 2.0 and MindSpore Libraries	Use the key concepts and principles of TensorFlow 2.0 and MindSpore. Use the Various functionalities of TensorFlow 2.0 and MindSpore in a practical setting.	Guide students to use of the key principles and concepts of TensorFlow 2.0 and MindSpore. Guide students to employ the functionalities of TensorFlow 2.0 and MindSpore to perform AI tasks.	Explain various libraries associated with TensorFlow 2.0 and MindSpore.		

			documentation,	Use the	Supervise		
			Online Course	different	students as		
			Material	libraries	they perform		
				associated with	tasks using		
				TensorFlow	different		
				2.0 and	libraries of		
				MindSpore.	TensorFlow		
				1	2.0 and		
					MindSpore.		
	General Objective 3.0: Apply AI Development Frameworks.						
6-9	3.1 Describe the process Explain the steps		PowerPoint slides,	Design an AI	Guide students	Explain the	
	of designing and	involved in designing	Online Course	model using	to design and	process of	
	developing AI models	and developing AI	Material,	TensorFlow	develop AI	testing AI	
	using TensorFlow 2.0	models using TensorFlow	TensorFlow 2.0	2.0 and	models using	models using	
	and MindSpore.	2.0 and MindSpore.	software,	MindSpore	TensorFlow	TensorFlow 2.0	
			MindSpore		2.0 and	and	
	3.2 Explain how to	Discuss how AI models	software, Sample		MindSpore.	MindSpore.	
	implement AI models	can be implemented	datasets				
	using TensorFlow 2.0	using TensorFlow 2.0	TensorFlow 2.0 and	Implement an	Guide students		
	and MindSpore.	and MindSpore, using	MindSpore	AI model	to implement		
		real-world examples	documentation,	using	an AI model		
			Online Course	TensorFlow	using		
	3.3 Explain the process	Discuss steps involved in	Material	2.0 and	TensorFlow		
	of testing AI models	testing AI models using	TensorFlow 2.0 and	MindSpore.	2.0 and		
	using TensorFlow 2.0	TensorFlow 2.0 and	MindSpore		MindSpore.		
	and MindSpore.	MindSpore.	documentation,	Test an AI			
			Online Course	model using	Supervise		
			Material, Testing	TensorFlow	students as		
			datasets	2.0 and	they perform		
				MindSpore	tasks		

					involving the	
					_	
					testing of AI	
					models using	
					TensorFlow	
					2.0 and	
					MindSpore.	
	General Objective 4.0: At	nalyze the Performance of A	I Models			
10-12	4.1 Explain how to	Discuss various	PowerPoint slides,	Evaluate the	Guide students	Explain how to
	evaluate the performance	performance metrics and	Online Course	performance of	to evaluate the	analyze the
	of AI models developed	how to measure the	Material,	an AI model	performance	performance
	using TensorFlow 2.0	performance of AI	TensorFlow 2.0	developed	of AI models	results of AI
	and MindSpore.	models using TensorFlow	software,	using	using	models.
	_	2.0 and MindSpore.	MindSpore	TensorFlow	TensorFlow	
	4.2 Explain how to	-	software, AI model	2.0 and	2.0 and	
	analyze the performance	Explain how to interpret	performance	MindSpore.	MindSpore.	
	results of AI models.	the results of	evaluation tools	-	-	
		performance metrics and	PowerPoint slides,	Analyze the	Guide students	
	4.3 Explain how to	the implications of the	Online Course	performance	to analyze and	
	interpret the	results on the AI model.	Material,	results of an AI	interpret the	
	performance results of		Performance metric	model	performance	
	AI models.	Discuss how to interpret	results	developed	results of AI	
		performance results.	PowerPoint slides,	using	models using	
	4.4 Describe how to	F	Online Course	TensorFlow	TensorFlow	
	suggest enhancements	Discuss different	Material,	2.0 and	2.0 and	
	for the performance of	techniques and strategies	TensorFlow 2.0	MindSpore.	MindSpore.	
	AI models using	for improving the	software,	initias poi c.	Timaspore.	
	TensorFlow 2.0 and	performance of AI	MindSpore			
	MindSpore.	models.	software, AI model	Interpret the		
	windspore.	models.	enhancement tools	performance		
			cimancement tools	-		
				results of an AI		

				model developed using TensorFlow 2.0 and MindSpore Enhance the performance of an AI model developed using TensorFlow 2.0 and MindSpore.	Supervise students as they apply enhancement techniques to improve the performance of AI models using TensorFlow 2.0 and	
					MindSpore.	
		valuate AI Development Fra	amework Suitability			
13	5.1 Explain how to evaluate the efficiency, scalability, and compatibility of TensorFlow 2.0 and MindSpore. 5.2 Explain the	Discuss the factors of efficiency, scalability, and compatibility and how they apply to TensorFlow 2.0 and MindSpore. Explain the differences in	PowerPoint slides, Online Course Material, TensorFlow 2.0 software, MindSpore software Case studies,	Evaluate the efficiency, scalability, and compatibility of an AI model developed using TensorFlow	Guide students to evaluate the efficiency, scalability, and compatibility of AI models using TensorFlow	Evaluate the effectiveness of machine learning solutions in given case studies
	suitability of TensorFlow	suitability for these tasks.	Online Course	2.0 and MindSpore.	2.0 and MindSpore.	

	2.0 aı	nd MindSpore for	Discuss different	Material, Internet	Determine the	Guide students	
	speci	fic tasks.	scenarios where one AI	for research	suitability of	to evaluate	
			development framework	PowerPoint slides,	TensorFlow	different tasks	
	5.3 E	xplain how to	might be more	Online Course	2.0 and	and determine	
	ju	stify their choice of	appropriate than the	Material,	MindSpore for	the suitability	
	A]	development	other.	TensorFlow 2.0	specific tasks	of TensorFlow	
	fra	mework for a		software,	through real-	2.0 and	
	sp	ecific task.		MindSpore	world	MindSpore for	
				software	examples.	these tasks.	
Genera	l Objec	tive 6.0: Solve Real-	World Problems Using AI D	evelopment Framewor	ks.		
14	6.1	Explain how to	Discuss the steps	PowerPoint slides,	Design an AI	Guide students	Analyze real-
		plan, develop,	involved in the planning,	Online Course	solution using	to design,	world problems
		and deploy AI	development, and	Material,	TensorFlow	develop, and	that can be
		solutions using	deployment of AI	TensorFlow 2.0	2.0 and	deploy AI	solved using AI
		TensorFlow 2.0	solutions using	software,	MindSpore	solutions using	solutions
		and MindSpore.	TensorFlow 2.0 and	MindSpore		TensorFlow	developed with
			MindSpore.	software	Deploy an AI	2.0 and	TensorFlow 2.0
	6.2	Explain how to		Case studies,	solution using	MindSpore.	and
	0.2	analyze real-	Use case studies to	Online Course	TensorFlow		MindSpore.
		world problems	illustrate real-world	Material, Internet	2.0 and	Guide students	
		•	problems that can be	for research	MindSpore.	to identify	
		that can be solved	solved using AI.	TensorFlow 2.0 and		real-world	
		using AI solutions		MindSpore	Identify a real-	problems and	
		developed with		documentation,	world problem	design AI	
		TensorFlow 2.0		Online Course	and propose an	solutions using	
		and MindSpore.		Material, Testing	AI solution	TensorFlow	
				datasets	using	2.0 and	
			Explain how to		TensorFlow	MindSpore.	
	6.3	Explain the	implement and test		2.0 or	Guide	
			1xxAI solutions.		MindSpore.	students to	

	problems that can			Implement	implement and	
	be solved using			their AI	test their AI	
	AI.			solution to a	solutions using	
	711.			real-world	TensorFlow	
				problem using	2.0 and	
				TensorFlow	MindSpore.	
				2.0 or		
				MindSpore.		
Gener	al Objective 7.0 Comprehen	d Adaptation of AI Develop	ment Frameworks.	-	1	l
15	7.1 Explain how to	Explain how to	Recent literature,	Adapt projects	Guide students	Explain how to
İ	incorporate new	incorporate new	Blogs, Articles,	to include the	to update and	incorporate
	advancements into their	advancements into their	Online Course	latest	adapt their	new
	existing projects.	existing projects.	Material	advancements	projects to	advancements
			TensorFlow 2.0 and	in TensorFlow	include the	into their
		Discuss how to adapt	MindSpore	2.0 and	latest	existing
		existing projects to use	documentation,	MindSpore.	advancements	projects.
		the latest advancements.	Online Course		in TensorFlow	
			Material	Demonstrate	2.0 and	
			Student projects,	continuous	MindSpore.	
			Presentation	learning by	Guide students	
			equipment	presenting a	to showcase	
				project that	their projects.	
				effectively		
				uses the latest		
				advancements		
				in TensorFlow		
]				2.0 and		
				MindSpore.		

Neural Computation and Bioinformatics

Programme: Higher National Diploma Artificial	Course Code: AIT 325	Contact Hours: 4 hours/week
Intelligence		
Course Title: Neural Computation and Bioinformatics		Practical: 2 hours /week
Year: 1	Pre-requisite: AIT 313	Theoretical: 2 hours/week
Credit Unit: 3	Semester: 2	

Goal: This course is designed to provide students with an understanding of the principles and applications of neural networks and computational techniques to analyze biological data

General Objectives: On completion of this course the student should be able to:

- 1.0 Understand Neural Network Fundamentals
- 2.0 Comprehend Different Neural Network Architectures
- 3.0 Understand Neural Network Optimization Techniques, Transfer Learning and Pre-trained Models
- 4.0 Understand Neural Network Applications
- 5.0 Comprehend Neural Network Interpretability
- 6.0 Understand Bioinformatics Basics
- 7.0 Understand the Application of Neural Networks in Bioinformatics

Course:	Neural Computation and Bioir	nformatics COURS	E CODE: AIT 325	Contact Hou	rs: 4 hours/week	rs: 4 hours/week	
Credit U	Inits: 3	Pre-Req	uisite: Nil	Theoretical:	2 hours /week		
		_		Practical: 2 h	nours /week		
Goal: Th	nis course is designed to acquain	int students with an und	erstanding of the princi	ples and applications of	of neural networks a	and computation	
tec	chniques to analyze biological	data				-	
COURS	E SPECIFICATION: Theore	etical Contents:	Praction	cal Contents:			
	General Objective: 1.0 Und	lerstand Neural Networl	Fundamentals				
WEEK	Specific Learning Outcome		Learning	Specific Learning	Teachers	Evaluation	
			Resources	Outcomes	Activities		
1-3	1.1 Explain the Concept of	Explain neural	Textbooks and	Execute a	Guide students	Explain the	
	Neural Network.	network fundamentals.	Research Papers.	Neural Network	to design and	different	
				Projects.	implement	Neurons	
	1.2 Explain the different	Discuss the different	Neural Network		neural network	Activation	
	Neurons Activation	neural network	Libraries, such as	Use Model	models to solve	Functions.	
	Functions.	activation functions.	TensorFlow or	Optimization and	various tasks,		
	1 2 F12: F2		PyTorch.	Fine-tuning	such as image		
	1.3 Explain Forward and Backward Propagation.	Discuss the different		techniques	classification or		
	Backward Fropagation.	neural learning		-	natural language		
	1.4 Explain Learning	algorisms.			processing		
	Algorithms		MATLAB,				
			SIMULINK, and		Guide students		
			Google Colab.		to optimize and		
			_		fine-tune neural		
			1			1	

networks hyper

parameters to achieve better

Optimize and fine-

tune neural networks hyper

				parameters to	model	
				achieve better		
					performance.	
				model		
				performance		
	General Objectives:2.0 Con	_ =		es	T	
4	2.1 Explain various neural	Explain the different	Textbooks and			
	network architectures	neural network	Research Papers.			
		architecture.				
	2.2 Explain Convolutional					
	neural networks	Discuss the different	Neural Network	Use CNN, ANN,	Guide students	
	(CNNs).	neural models such as;	Libraries, such as	EANN, RNN, or	to use CNN,	
		ANN, EANN, CNN,	TensorFlow or	GAN to solve real-	ANN, EANN,	
	2.3 Explain Recurrent	RNN, and GAN.	PyTorch.	world problem	RNN, or GAN	
	Neural Networks					
	(RNNs)					
	2.4 Explain Generative		MATLAB,			
	Adversarial Networks		SIMULINK, and			
	(GANs).		Google Colab.			
	General Objective 3.0: Und	lerstand Neural Network		ies. Transfer Learning	and Pre-trained Mo	odels
5-6	3.1 Explain optimization	Explain optimization	Textbooks and	Use gradient	Guide students	Explain
	techniques, such as	techniques:	Research Papers.	descent, stochastic	to use gradient	Advanced
	gradient descent,	- gradient descent,	1	gradient descent to	descent,	optimization
	stochastic gradient	- stochastic	Neural Network	optimize the	stochastic	algorithms
	descent.	gradient descent.	Libraries, such as	following CNN,	gradient descent	<i>G</i>
		gradient descent.	TensorFlow or	ANN, EANN,	to optimize the	
			PyTorch.	RNN, or GAN to	following CNN,	
	3.2 Explain Advanced	E1-1 A 1	1 , 101011.	solve real-world	ANN, EANN,	
	optimization algorithms	Explain Advance		problem	RNN, or GAN to	
	opullization algorithms	optimization such as;		problem	KININ, OI GAIN 10	

7-8	General Objective 4: Under 4.1 Explain various neural networks applications.	Discuss the different neural networks	MATLAB, SIMULINK, and Google Colab. oplications Textbooks and Research Papers.	Apply different neural network	solve real-world problem Use MATLAB, SIMULINK, and	Evaluate the different neural
	4.2 Explain image recognition and natural language processing.	applications. Discuss the image recognition in machine learning (ML) and	Neural Network Libraries, such as TensorFlow or PyTorch.	Apply ML to process images	Google colab to apply neural network to address realworld problems.	network applications developed by the students, and compare
	4.3 Explain speech recognition and time series prediction.	natural language processing. Discuss time series prediction and speech recognition in AI	MATLAB, SIMULINK, and Google Colab.	Apply ML to process Natural Languages and time series predictions.		the various time series predictions produce by the neural models.
	General Objective: 5.0 Con	nprehend Neural Network	Interpretability.			
9-10	5.1 Explain neural network interpretability.	Discuss neural network interpretation with real-world examples.	Textbooks and Research Papers. Neural Network Libraries, such as	Use different machine learning algorithms to carry out features selection	Guide students to use different machine learning algorithms to carry out	Evaluate students' practical projects based on their
	5.2 Explain the different methods used to interpret neural network decisions.	Discuss the different methods employed to interpret decisions obtained from neural network algorithms, and how to gain an	TensorFlow or PyTorch etc. MATLAB, SIMULINK, and Google Colab.		features selection	implementation, model performance, and ability to solve the

	5.3 Explain how to gain	insight into the				designated
	insights into the learned	features and other				tasks.
	representations and	learned				
	features.	representations				
		produced by the				
		network.				
	Objective 6.0: Understand Bi					
11-12	6.1 Explain the concepts of	Discuss the concept of	MATLAB,	Use machine	Guide students	Explain
	Bioinformatics.	Bioinformatics in	SIMULINK,	learning	to	biological data
		Neural network.	TensorFlow or	techniques to carry	use machine	types and
	6.2 Explain biological data		Keras Google	out molecular	learning	sequence
	types and sequence	Discuss the different	Colab.	structure	techniques to	analysis.
	analysis.	Bioinformatics		predictions in	carry out	
		datasets, processing	Bioinformatics	Bioinformatics	molecular	
	6.3 Explain molecular	techniques and	databases like		structure	
	structure prediction	sequence analysis	NCBI, and UniProt.		predictions in	
					Bioinformatics	
		Discuss the various				
		modular structure				
		predictions.				
General	Objective 7.0: Understand th	ne Application of Neural N	Networks in Bioinform	atics.		
13-15	7.1 Explain the usage of	Discuss how neural	MATLAB,	Implement neural	Guide students	Evaluate
	neural network in	networks are used in	SIMULINK,	network models in	to implement	students'
	Bioinformatics.	bioinformatics for	TensorFlow or	Bioinformatics	neural network	bioinformatics
		tasks such as protein	Keras Google	projects	models in	projects based
	7.2 Explain Bioinformatics	structure prediction,	Colab.		Bioinformatics	on their
	protein structure	gene expression			projects	implementation,
	prediction.	analysis, and	Bioinformatics			model
	prediction.	functional annotation.	databases like			performance,
		The general concept of	NCBI, and UniProt			and ability to

	Bioinformatics in		address specific
7.3 Explain gene	Neural network.		bioinformatics
expression analysis,			challenges.
and functional	Discuss the different		
annotation.	Bioinformatics		
	datasets, processing		
	techniques and		
	sequence analysis in		
	order to prepare data		
	for neural network.		

Natural Language Processing

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE						
COURSE TITLE: Natural Language	Course Code: AIT 326	Contact Hours: 4 hours/week				
Processing (NLP)						
CREDIT UNIT: 3	PRE-REQUISITE: Nil	Practical: 2 hours /week				
YEAR: ONE	SEMESTER: TWO	Theoretical: 2 hours/week				

GOAL: This course is designed to provide students with skills required to apply Natural Language Processing (NLP) algorithms for various applications.

General Objectives: On completion of the course, the student should be able to:

- 1.0 Understand the fundamentals of Natural Language Processing and its applications in various fields.
- 2.0 Comprehend and implement fundamental linguistic concepts
- 3.0 Understand the key NLP techniques.
- 4.0 Understand different machine learning translation models and sentiment analysis
- 5.0 Understand the application of machine learning and deep learning algorithms to improve NLP tasks.
- 6.0 Comprehend the performance of various NLP models and their optimization.
- 7.0 Understand and navigate ethical and bias considerations in NLP.

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE					
Course: Natural Language Processing (NLP) COURSE CODE: AIT 326 Contact Hours: 4 hours /week					
Credit Units: 3	Pre-Requisite: Nil	Theoretical: 2 hours /week			
	Practical: 2 hours /week				

GOAL: This course is designed to equip students with knowledge and skills necessary to understand, design, and apply NLP algorithms in various applications.

COURSE SPECIFICATION: Theoretical Contents:

Practical Contents:

General Objective: 1.0 Understand the fundamentals of Natural Language Processing and its applications in various fields.

WEEK	Speci	fic Learning	Teachers Activities	Learning Resources	Specific Learning	Teachers	Evaluation
	Outc	omes			Outcomes	Activities	
1-2	1.1	Explain the basic concepts and terminologies in NLP. Explain the applications of NLP in various fields such as healthcare, finance, and customer service.	Discuss NLP fundamentals. Discuss NLP applications.	Computer with internet access and projector for presenting lectures. Case study materials and resources. Debate topics and resources. Software tools for NLP demonstrations such as Python with NLTK or Spacy libraries	Use applications of NLP in various fields such as healthcare, finance, and customer service. Use NLP in machine learning and information retrieval.	Guide students to use applications of NLP in various fields such as healthcare, finance and customer service. Guide students to provide feedback and additional insights.	Explain the basic concepts and terminologies in NLP.
	1.3	Explain the challenges and limitations in NLP.	Discuss NLP challenges and limitations.			Guide students to use NLP for information retrieval and	

	1.4 Describe the role of NLP in information retrieval and machine learning General Objective 2.0: C				machine learning.	
3-5	 2.1 Define morphology, syntax, semantics, and pragmatics. 2.2 Explain the differences between morphology, syntax, semantics, and pragmatics. 2.3 Explain the linguistic analysis methods in NLP projects. 2.4 Explain linguistic concepts to improve machine understanding of human language. 	Discuss fundamental linguistic concepts. Explain linguistic analysis methods to text data. Discuss how linguistic concepts can improve machine understanding through examples.	Computer with internet access and projector for presenting lectures. Access to NLP software (Python, NLTK, Spacy) for lab sessions. Examples and resources illustrating the application of linguistic concepts. Computing resources for training language models	Apply knowledge of semantics and pragmatics in the construction of language models. Implement linguistic analysis methods in NLP projects. Utilize linguistic concepts to improve machine understanding of human language.	Guide students during lab sessions to implement linguistic analysis. Guide students to apply linguistic concepts in their projects. Guide students work in building language models, giving feedback and additional inputs.	Distinguish between morphology, syntax, semantics, and pragmatics.

		Understand the key NLP			T	T
6-8	 3.1 Explain tokenization in different language contexts. 3.2 Explain part-of-speech tagging and understand its significance in NLP. 3.3 Explain named entity recognition on different types of text data. 	Discuss the concept of tokenization with examples Discuss how to perform named entity recognition. Discuss process of syntactic parsing and interpretation of results	Computer with internet access and projector for delivering lectures. NLP software (Python, NLTK, Spacy) for practical sessions. Datasets for named entity recognition and syntactic parsing.	Perform syntactic parsing and interpret the results for further text analysis Implement part-of-speech tagging and understand its significance in NLP. Conduct named entity recognition on different types of text data. Provide feedback and guidance during syntactic parsing activities	Guide students through the process of syntactic parsing and interpretation of results Guide students to implement part-of-speech tagging. Guide students to conduct named entity recognition on provided datasets. Guide students to provide feedback and guidance during syntactic parsing activities.	Explain named entity recognition on different types of text data.

	General Objectives: 4.0	Understand different mac	hine learning translation	n models and sentimen	t analysis	
9-10	4.1 Explain basic principles of machine translation and its applications.4.2 Explain machine translation models using standard NLP libraries.	Discuss machine translation, its history, principles, and applications. Discuss the process of designing and implementing machine	Computer projector NLP software and libraries (Python, NLTK, Spacy, Tensorflow, PyTorch) Datasets	Use machine translation models to build NLP projects using standard NLP libraries	Guide students to use machine translation models to build NLP projects using standard NLP libraries	Explain basic principles of machine translation and its applications.
	4.3 Explain the process of sentiment analysis and its uses.	translation models using examples. Discuss the concept of sentiment analysis and its importance in data analytics.		Develop and train models for sentiment analysis.	Guide students to develop and train models for sentiment analysis	
	4.4 Explain models for sentiment analysis.	Discuss various other NLP tasks and the models used to tackle them.				

	General Objective 5.0: Understand the application of machine learning and deep learning algorithms to improve NLP tasks.						
11-12	5.1 Explain the principles of machine and deep learning as applied to NLP. 5.2 Explain machine learning algorithms for text classification, topic modeling, and other NLP tasks. 5.3 Explain deep learning methods for NLP tasks such as word embeddings and sequence-to-sequence models. 5.4 Explain the performance and accuracy of machine learning and deep learning models on NLP tasks.	Discuss machine and deep learning principles and how they're applied in NLP. Discuss machine learning algorithms for NLP tasks. Discuss deep learning methods for various NLP tasks.	Computer systems with internet access and a projector for lectures. NLP and machine learning/deep learning software libraries (Python, Scikit-learn, TensorFlow, Keras, etc). Relevant text datasets for machine learning and deep learning practice.	Apply machine and deep learning algorithms for NLP tasks. Use machine and deep learning algorithms for text classification, topic modeling, and other NLP tasks. Apply deep learning methods for NLP tasks such as word embeddings and sequence-to-sequence models. Evaluate the performance and accuracy of machine learning and deep learning models on NLP tasks.	Guide students on evaluating the performance of deep learning models and interpreting results. Guide students to apply machine and deep learning algorithms to NLP tasks. Guide students to evaluate the performance and accuracy of their models.		

Genera	l Objective 6.0: Comprehe	-	rious NLP models and t			
13-14	 6.1 Explain various performance metrics used to evaluate NLP models. 6.2 Explain the performance of different NLP models. 6.3 Explain optimization techniques to improve the performance of NLP models. 	Discuss different performance metrics used in NLP. Discuss how to evaluate NLP models. Discuss optimization techniques.	Computer systems with internet access and a projector for lectures. NLP and machine learning/deep learning software libraries (Python, Scikit-learn, TensorFlow, Keras, etc). Relevant text datasets for practicing model evaluation and optimization.	Evaluate the performance of different NLP models. Apply optimization techniques to improve the performance of NLP models. Use validation sets, cross-validation, and other techniques to assess and improve model performance.	Guide students to evaluate NLP models. Guide students in applying optimization techniques to NLP models Guide students to apply techniques like cross-validation to assess and	Explain optimization techniques to improve the performance of NLP models.
	6.4 Explain validation sets, cross-validation, and other techniques used to assess and improve model performance.				improve model performance.	

Research Methodology in AI

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
Course: Research Methodology in AI	Course Code: AIT 327	Contact Hours: 4 Hours/Week					
Credit Units: 2	Pre-requisite: NIL	Theoretical: 2Hours/Week					
YEAR: ONE	SEMESTER; TWO	Practical: 2 Hours/Week					

GOAL: This course is designed to provide students with a comprehensive understanding of the fundamental research principles, methodologies, and best practices essential for conducting effective and innovative AI research.

General Objective: On completion of this course students should be able to:

- 1.0: Understand AI Research Landscape.
- 2.0 Evaluate Research Literature
- 3.0 Design Robust AI Experiments
- 4.0 Apply Ethical Research Practices
- 5.0 Utilize AI Tools and Frameworks
- 6.0 Collaborate in Research Projects
- 7.0 Produce High-Quality Research Papers

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE Contact Hours: 4 Hours/Week Course: Research Methodology in AI Course Code: AIT 327 **Theoretical:** 2Hours/Week **Credit Units: 2 Pre-requisite: NIL** Practical: 2 Hours/Week GOAL: This course is designed to provide students with a comprehensive understanding of the fundamental research principles, methodologies, and best practices essential for conducting effective and innovative AI research. PRACTICAL CONTENT **Course Specification: THEORETICAL CONTENT** General Objective 1.0: Understand AI Research Landscape. **Specific** Teachers' Week **Specific Learning Teachers' Activities Learning Resources Evaluation Outcome** Learning Activities **Outcome** 1.1 Explain the fundamental Discuss AI concepts and Reading materials, Analyze real-Guide student to Explain the 1-2 concepts of AI and its real-world applications. case studies, and world AI analyze realfundamental applications. research papers for projects or case world AI projects concepts of AI and studies and or case studies its applications. students to explore 1.2 Explain key milestones Discuss timeline of current AI research identify their key Enumerate key and identify their and historical significant events in AI milestones and components and key components trends. developments in AI research history and challenges. and challenges. historical research. facilitate discussions. developments in AI Develop a Guide student to research. 1.3 Explain the current develop a simple simple AI state of AI research, AI prototype or Explain the current prototype or including major trends state of AI research, model using a model using a and breakthroughs. programming including major programming trends and language or AI language or AI 1.4 Explain ethical Discuss ethical issues in toolkit. toolkit. breakthroughs.

considerations and

AI research.

	challenges related to AI research. 1.5 Explain the interdisciplinary nature of AI and its collaboration with other fields	Discuss the interdisciplinary nature of AI and its collaboration with other fields.				
Genera 3-4	Objective 2.0: Evaluate Research 2.1 Explain key components	•	Reading materials,	Evaluate a	Guide student to	Define key
	of research literature.	of research literature, such as abstracts, introductions, methodologies, results, and conclusions.	case studies, and research papers for students to explore current AI research trends.	research paper and present findings in a structured manner.	evaluate a research paper and present findings in a structured manner.	components of research literature.
	2.2 Explain the credibility and reliability of research sources and identify potential biases.2.3 Explain the criteria to evaluate the quality and relevance of research	Discuss the credibility and reliability of research sources and identify potential biases. Discuss the appropriate criteria to evaluate the quality and relevance of		Compare and contrast research methodologies used in two different papers.	Guide student to Compare and contrast research methodologies used in two different papers.	Explain the credibility and reliability of research sources and identify potential biases.
	articles.	research articles.		Prepare a literature review	Guide student to Prepare a	
	2.4 Explain the strengths and weaknesses of different research methodologies used in the literature.	Discuss the strengths and weaknesses of different research		by synthesizing information from multiple research articles.	literature review by synthesizing information from	

sy m fo su	2.5 Explain how to ynthesize information from nultiple research papers to orm a coherent and well-upported argument.	methodologies used in the literature. Discuss how to Synthesize information from multiple research papers to form a coherent and well-supported argument.			multiple research articles.	
5-6 3. cc ex 3. fc qu ex 3. ap ex 3. re al	Objective 3.0: Design Robus 1.1 Explain the key components of a robust AI experiment. 2.2 Explain how to cormulate research uestions suitable for AI experimentation. 3.3 Explain how to select propriate datasets for AI experiments. 4.4 Explain how to apply elevant machine learning ligorithms to solve specific roblems.	Discuss the key components of a robust AI experiment. Discuss how to formulate research	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts, Policy documents, research papers, etc.	Apply relevant machine learning algorithms to solve specific problems. Implement proper techniques for model evaluation and validation. Perform ethical considerations in AI experiment design.	Guide student to apply relevant machine learning algorithms to solve specific problems. Guide student to Implement proper techniques for model evaluation and validation. Demonstrate to student ethical considerations in AI experiment design.	Explain the key components of a robust AI experiment. Formulate research questions suitable for AI experimentation. Explain how to Select appropriate datasets for AI experiments.

	3.5 Explain how to analyze	Discuss how to analyze				
	and interpret the results of	and interpret the results				
	-	-				
	AI experiments. f.	of AI experiments.				
	Implement proper					
	techniques for model					
	evaluation and validation.					
	3.6 Explain ethical	Discuss ethical				
	considerations in AI	considerations in AI				
	experiment design.	experiment design.				
Genera	l Objective 4.0: Apply Ethica	l Research Practices				
7-8	4.1 Explain the principles of	Discuss ethical research	Marker board,	Develop a	Guide student to	Describe the
	ethical research and their	principles, codes and	Markers,	research	develop a	principles of ethical
	importance in academic and	guidelines.	Documentary films,	proposal that	research proposal	research and their
	professional settings.		Multimedia Projector	incorporates	that incorporates	importance in
			and Screen, Case	ethical	ethical	academic and
	4.2. Explain potential	Discuss potential ethical	studies, Power point	considerations.	considerations.	professional
	ethical issues and	issues and challenges	slides, Internet,			settings.
	challenges that may arise	that may arise during	Textbooks, Computer,	Conduct	Guide student to	
	during the research process.	the research process.	Flip charts, Policy	practical on	conduct practical	Explain potential
			documents, research	ethical review of	on ethical review	ethical issues and
	4.3 Explain the ethical	Discuss the ethical	papers, etc.	an existing	of an existing	challenges that may
	guidelines and protocols to	guidelines and protocols		research study.	research study.	arise during the
	design, conduct, and report	to design, conduct, and		Prepare an		research process.
	research studies.	report research studies.		ethical data		
		_		management	Guide student to	Describe ethical
	4.4. Explain the ethical	Discuss the ethical		plan for a	prepare an ethical	guidelines and
	implications of research	implications of research		research project.	data management	protocols to design,
	findings and propose	findings and propose			plan for a	conduct, and report
	appropriate solutions.	appropriate solutions.			research project.	research studies.

4.5 Explain awareness of the ethical use of data, including privacy, confidentiality, and informed consent.	Discuss awareness of the ethical use of data, including privacy, confidentiality, and informed consent.				
9-10 5.1. Explain proficiency in using popular AI tools and frameworks 5.2. Explain AI tools to preprocess data and prepare it for model training and evaluation. 5.3. Explain AI models using the selected frameworks to solve specific problems 5.4. Explain the performance of AI models and fine-tune hyperparameters for optimization.	Discuss proficiency in using popular AI tools and frameworks, such as Mindspor, TensorFlow or PyTorch. Discuss exercises for	Marker board, Markers, Documentary films, Multimedia Projector and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts, Policy documents, research papers, etc. Mindspor, TensorFlow or PyTorch	Build and train an image classification model using TensorFlow. Fine-tune a pre-trained natural language processing model with PyTorch. Implement a simple AI-based recommendation system using a relevant framework.	Guide student to Build and train an image classification model using TensorFlow. Guide student to fine-tune a pre- trained natural language processing model with PyTorch. Guide student to Implement a simple AI-based recommendation system using a relevant framework.	Explain AI tools to preprocess data and prepare it for model training and evaluation. Explain and train AI models using the selected frameworks to solve specific problems

Genera	5.5. Explain how to integrate AI models into real-world applications and interpret their outputs. 1 Objective 6.0: Collaborate in 6.1 Explain effective	Discuss AI model integration into applications. n Research Projects Discuss effective	Marker board,	Collaborate in a	Assign students	Explain actively to
	communication and teamwork skills in a research project setting.	communication and teamwork skills in a research project setting.	Markers, Documentary films, Multimedia Projector and Screen, Case	research project with a team of peers.	to research project teams based on their interests and	research discussions and propose valuable ideas and insights.
	6.2 Explain actively to research discussions and propose valuable ideas and insights.	Discuss actively to research discussions and propose valuable ideas and insights.	studies, Power point slides, Internet, Textbooks, Computer, Flip charts, Policy	Conduct data analysis and interpretation as	expertise. Provide guidance and support to student during	Discuss with peers to divide tasks, set goals, and manage project timelines.
	6.3 Explain the management of project timelines.	Discuss with peers to divide tasks, set goals, and manage project timelines.	Mindspor, TensorFlow or PyTorch documents, research papers, etc.	part of the research project Deliver a group presentation on	data analysis and interpretation stages. Guide students to present	project time mess
	6.4 Explain data collection, analysis, and interpretation in a research project.	Discuss data collection, analysis, and interpretation in a research project.		the research project's findings	research project's	
	6.5 Explain research findings coherently and professionally to an audience.	Discuss research findings coherently and professionally to an audience.				

Genera	l Objective 7.0: Produce High	-Quality Research Papers			
14-15	7.1 Explain proficiency in	Discuss proficiency in	Marker board,		roficiency in
	conducting	conducting	Markers,	conducting	
	comprehensive literature	comprehensive literature			sive literature
	reviews and identifying	reviews and identifying	Multimedia Projector		d identifying
	research gaps.	research gaps.	and Screen, Case	research ga	aps.
			studies, Power point		
	7.2 Explain well-structured	Discuss well-structured	slides, Internet,	-	ell-structured
	research questions or	research questions or	Textbooks, Computer,	-	uestions or
	hypotheses for a research	hypotheses for a	Flip charts, Policy	hypotheses	s for a
	paper.	research paper.	documents, research	research pa	aper
			papers, etc.		
	7.3 Explain appropriate	Discuss appropriate			
	research methodologies	research methodologies			
	and data analysis	and data analysis			
	techniques to answer	techniques to answer			
	research questions.	research questions.			
	7.4 Explain how to write	Discuss how to write			
	clear, concise, and well-	clear, concise, and well-			
	organized research	organized research			
	papers adhering to	papers adhering to			
	academic writing	academic writing			
	conventions	conventions.			
	7.5 Explain how to revise	Discuss how to revise			
	and edit research papers	and edit research papers			
	based on feedback to	based on feedback to			
	improve clarity and	improve clarity and			
	coherence	coherence.			

7.6 Explain how to carry out a comprehensive literature review for a chosen research topic.			
7.7 Explain how to formulate clear and focused research questions or hypotheses.			
7.8 Explain how to write a complete research paper on a specific research topic.			

YEAR TWO SEMESTER ONE COURSES

Deep Learning

Programme: Higher National Diploma Artificial	Course Code: 412	Contact Hours: 6 Hours/Week					
Intelligence							
Course Title: Deep Learning	Credit Units: 3	Theoretical: 2 hour /week					
Year: 2 Semester: 1	Pre-requisite: AIT 313	Practical: 4 hour /week					

Goal: This course is designed to provide students with deep learning skills

General Objectives: On completion of this course the student should be able to:

- 1.0 Comprehend Deep Learning Fundamentals
- 2.0 Apply Neural Networks
- 3.0 Comprehend Advanced Deep Learning Techniques
- 4.0 Comprehend Enhanced Deep Learning Model Performance
- 5.0 Implement deep learning models on real-world datasets.
- 6.0 Understand how to leverage pre-trained models and adapt them for new applications.

1 0			COURSE COD	COURSE CODE: AIT 412		Contact Hours: 6 Hours/Week		
			Pre-requisite			Theoretical: Practical: 2 h	2 hours/week	
Goal: Th	nis course is designed to pro-	vide studei	nts with deep learn	ning skills				
COURS	E SPECIFICATION: The			Practical C	Conter	ıts:		
	General Objective: 1.0 U							T
WEEK	Specific Learning	Teacher	s Activities	Learning	_	ecific Learning		Evaluation
	Outcomes			Resources	Ou	tcomes	Activities	
1-3	1.1 Define deep learning and its significance in AI 1.2 Explain the role of neural networks in deep learning 1.3 Describe the layers and architecture of a neural network 1.4 Explain the role of activation functions	Explain to networks learning Describe architect network Explain to activation	the role of neural the layers and ure of a neural the role of neural t	- Textbooks on deep learning concepts Online articles on the significance of deep learning in AI Online tutorials explaining neural network fundamentals Visual resources illustrating neural network	Imp Bas Fee Net Bui a C Net	up a Deep arning vironment blement a sic dforward aral Network Id and Train onvolutional aral Network NN)	Guide students in installing required software and libraries for deep learning. Guide students to code and train basic feedforward neural network.	Explain the role of neural networks in deep learning
	1.5 Explain optimization algorithms in deep learning	-	ns in deep	architectures Online tutorials demonstrating activation function applications.	Tra Cor Net	e Image Style nsfer using nvolutional ural works	Guide students to build and train a CNN for image classification	

	1.6 Explain the concept of regularization and its importance 1.7 Explain the structure and organization of neural network layers. 1.8 Explain the various optimization methods. 1.9 Regularize techniques to prevent overfitting.	Explain the concept of regularization and its importance Explain the structure and organization of neural network layers. Discuss gradient descent and various optimization methods. Discuss regularization techniques to prevent overfitting.	- Research papers on optimization algorithms in deep learning Articles and tutorials on regularization in deep learning.	Perform Text Generation using Recurrent Neural Networks (RNNs) Fine-tune Pre- trained Models for Image Recognition	Guide students to implement image style transfer using CNNs. Guide students to code and train an RNN for text generation. Guide students to fine-tune a pretrain model for a specific task.	
	General Objectives: 2.0	Apply Neural Networks	<u> </u>		F	<u></u>
4-5	2.1 Explain the role of neural networks in AI 2.2 Explain the components of a neural network 2.3 Describe the process of forward and backward propagation 2.4 Explain the concept of loss functions and their optimization	Explain the role of neural networks in AI Explain the components of a neural network Describe the process of forward and backward propagation Explain the concept of loss functions and their optimization	- Textbooks on deep learning concepts Online articles on the significance of deep learning in AI Online tutorials explaining neural network fundamentals Visual resources	Implement Feedforward Neural Network for Image Classification Use Text Classification with Recurrent Neural Networks (RNNs) Generate Image using Generative Adversarial	Guide students in coding and training a neural network for image classification. Assist students in building and training an RNN for text classification.	Discuss research papers on AI security and network topics

 2.5 Explain techniques for neural network regularization 2.6 Explain how data flows and gradients are computed in neural networks. 2.7 Explain strategies for hyperparameter tuning 2.8 Explain the concept of backpropagation and gradients 2.9 Describe methods to prevent overfitting in neural networks. 	Explain techniques for neural network regularization Explain how data flows and gradients are computed in neural networks. Discuss strategies for hyperparameter tuning Explain the concept of backpropagation and gradients Describe methods to prevent overfitting in neural networks.	illustrating neural network architectures Online tutorials demonstrating activation function applications Articles and tutorials on regularization in deep learning.	Networks (GANs) Use Sentiment Analysis with Convolutional Neural Networks (CNNs) Implement Transfer Learning for Image Recognition Implement Sequence-to- Sequence Models for Language Translation Build a Custom Neural Network for a Specific Task	Guide students in implementing a GAN for image generation. Assist students in building a CNN for sentiment analysis. Guide students in applying transfer learning to a pre-trained model. Assist students in building sequence-to-sequence models for translation Supervise students in developing a	
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					custom neural network project.	
	General Objective 3.0: Co	omprehend Advanced Deep	<u> </u>	3		
6-7	3.1 Explain the fundamentals of Convolutional Neural Networks (CNNs) 3.2 Explain the role of CNNs in image analysis 3.3 Describe the structure of Recurrent Neural Networks (RNNs) 3.4 Explain RNN variations 3.5 Explain the concept of generative models 3.6 Explain the working of Generative Adversarial Networks (GANs) 3.7 Describe the concept of Transfer Learning and its application in deep learning	Explain CNN architecture and applications. Discuss how CNNs are used for image recognition tasks. Explain RNN architecture and its sequential data processing. Discuss LSTM and GRU benefits. Explain generative models and their applications. Explain the adversarial training process in GANs.	Textbooks on advanced deep learning techniques Online tutorials on CNNs. Research papers on CNN applications in computer vision. Online tutorials on RNNs and sequence modeling. Articles comparing different RNN architectures. Online resources on generative models in deep learning. Research papers on GAN theory and applications.	Classify Image using CNNs Detect Object using Faster R-CNN Generate Sequence with Long Short-Term Memory (LSTM) Implement Text Generation using Recurrent Neural Networks Implement Variational Autoencoders (VAEs)	Guide students in implementing CNNs for image classification. Assist students in implementing Faster R-CNN for object detection. Guide students in building an LSTM-based sequence generator. Assist students in developing RNN-based text generation models. Guide students in	Describe the structure of Recurrent Neural Networks (RNNs)

	General Objective 4.0: C	omprehend Enhanced Deep	, 		implementing GANs for image generation. Assist students in building VAEs for image generation.	
8-9	 4.1 Explain the concept of model optimization 4.2 Explain the role of regularization in preventing overfitting 4.3 Describe hyperparameter tuning and its impact on model performance 4.4 Discuss gradient descent and its role in model optimization 4.5 Explain the challenges and trade- 	Explain the concept of model optimization Explain the role of regularization in preventing overfitting Describe hyperparameter tuning and its impact on model performance Explain gradient descent and its role in model optimization Explain the challenges and trade-offs in model optimization	Textbooks on model optimization and deep learning Online articles on model optimization techniques. Research papers on regularization techniques in deep learning. Online tutorials on hyperparameter optimization methods.	Carry out Hyperparameter Tuning for Improved Model Performance Implement Dropout and Regularization Techniques Use Gradient Descent Optimization for Model Training Optimize a	Guide students in tuning the hyperparameters of a model. Assist students in implementing dropout and other regularization methods. Guide students in implementing gradient descent for model optimization.	Explain the role of regularization in preventing overfitting
	offs in model optimization		Online resources on gradient	Deep Learning Model	Supervise students in	

	1	T	descent		antimizing a
					optimizing a
			algorithms.		complex deep
			G 11		learning model.
			Case studies on		
			model		
			optimization in		
			real-world		
			scenarios.		
	General Objective: 5.0 In	nplement deep learning mod	lels on real-world dat	asets.	
10-12	5.1 Explain AI Bias and	Explain AI bias, its	Textbooks on AI	Carry out Bias	Guide students
	Its Impact	types, and	bias and fairness.	Detection in AI	in detecting
		consequences.		Datasets	bias in AI
	5.2 Explain Biases in AI		Research papers		datasets.
	Algorithms	Discuss biases in AI	on AI bias in	Carry out Bias	
		algorithms and models.	algorithms.	Mitigation	Assist students
	5.3 Explain Fairness			Strategies in AI	in
	Metrics for AI Decision-	Explain fairness metrics	Guidelines for	Models	implementing
	making	used in AI decision-	fairness	Carry out	bias mitigation
		making.	evaluation in AI.	Fairness	strategies.
	5.4. Explain Strategies			Evaluation in AI	
	to Mitigate Bias in AI	Discuss strategies to	Case studies on	Systems	Conduct
	Applications	mitigate bias in AI	bias mitigation in		fairness
		applications.	AI.	Carry out	evaluations of
	5.5 Explain Ethical			Fairness	AI systems.
	Considerations in AI	Discuss ethical	Ethical guidelines	Analysis in AI	
	Bias and Fairness	considerations in AI bias	for AI bias and	Decision-	Guide students
		and fairness.	fairness.	making	in developing
		and fairness.	idiliioss.	Illakilig	fairness-aware
					AI models.
					7 II models.

General	General Objective 6.0: Understand how to leverage pre-trained models and adapt them for new applications.								
13-15	6.1 Explain the concept	Explain transfer learning	Textbooks on	Fine-tune a Pre-	Guide students	Explain the			
	of transfer learning	and its applications.	transfer learning	trained Image	in fine-tuning a	different			
			in deep learning.	Classification	pre-trained	architectures			
	6.2 Describe the process	Explain how to adapt	_	Model	model for	for transfer			
	of leveraging pre-trained	pre-trained models for			image	learning			
	models	new tasks.	Online articles on	Adapt a	classification.	8			
			the benefits of	Language					
	6.3 Explain the different	Explain various pre-	transfer learning.	Model for Text	Assist students				
	architectures for transfer	trained architectures like		Generation	in adapting a				
	learning	VGG, ResNet, BERT.	Online tutorials		pre-trained				
			on using pre-	Fine-tune a Pre-	language				
	6.4 Explain the concept	Discuss how to extract	trained models in	trained Object	model for text				
	of feature extraction in transfer learning	meaningful features from pre-trained models.	deep learning.	Detection Model	generation.				
	transfer fearining	pre-trained models.	Visual resources		Guide students				
	6.5 Explain the	Explain the challenges	illustrating		in fine-tuning a				
	challenges and	and considerations in	different pre-		pre-trained				
	considerations in transfer		trained		object				
	learning	transfer learning	architectures.		detection				
	learning		dromteetares.		model.				
			Research papers						
			on feature		Supervise				
			extraction		students in				
			methods in		adapting a pre-				
			transfer learning.		trained model				
					for a domain-				
			Case studies on		specific				
			successful		problem.				
			transfer learning		L. 2011.				
			applications.						

Soft and Quantum Computing

Programme: Artificial Intelligence (Higher National	Course Code: 413	Contact Hours: 4Hours/week
Diploma)		
Course Title: Soft and Quantum Computing	Credit Units: 3	Theoretical: 2 hour /week
Year: 2 Semester: 1	Pre-requisite: AIT 313	Practical: 2 hour /week

Goal: This course is designed to provide students with knowledge and skills of soft computing and quantum techniques

General Objectives: On completion of this course the student should be able to:

- 1.0 Understand Soft Computing Concepts
- 2.0 Apply Soft Computing Techniques
- 3.0 Comprehend Fuzzy Logic Applications
- 4.0 Comprehend Evolutionary Algorithms for Optimization
- 5.0 Understand Quantum Computing Fundamentals
- 6.0 Comprehend Application of Soft and Quantum Computing
- 7.0 Understand Quantum Algorithms and Applications

Course:	Soft and Quantum Computing	ng COURSE COI	COURSE CODE: AIT 413 Contact Ho		urs: 4 Hours/Week	
Credit Units: 3		Pre-requisite:	Nil		Theoretical: 2 hours/week Practical: 2 hours/week	
	nis course is designed to prov		<u> </u>		iques	
COURS	E SPECIFICATION: Theo		Practical Co	ntents:		
	General Objective: 1.0 U			T =: - = =	T	T
WEEK	Specific Learning Outcomes	Teachers Activities	Learning Resources	Specific Learning	Teachers Activities	Evaluation
	outcomes		Resources	Outcomes	1 tell villes	
1-3	1.1 Explain the concept soft computing methodologies.	Explain the basic concepts of soft computing.	MATLAB, SIMULINK, Google Colab, and	Use Hybrid Soft Computing	Guide students to use Hybrid Soft	Explain the concept of Fuzzy logic
	1.2 Explain the concept of Fuzzy sets.	Explain the concept of Fuzzy logic, neural	Python libraries (e.g., scikit-fuzzy, TensorFlow,	Approaches.	Computing Approaches	neural networks, and
	1.3 Explain the concept of genetic algorithms, and particle swarm optimization.	networks, and evolutionary algorithms. Explain how Genetic Algorithms (GA) and Particle Swarm Optimization (PSO) techniques can be used to solve optimization problems.	PyTorch). Research papers on	Develop hybrid systems for more effective problem- solving.	Guide Students to combine different soft computing methodologies to develop hybrid systems for more effective problem- solving.	evolutionary algorithms.

	General Objectives: 2.0	Apply Soft Computing Tech	niques			
4-5	2.1 Explain the concept of different soft computing integration techniques.	Explain the concept soft computing, soft computing techniques, and integration.	MATLAB, Python Libraries, R Programming, Juzzy,	Apply Fuzzy- Neural Hybrid techniques to solve real- world	Guide students to apply Fuzzy- Neural Hybrid techniques to solve real-world	Explain the concept of Validation and Testing ML.
	2.2 Explain how to integrate various soft computing techniques to solve complex real-world problems effectively.	Explain the different Ensemble methods, such as stacking, bagging, or boosting on how to enhance the overall model.		problems	problems	
	2.3 Explain the concept of Validation and Testing ML.	Explain the different Testing and Validation techniques such as; cross-validation, and hold-out validation.				
		Comprehend Fuzzy Logic Ap			T	
6-7	3.1 Explain the applications of Fuzzy logic in decision-making.	Explain the concept of Fuzzy logic applications, and its uses in decision making.	MATLAB Fuzzy Logic Toolbox, scikit-fuzzy and fuzzy wuzzy for fuzzy logic.	Implement a Fuzzy Logic system	Guide students to implement a Fuzzy Logic system	Explain the concept of Fuzzy logic applications, and its uses
	3.2 Explain Fuzzy Set Theory, Fuzzy Logic System Design, and Fuzzy Inference Implementation.	Explain membership functions, fuzzy operations, and linguistic variables, using realworld examples for better understanding.		Create Hybrid Fuzzy-Neural Systems	Guide students to create Hybrid Fuzzy-Neural Systems.	in decision making.

	3.3 Explain Fuzzy	Explain the principles of				
	Control System.	fuzzy control systems				
		and their applications in				
		managing complex and				
		uncertain environments.				
	General Objective 4.0:	Comprehend Evolutionary A	Algorithms for Optimiz			
8-10	4.1 Explain the concept	Explain the principles	MATLAB's Global	Optimize	Guide students	Explain
	of evolutionary	and mechanics of	Optimization	Genetic	to use genetic	genetic
	algorithms.	evolutionary algorithms,	Toolbox for built-in	Algorithm	Algorithm and	algorithms
		such as; genetic	functions related to		programming to	and genetic
	4.2 Explain genetic	algorithms, genetic	optimization and	Use Genetic	evolve	programming
	algorithms and	programming, and	genetic algorithms.	Algorithm and	mathematical	
	genetic programming.	particle of swarm		Programming	expressions that	
		optimization.		for Symbolic	fit given	
			Python Libraries	Regression	datasets, such as	
	4.3 Explain different	Explain to students how	such as; such as		symbolic	
	optimization tasks.	to formulate real-world	DEAP (Distributed		regression	
		optimization problems,	Evolutionary		problems.	
		and fitness functions for	Algorithms in			
		applying evolutionary	Python), JMetal			
		algorithms.				
	General Objective: 5.0 Und	derstand Quantum Computin	ng Fundamentals			
11-12	5.1 Explain the	Explain the fundamental	Qiskit, Cirq,	Design a	Guide students	Explain the
	fundamental	principles of quantum	ProjectQ, and	Quantum	to design and	fundamental
	principles of quantum	computing, such as	Quipper.	Circuit.	implement	principles of
	computing	quantum origin, quantum			quantum circuits	quantum
		bits, and how the differs		Implement	using quantum	computing
	5.2 Explain quantum	with classical bits.		Quantum	programming	
	qubits, and quantum			Algorithm		
	Two its, and quantum				1	

	gates.	Explain superposition,		Mitigate	frameworks like	
		and how qubits exist in a		Quantum Error	Qiskit or Cirq.	
		superposition of states,				
		representing both 0 and 1				
		simultaneously.				
		Explain how quantum				
		gates manipulate qubits				
		to perform quantum				
		operations, such as				
		rotations, phase shifts,				
		and entanglement				
		operations.				
	5 2 Evaloin quantum	F1-: O				
	5.3 Explain quantum	Explain Quantum				
	algorithms, and	algorithms, such as				
	quantum	Shor's algorithm for				
	entanglement.	factoring large numbers,				
		and Grover's algorithm for unsorted database				
		search.				
Conoral	Objective 6 0. Comprehens	searcn. Application of Soft and Qu	antum Camputina			
13-14	6.1 Explain the soft and	Explain how Soft	MATLAB, Google			Explain the
10 11	quantum computing	computing techniques,	Colab, Qiskit Aqua,			soft and
	techniques.	such as fuzzy logic,	Python libraries			quantum
	1	neural networks, and	such as Quantum			computing
	6.2 Explain the	genetic algorithms, can	Neural Networks in			techniques.
	application	be combined with	Quantum Machine			
	of soft computing	quantum computing to	Learning (QML).			
	and quantum	address challenges in				

	computing	optimization, machine				
	techniques.	learning, and decision-				
	techniques.	_				
	101: 4: 7011 1 4 1	making.	1: 4:			
		Quantum Algorithms and Ap		T		
15	7.1 Explain the various	Discuss quantum	MATLAB, Google	Implement	Guide students	Explain the
	quantum algorithms.	algorithms such as	Colab, Qiskit Aqua,	Quantum and	to implement	application of
		Quantum Support Vector	Python libraries	soft algorithms	Quantum and	quantum
	7.2 Explain the	Machine (QSVM),	such as Quantum		soft algorithms	algorithms in
	application of	Quantum Generative	Neural Networks in			machine
	quantum algorithms	Adversarial Network	Quantum Machine			learning, and
	in machine learning,	(QGAN),	Learning (QML).			optimization.
	and optimization.	Quantum Approximate				
	_	Optimization Algorithm				
		(QAOA), Quantum K-				
		Means Algorithm, and				
		Quantum Neural				
		Networks (QNN).				
		Explain how the above-				
		mentioned quantum				
		algorithms can be used in				
		other machine learning				
		and optimization				
		techniques such as such				
		as regression,				
		classification, and				
		quantum-enhanced				
		1 *				
		reinforcement learning.				

AI Computing Solutions

Programme: Higher National Diploma Artificial	Course Code: AIT 414	Contact Hours: 6Hours/week		
Intelligence				
Course Title: AI Computing Solutions	Credit Units: 4	Theoretical: 2 hour /week		
Year: 2 Semester: 1	Pre-requisite:	Practical: 4 hour /week		

Goal: This course is designed to provide students with the skills to develop and deploy AI applications

General Objectives: On completion of this course the students should be able to:

- 1. Understand Basic Hardware Components of AI Processor
- 2. Understand the Various Software Architecture of AI Processor
- 3. Explore the different AI Computing Solutions
- 4. Apply AI Industrial Solutions
- 5. Explore Different AI Open Platforms
- 6. Explore Cloud Enterprise Intelligence Application Platforms
- 7. Understand the Concept of AI Applications Models Deployment

PROGR	PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE									
COURS	E: AI Computing Solutions		COURSE COL	E: AIT	T 414	Contact Hour	Contact Hours: 6 Hours/Week			
Credit l	Units: 4		Pre-requisite: N	Vil		Theoretical: 2	Theoretical: 2 hours/week			
					Practical: 4 h	ours/week				
	This course is designed to pro			s to dev						
	E SPECIFICATION: The				Practical Cor	itents:				
	Objective: 1.0 Understand					C 100				
WEEK	Specific Learning	Teacher	s Activities	Learn	ing Resources	Specific	Teachers	Evaluation		
	Outcomes					Learning	Activities			
				T 7' 1		Outcomes				
1-3	1.1 Explain the basic	-	the concept of	Visual	entations of	Compare	Guide	Explain the		
	concept of hardware acceleration acceleration and its importance in		hardw	are	performance of	students to	concept of			
			nportance in	accele	rators such as;	a CPU-based AI	compare the	hardware		
	importance in	speeding	; up AI		ei Ascend AI ssors, Google	computation.	performance	acceleration		
	speeding up AI	computa	tions.	Tenso	r Processing		of a CPU-	and its		
	computations.			Unit (TPU), Intel		based AI	importance in		
	1.2 Explain acceleration	Discuss	acceleration	Tensor Processing Unit (TPU), Intel Nervana Neural Network Processor	na Neural		computation	speeding up AI		
	techniques.	techniqu	es, such as), NVIDIA		with a	computations.		
	teeninques.	Ascent A	I processor,	Tenso	r Cores,		hardware-			
		tensor co	ore units and	Qualc	omm gon DSP		accelerated	Explain how		
		systolic	arrays that are	TICKUE	3011 D31		version using	specialized		
		used in A	AI processors.				tensor cores.	hardware units can improve		
	1.2 Examinate							the efficiency		
	1.3 Explain how		how specialized				Demonstrate	of specific AI		
	specialized hardware units can improve the		e units can			Compare the	how to	operations.		
	efficiency of specific		the efficiency			performance of	implement			
	AI operations.	of specif				a systolic array.	and evaluate			
	Ai operations.	operation	ns.				the			
							performance			

					of a systolic array for matrix multiplication in an AI processor.	
	Objective 2.0: Understand				G · 1	D 1 ' .1
4-5	2.1 Explain the basic	Discuss the various	Presentation	Identify	Guide	Explain the
	Software Architecture	processor of AI software	software	components of	students to	integration
	of AI Processor	architecture.	(e.g., PowerPoint).	software	identify the	process of AI
				architecture in	components	processors
	2.2 Explain the concept	Explain the role of each	Educational videos.	AI processors.	of software	into existing
	of Optimization	component in AI	Documents on AI		architecture	systems.
	Techniques in AI	computations.	processor		in AI	
	Processor.		optimization		processors.	Explain how to
		Discuss the concepts of	techniques.			interface AI
		vectorization and	Visualization tools	Identify	Guide	processors with
		parallelization, and	(e.g., diagrams,	different	students to	existing APIs.
		explain code	graphs)	optimization	implement	
		optimization examples.	- API	techniques.	and compare	Discuss
	2.3 Explain integration		documentation and		different	communication
	process for existing	Provide visual aids and			optimization	protocols and
	Systems.	diagrams for better			techniques	data exchange.
		comprehension.			for AI	
	2.2 Explain how to	Explain the integration			workloads	
	interface AI	process of AI processors			using .	
	processors with	into existing systems.			appropriate.	
	existing APIs.			Identify AI		
				integration	Guide	
				processor.	students to	

	2.3 Discuss communication protocols and data exchange.	Explain how to interface AI processors with existing APIs. Discuss communication protocols and data exchange.			integrate AI processors into a larger system or software architecture, considering compatibility and communicati on requirements.	
	Objective 3.0: Explore the			T		1
6-7	 3.1 Explain the different AI Computing Solutions. 3.2 Explain the application of AI Computing Solutions in various domains. 3.3 Explain the benefits of AI Computing Solutions in addressing complex problems. 3.4 Explain AI Computing Solutions Implementation. 	Explain the concept and components of AI Computing Solutions. Discuss the application of AI Computing Solutions in various domains. Explain the benefits of AI Computing Solutions in addressing complex problems. Explain how to set up and configuring AI software stacks.	AI development platforms (e.g. Huawei HCIA, and TensorFlow). AI development platforms (e.g., TensorFlow, PyTorch, scikit-lear, and MindSpore).	Develop AI applications. Set up the AI stack software.	Guide students to develop AI applications for specific tasks using appropriate AI frameworks, such as Huawei MindSpore,	Explain AI model development and deployment. Explain evaluation metrics and methodologies for AI model assessment.

	3.5 Explain AI model development and deployment.3.6. Explain how to evaluate AI Computing Solutions.	Explain AI model development and deployment. Explain evaluation metrics and methodologies for AI	AI evaluation libraries (e.g., scikit-learn) AI fairness and ethics assessment frameworks.		Guide students to Set up AI software stack on machines or cloud platforms	Discuss benchmarking and comparison with existing AI solutions.
	Computing Solutions.	model assessment. Discuss benchmarking and comparison with existing AI solutions.		Fine-Tune AI model	using MindSpore. Guide students to Fine-tune an AI models to improve robustness	
					and fairness.	
	Objectives: 4.0 Understand			1		T
8-10	4.1 Explain AI Industrial Applications	Explain the role of AI in various industrial domains.	AI application frameworks (e.g., Huawei MindSpore AI Development	Identify the different potential of AI applications in	Guide students to identify the different	Explain how to select appropriate AI algorithms and
	4.2 Explain the impact of AI on process automation and optimization.	Explain the impact of AI on process automation and optimization.	Framework, TensorFlow, scikit-learn). AI model development tools (e.g., Huawei	industrial processes.	potential of AI applications in industrial processes.	models. Explain data preprocessing techniques for industrial data.

4.3 Explain the benefits	Discuss the benefits of	ModelArts,	Develop a	Guide	Explain the
of AI integration in	AI integration in	TensorFlow,	project proposal	students to	different
manufacturing,	manufacturing,	PyTorch, Keras)	outlining AI	develop a	techniques for
logistics, predictive	logistics, predictive		integration in an	project	optimizing AI
maintenance, and other	maintenance, and other	Data preprocessing	industrial setting	proposal	models for
industrial sectors.	industrial sectors.	tools (e.g., Pandas,		outlining AI	industrial
		NumPy etc).Cloud		integration in	tasks, such as
4.4 Explain how to select	Explain how to select	platforms and APIs		an	transfer
appropriate AI	appropriate AI	(e.g., AWS, Azure,		industrial	learning and
algorithms and models.	algorithms and models.	Elastic Cloud Server		setting.	fine-tuning.
		(ECS), Object Storage			
4.5 Explain data	Explain data	Service (OBS) API,	Implement AI	Guide	Explain how
preprocessing techniques	preprocessing	Virtual Private Cloud	models for	students to	to integrating
for industrial data.	techniques for industrial	(VPC) API, Cloud	specific	implement	AI Solutions
	data.	DNS (Domain Name	industrial tasks	AI models	into Industrial Processes
		Service) API.	using relevant	for specific	Processes
4.6 Explain the different	Explain the different		datasets.	industrial	
techniques for	techniques for			tasks using	
optimizing AI models	optimizing AI models			relevant	
for industrial	for industrial			datasets.	
Processes.	tasks, such as transfer				
	learning and fine-tuning.		Evaluate AI	Guide	
			model	students to	
	Explain how to integrate		performance on	evaluate AI	
	AI Solutions into		industrial	model	
4.7 Explain how to	Industrial Processes.		datasets.	performance	
integrate AI Solutions				on industrial	
into Industrial Processes.	Discuss challenges and			datasets.	
	considerations for AI				
	implementation.				

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	4.2 Explain AI Models			Fine-tune AI	students to	
	for Industrial			models to	Fine-tune	
	applications.			improve	AI models	
				efficiency in	to improve	
	4.3 Explain AI Solution			specific	efficiency in specific	
	integration processes.			scenarios.	scenarios.	
General	Objective 5.0: Explore Diff	erent AI Open Platform				
11-12	5.1 Explain the concepts	Discuss the basic	TensorFlow	Design a simple	Guide	Discuss how to
	of AI platforms.	concepts of AI such as	Playground or	AI application	students to	use AI platform
		machine learning, deep	PyTorch, and Model	or chatbot	design a	APIs and
		learning, and natural	Arts:	especially in	simple AI	SDKs for
		language processing.	Huawei Elastic	groups	application	application
			Cloud Server		or chatbot	development.
	5.2 Explain AI	Discuss AI applications	(ECS), Google		especially in	_
	applications and use	and use cases to	Cloud Vision API,		groups.	Explain how to
	cases to illustrate the	illustrate the potential of	Microsoft Azure			integrate AI
	potential of AI	AI technologies.		Train AI model	Guide	services into
	technologies		AI Fairness 360	using accessible	students to	applications.
	8		(AIF360) toolkit,	datasets and AI	train AI	11
	5.3 Explain how to use	Discuss how to use AI		development	model using	Discuss the
	AI platform APIs and	platform APIs and SDKs	Fairness Indicators	frameworks	accessible	various ethical
	SDKs for application	for application	from TensorFlow	Turne works	datasets and	considerations
	development.	development.	for fairness		AI	regarding AI
	development.	development.	evaluation, and			
		F 1:1 4:4 4	Internal Bias		development	technologies
	5.45	Explain how to integrate	Mitigation		frameworks	deployment.
	5.4 Explain how to	AI services into	Research and			
	integrate AI services	applications.	Tools.			
	into applications			Develop a	Guide	
				computer vision	students to	
				application	develop a	

5.5 Explain AI	Discuss the various	using image	computer
Applications	ethical considerations	recognition	vision
development process.	regarding AI	APIs.	application
	technologies		using image
	deployment.		recognition
5.5 Explain case studies			APIs.
of AI bias and	Discuss case studies of		
fairness issues to	AI bias and fairness	Create a	Guide
raise awareness	issues to raise	sentiment	students to
	awareness.	analysis tool	create a
		using natural	sentiment
5.6 Explain AI	Explain the techniques	language	analysis tool
deployment and ethics.	for mitigating bias and	processing APIs	using natural
	ensuring fairness in AI		language
	models.		processing
			APIs.
		Analyze AI	Guide
		models for bias	students to
		using fairness	analyse AI
		evaluation	models for
		libraries.	bias using
			fairness
			evaluation
			libraries.
			Guide
			students to
			implement
			algorithms

General 13-14	Objective 6.0: Explore Clor 6.1 Explain cloud EI service. 6.2 Explain deep learning models' application to real-world problems. 6.3 Explain computer vision, natural language processing, and generative modeling	ad Enterprise Intelligence (Explain cloud EI service. Explain deep learning models' application to real-world problems. Explain computer vision, natural language processing, and generative modeling.	EI) Application Platform MindSpore by Huawei, PyTorch, TensorFlow by Google, and MXNet By Apache Software Foundation (ASF).	Carry out practical on AI-enabled edge computing platforms	for bias correction and fairness enhancement Guide students to use different AI-enabled edge computing platforms such as; Huawei HiLens Platform, Google Cloud IoT Edge, AWS IoT Greengrass, and Microsoft Azure IoT Edge	Explain cloud EI service. Explain deep learning models' application to real-world problems. Explain computer vision, natural language processing, and generative modeling
Genera	Objective 7.0: Understand	the Concept of AI Applicat	tions Models Deployme	ent		
15	7.1 Explain the necessary tools needed for AI model deployment.	Discuss AI models development process, such as; - Data preparationModel training.	ModelArts, TensorFlow Playground or PyTorch.			

- Model deployment.		
- Application		
development.		

AI Project Management

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PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
COURSE TITLE: AI Project Course Code: AIT 415 Contact Hours: 4Hours/week							
Management							
CREDIT UNIT: 2	PRE-REQUISITE:	Theoretical: 2 hours /week					
YEAR: TWO SEMESTER: ONE Practical: 2 hours /week							

GOAL: This course is designed to provide students with the skills to manage Artificial Intelligence projects

General Objectives: On completion of the course, the student should be able to:

- 1.0 Understand the fundamentals of project management and its application to AI projects.
- 2.0 Appreciate the unique challenges and requirements of managing AI projects.
- 3.0 Apply traditional and agile methodologies to AI projects.
- 4.0 Develop a project plan.
- 5.0 Understand how to apply best practices for team management in AI projects.
- 6.0 Use project management tools relevant to AI projects.
- 7.0 Understand the ethical considerations, privacy issues, and legal implications inherent in AI project management.

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE							
COURS	SE: AI Project Managem	nent	COURSE CODE: AI	T 415	Contact Hours: 4 Hours/Week		
Credit	Credit Units: 2		Pre-requisite: Nil		Theoretical: 2 hours/week Practical: 2 hours/week		
GOAL:	This course is designed	to equip students with	the knowledge and sl	cills necessary to mar	nage Artificial Intellige	nce projects.	
COURS	SE SPECIFICATION: '	Theoretical Contents	:	Practical Content	ts:		
	General Objective: 1.	.0 Understand the fund	damentals of project m	nanagement and its ap	plication to AI projects	S	
WEEK	Specific Learning	Teachers Activities	Learning	Specific Learning	Teachers Activities	Evaluation	
	Outcomes		Resources	Outcomes			
1-3	1.1 Explain the principles of project management including project initiation, planning, execution, control, and closure.	Explain the fundamentals of project management, focusing on its application in AI.	Learning Management System for content delivery. Access to case studies related to AI project management. Access to project management software or tools.			Explain the principles of project management including project initiation, planning, execution, control, and closure.	
	1.2 Explain key differences between managing AI projects and other types of projects.	Explain key differences between managing AI projects and other types of projects.					

	1.3 Explain the specific challenges of managing AI projects.	Discuss the specific challenges of managing AI projects like data gathering, data cleaning, model selection, training and testing, deployment, and maintenance the specific challenges of managing AI projects.				
	General Objective 2.0	Appreciate the unique	challenges and requi	rements of managing	AI projects.	
4-5	2.1 Explain the unique challenges involved in AI projects 2.2 Explain strategies to mitigate these challenges, such as effective data management, selection of appropriate AI	Explain the unique challenges involved in AI projects such as data acquisition, data privacy, model selection, model interpretability, and deployment issues. Explain strategies to mitigate these challenges, such as effective data management, selection of appropriate AI	Moodle, Blackboard, Microsoft Power BI Microsoft Office 365 Teams, Google Doc, Teamviewer	Use LMS for content delivery such as Moodle, Blackboard, MS Power BI. Use Collaboration tools for brainstorming and group discussions	Guide students to use LMS for content delivery such as Moodle, Blackboard, MS Power BI Guide students to use Collaboration tools for brainstorming and group discussions	Explain the unique challenges involved in AI projects such as data acquisition, data privacy, model selection, model interpretability, and deployment issues

	models, and a robust testing and deployment process.	models, and a robust testing and deployment process.				
	2.3 Explain the importance of cross-functional collaboration in AI projects.	Explain the importance of cross-functional collaboration in AI projects, including coordination with data scientists, software engineers, business stakeholders, and others.				
Genera	l Objective 3.0: Apply to		thodologies to AI pro	iects.		
6-7	3.1 Explain the principles and processes of traditional project management methodologies and their potential use in AI projects. 3.2 Explain the principles and	Explain the principles and processes of traditional project management methodologies and their potential use in AI projects. Explain the principles and processes of agile	Moodle, Blackboard, Microsoft Power BI MS Project Primavera	Apply Moodle, Blackboard, Microsoft Power BI MS Project to manage AI Project	Guide students to apply Moodle, Blackboard, Microsoft Power BI MS Project to manage AI Project	Explain both traditional and agile project management methodologies to hypothetical AI projects, determining which approach (or combination thereof) is most

processes of agile	project	Microsoft Office		suitable in different
project	management	365 Teams,		circumstances.
management methodologies	methodologies and how their iterative	Google Doc, Teamviewer		
and how their iterative approach can accommodate the uncertainties and evolving nature of AI projects.	approach can accommodate the uncertainties and evolving nature of AI projects.			
3.3 Describe both traditional and agile project management methodologies to hypothetical AI projects, determining which approach (or combination thereof) is most suitable in different circumstances.	Explain both traditional and agile project management methodologies to hypothetical AI projects, determining which approach (or combination thereof) is most suitable in different circumstances.			

	General Objectives: 4	.0 Develop a project p	lan.			
9-10	4.1 Explain the scope of an AI project, including how to set realistic goals and objectives.	Explain various components of a comprehensive project plan for an AI project.	MS Project, Primavera	Use Project management tools to plan and allocate resources for AI projects	Guide students to use Project management tools to plan and allocate resources for AI projects	Explain risk management within the context of AI projects, including identifying,
	4.2 Explain how to develop a feasible timeline for an AI project, accounting for various stages of the AI development process.	Explain how to develop a feasible timeline for an AI project, accounting for various stages of the AI development process.		Use Project management tools to develop timeline for AI projects	Guide students to use Project management tools to develop timeline for AI projects	analyzing, and mitigating potential risks.
	4.3 Explain resource planning and allocation for an AI project, recognizing the unique resource needs of AI projects.	Explain resource planning and allocation for an AI project, recognizing the unique resource needs of AI projects.		Use Project management tools to analyse and mitigate risks in AI projects	Guide students to use Project management tools to analyse and mitigate risks in AI projects	

	4.4 Explain risk management within the context of AI projects, including identifying, analyzing, and mitigating potential risks.	Explain risk management within the context of AI projects, including identifying, analyzing, and mitigating potential risks.				
Genera 11-12	Objective: 5.0 Underst		practices for team ma		Guide students to	E 1 1 1
11-12	 5.1 Explain the dynamics and unique challenges of managing crossfunctional teams in AI projects. 5.2 Explain strategies for effective communication and collaboration within a crossfunctional AI team. 	Explain the best practices of team management, particularly in the context of AI projects. Explain strategies for effective communication and collaboration within a cross-functional AI team.	365 Teams Google Doc, Teamviewer MS Project Primavera Access to case studies literature, and industry reports on team management in AI projects. Project management software and collaboration tools	Use project management tools for collaboration in AI project	use project management tools for collaboration in AI project	Explain the nuances of managing remote teams, particularly in the context of AI projects.
	5.3 Explain the nuances of managing remote	Explain the nuances of managing remote teams, particularly	that students can use to practice managing virtual teams.			

	tooms	in the context of AI				
	teams,					
	particularly in the	projects.				
	context of AI					
	projects.					
	5.4 Explain Leverage project management tools and technology for effective team management in AI projects.	Explain project management tools and technology for effective team management in AI projects.				
General	Objective 6.0: Use pro	ject management tools	relevant to AI project	S		
13-14	6.1 Explain of project management tools, software and their application in managing AI projects. 6.2 Explain various project management tools, such as Jira, Trello, and Asana, among others.	Explain of project management tools, software and their application in managing AI projects. Explain various project management tools through demonstrations or tutorials.	MS Project Primavera Computer lab or personal computers with internet access. Subscription or access to various project management tools (e.g., Jira, Trello, Asana). Training materials or guides for using these tools.	Simulate AI project using these tools for project management.	Guide Students to simulate AI project using these tools for project management.	Explain the appropriate tools based on the unique requirements of different AI projects.

	6.3 Explain the appropriate tools based on the unique requirements of different AI projects.	Explain the appropriate tools based on the unique requirements of different AI projects.				
	6.4 Explain the role of these tools in team collaboration, project tracking, resource management, and risk management in AI projects.	Explain the role of these tools in team collaboration, project tracking, resource management, and risk management in AI projects.				
General	Objective 7.0 Understan	d the ethical considera	tions, privacy issues,	and legal implications	s inherent in AI project	management
15	7.1 Explain the ethical considerations in managing AI projects. 7.2 Describe privacy issues in AI projects, especially related to data management.	Discuss the ethical, privacy, and legal issues in AI project management. Explain how these issues can arise in real-world AI projects and how they can be managed.	Classroom or virtual learning platform for lectures and discussions. Access to research papers, articles, and case studies related to ethical, privacy, and legal issues in AI.			Describe privacy issues in AI projects, especially related to data management.

7.3 Explain the	Explain the legal		
legal	implications of AI		
implications	projects, such as		
of AI projects.	intellectual property		
	rights, compliance		
	with data protection		
	laws, and other		
	regulations.		
7.4 Explain the potential impacts of ignoring these considerations and issues	Explain the potential impacts of ignoring these considerations and issues		

YEAR TWO SEMESTER TWO COURSES

Networks Security for AI

Programme: Higher National Diploma Artificial Intelligence	Course Code: 421	Contact Hours: 4 hours /week
Course Title: Networks Security for AI	Credit Unit: 2	Theoretical: 2 hours /week
Year: 2 Semester: 2	Pre-requisite: AIT 313	Practical: 2 hours /week
	Tre-requisite. Arr 515	Tractical. 2 hours/week

Goal: This course is designed to provide students with knowledge and skills in networks security for AI.

General Objectives: On completion of this course the student should be able to:

- 1.0 Understand AI Security Concept
- 2.0 Understand Network Architecture for AI
- 3.0 Comprehend AI Model Deployment Security
- 4.0 Comprehend Network Security for AI Systems
- 5.0 Understand AI and Internet of Things (IoT) Security Integration
- 6.0 Comprehend AI Privacy and Regulatory Compliance
- 7.0 Understand threats to AI data sent on the network

PROGR	AMME: HIGHER NATIO	ONAL DII	PLOMA ARTIFIC	CIAL INTELLIGEN	CE			
Course:	Security and Networks for A	ΑI	COURSE COD	E: AIT 421	Contact H	Contact Hours: 4 hours /week		
Credit U	Jnits: 2		Pre-requisite: N	il	Theoretica	l: 2 hours /week		
					Practical:	2 hours /week		
	nis course is designed to pro					I.		
COURS	E SPECIFICATION: The			Practical Co	ntents:			
	General Objective: 1.0 U							
WEEK	Specific Learning	Teacher	s Activities	Learning	Specific	Teachers	Evaluation	
	Outcomes			Resources	Learning	Activities		
					Outcomes			
1-3	1.1 Explain AI security		the concept of AI	` =	Apply Open	Guide students	Discuss the	
	concept.	security.		Web Application	Web	to assess and	different AI	
	1.2 Explain AI systems		1 1100	Security Project)	Application	improve the	data privacy	
	security including		the different AI	for securing AI	Security	security of AI	issues and	
	Data privacy, and		acy issues and	systems.	Project to	applications	security models	
	security models.	security	models.	NICT	assess AI	and model		
		D.	41 1°CC 4 A T	NIST	systems	deployment.		
			the different AI	Cybersecurity Framework and				
		systems	security issues.	ISO/IEC 27001 for		Guide students		
		Eveloin	a decama ani a 1		Simulate AI	to use network		
	1.3 Explain adversarial	-	adversarial n AI Data.	securing AI	Network.	simulation		
	attacks on AI Data.	attacks o	n Al Data.	applications and networks.	Network.	tools to		
				HELWOIKS.				
						experiment with different		
						network		
I						architectures		

					and security	
					configurations.	
	General Objectives: 2.0	Understand Network Archite	ecture for AI			
4	2.1 Explain the concept of network architecture and infrastructure. 2.2 Explain the necessary network infrastructure that support AI applications 2.3 Explain distributed computing, edge computing, and cloud	Discuss the various AI network architecture and infrastructure. Discuss the necessary architectures and infrastructures required for AI applications deployment such as distributed computing, edge computing, and cloud networking.	White board. TensorFlow Privacy, PySyft, Adversarial Robustness Toolbox (ART)			Discuss research papers on AI security and network topics
	networking.	oroug nevivoring.				
		omprehend AI Model Deplo	yment Security	I.	l	<u> </u>
5-6	3.1 Explain the different techniques and practices of securing AI models. 3.2 Explain how to protect deployed AI models in production environments.	Discuss data privacy measures to protect sensitive information used for training AI. Discuss homomorphic encryption to allow computations on encrypted data without decrypting it to ensuring data privacy.	White board. TensorFlow Privacy, PySyft, Adversarial Robustness Toolbox (ART)	Use Python Libraries, or Google Colab to show students how to secure AI models.	Guide students to use Python Libraries, or Google Colab to show students how to secure AI models.	Explain how to use model deployment mechanisms to ensure that AI models are hosted on trusted servers and accessed through secure channels.

	3.3 Explain how to maintain the confidentiality and integrity of AI models and data.	Explain how to use model deployment mechanisms to ensure that AI models are hosted on trusted servers and accessed through secure channels.	S. A.I. S. A.I. S.			
7-8	4.1 Explain network security principles for AI systems. 4.2 Explain secure communication protocols, and access controls. 4.3 Explain intrusion detection in AI applications.	Discuss the principles for AI systems such as; Model Integrity and Authenticity, Secure APIs and Communication, Secure Data Storage and Transmission. Discuss Access Control and Authorization, and intrusion detection in AI application	White board. TensorFlow Privacy, PySyft, Adversarial Robustness Toolbox (ART)	Perform Regular Security Audits and Monitoring. Carry out Threat Modeling and Risk Assessment	Guide students on how to secure and monitor AI applications and data	Explain intrusion detection in AI applications.
	* *	nderstand AI and Internet of	Things (IoT) Security	Integration		
9-10	 5.1 Explain the concept of Internet of Thing (IoT). 5.2 Explain how AI and Internet of Things (IoT) technologies 	Discuss the concept of IoT. Discuss the intersection between AI and IoT, and different AI-IoT	White board. TensorFlow Privacy, PySyft, Adversarial Robustness	Use IoT Device Security.	Guide students to analyze the security vulnerabilities of different IoT devices,	Explain the various challenges associated with the above mention AI-IoT
	intersect.	technologies such as;	Toolbox (ART)		such as smart	technologies.

General	5.3 Explain the security challenges associated with AI-powered IoT devices.	Smart cities, smart homes, predictive maintenance, and Healthcare IoT with AI analytics. etc. Explain the various challenges associated with the above mention AI-IoT technologies.	Compliance	Simulate Adversarial Attack	home devices, wearables, or industrial sensors. Guide students to launch adversarial attacks on AI models integrated with IoT systems. Guide Students to experiment with techniques like adversarial inputs to understand AI model vulnerabilities	
11-12	6.1 Explain the concept	Discuss the concepts of	White board.			Explain the
	of data privacy,	AI privacy, data				different
	regulations, and legal	protection laws, and	PC with internet			methods used
	considerations.	regulatory compliance,	connection.			to ensure
	6.2 Explain AI data	such as GDPR (General				compliance,
	privacy and	Data Protection				

	regulations for AI	Regulation) and CCPA	GDPR Guidelines,			and protect AI
	application.	(California Consumer	CCPA Resources,			user privacy.
	6.3 Explain the different	Privacy Act)	and AI Ethics			
	methods used to ensure		Guidelines.			
	compliance and protect					
	AI user privacy.					
Genera	Objective 7.0: Understand	the threats to AI data sent of	n the network			
13-15	7.1 Explain AI Data	Discuss the various	Encryption	Encrypt and	Guide students	Explain the
	Vulnerabilities.	vulnerabilities and	Libraries and Tools	decrypt AI data	to encrypt and	various
		threats that AI data faces	such as; OpenSSL	using different	decrypt AI	vulnerabilities
		when transmitted over	and GnuPG	encryption	data using	and threats that
		networks, including		techniques	different	AI data faces
		interception,			encryption	when
		eavesdropping, data			techniques,	transmitted
		tampering, and			emphasizing	over networks,
		unauthorized access.			the importance	including
	7.2 Evalaia Natavaula				of encryption	interception,
	7.2 Explain Network	Discuss the different			for data	eavesdropping,
	Security Protocols.	network security			protection	data tampering,
		protocols, such as				and
		HTTPS, SSL/TLS, and				unauthorized
		VPN, and their role in				access.
		protecting AI data during				
		transmission.				
	7.3 Describe encryption	Discuss encryption				
	Techniques for AI	techniques, such as				
	Data.	symmetric and				
		asymmetric encryption				
		works, and how they can				

	be applied to secure AI
	data sent over networks.
7.4 Explain Threat	Discuss proposed
Mitigation Strategies	appropriate threat
	mitigation strategies,
	such as using secure
	communication channels,
	implementing access
	controls, and performing
	regular security audits.

Robotics and Intelligent System

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE						
COURSE: Robot	ics and Intelligent System	CODE: 422	Credit Unit: 3	Contact Hours: 4Hours/week		
GOAL: This course is designed to provide students with knowledge and skills in robotics and intelligent systems						
YEAR: TWO	SEMESTER: TWO	PRE-REQUISIT	E: Nil	Theoretical: 2 Hours/week		
				Practical: 2 Hours/week		

GENERAL OBJECTIVES: On completion of this course, the students should be able to:

- 1.0 Understand the fundamental of robotics and intelligent systems.
- 2.0 Understand robotic components, sensors, actuators, effectors, and control mechanisms.
- 3.0 Design intelligent robotic systems for real-world applications.
- 4.0 Understand artificial intelligence and machine learning techniques in robotics for enhanced decision-making and autonomy.
- 5.0 Understand problem-solving skills by analyzing and optimizing robotic algorithms and behaviours.
- 6.0 Design projects and simulate robotic systems.
- 7.0 Comprehend ethical considerations and practices in the use of robotic systems.

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE **Course: Robotics and Intelligent System** Course Code: 422 **Contact Hours:** 4Hours/week **Theoretical:** 2 Hours/week **Credit Unit: 3 Pre-requisite: NIL Practical:** 2 Hours/week **GOAL:** This course is designed to provide students with knowledge and skills in robotics and intelligent systems Course Specification: Theoretical Content: **Practical Content: GENERAL OBJECTIVE 1.0:** Understand the fundamental of Robotics and intelligent systems. PRACTICAL CONTENT **Course Specification:** THEORETICAL CONTENT **Teachers' Activities** Week **Specific** Learning **Learning Resources Specific** Learning Teachers' **Evaluation** Outcome **Outcome Activities** Marker board. 1-2 3.1 Explain the Discuss robotics Design a Robotic Guide student to Explain the principles and System Architecture design a Robotic fundamentals of Markers, fundamentals of technologies. System robotics and intelligent Documentary films, robotics and Architecture intelligent systems systems Multimedia Projector Discuss on robotic 3.2 Explain the key and Screen, Case components and **Build and Program** Guide student to components of robotic studies, Power point technologies. Robotic Prototypes build and program systems slides, Internet, Robotic Prototypes 3.3 Explain the Textbooks, Discuss applications of applications of Computer, Flip robotics and intelligent Guide student to robotics and Explain the key charts, research Implement Intelligent systems implement components of intelligent systems papers etc. Algorithms in Robotics Intelligent 3.4 Explain the principles robotic systems Discuss principles of Algorithms in of robotic control robotic control and

systems

3.5 Explain the

robotics

integration of AI and

machine learning in

motion planning

Discuss AI and

robotics

machine learning in

Robotics

Behaviors

Guide student to

Simulate Robotic

Simulating Robotic

Behaviors

				Develop Autonomous	Guide student to	
				Robotic Systems	Carry out an	
					experiment on	
					developing	
					Autonomous	
					Robotic Systems	
Genera	I Objective 2.0: Understand	l robotic components, sens	sors, actuators, effectors,	, and control mechanisms	•	
3-4	2.1 List the types of	Enumerate the types of	Marker board,	Identify Robotic	Guide student to	List the types of
	robotics and the	robotics and the	Markers,	Components	Identify Robotic	robotics and the
	functions of its	functions of its	Documentary films,		Components	functions of it
	components	components	Multimedia Projector			components
			and Screen, Case	Integrate Sensors in	Guide student to	
	2.2. Explain the principles	Discuss the principles	studies, Power point	Robotic Systems	Integrate Sensors	
	and operation of	and operation of	slides, Internet,		in Robotic Systems	Discuss safety
	sensors in robotics	sensors in robotics	Textbooks,			considerations in
			Computer, Flip	Building and	Guide student to	handling robotic
	2.3. Explain the functions	Discuss the functions	charts, research	Controlling Robotic	build and Control	components
	and types of robotic	and types of robotic	papers etc.	Actuators	Robotic Actuators	
	actuators	actuators				
	2.4. Explain the principles	Explain the principles		Program and Tune	Guide student to	
	of robotic control	of robotic control		Robotic Control	Carry out practical	
	mechanisms	mechanisms		Systems	on Programming	
					and Tuning	
	2.5. Explain the	Discuss the			Robotic Control	
	applications of robotic	applications of robotic			Systems	
	components, sensors,	components, sensors,				
	and actuators	and actuators		Design Robotic	Guide student to	
				Systems with	design Robotic	
					Systems with	

	2.6. Explain safety	Explain safety		Components, Sensors,	Components,				
	considerations in	considerations in		and Actuators	Sensors, and				
	handling robotic	handling robotic			Actuators				
	components	components							
GENE	GENERAL OBJECTIVE 3.0: Design intelligent robotic systems for real-world applications.								
5-6	3.1. Explain the principles	Discuss the principles	Marker board,	Design Intelligent	Guide student to	Explain the			
	of intelligent robotic	of intelligent robotic	Markers,	Robotic System	design Intelligent	programming			
	systems	systems	Documentary films,	Architecture	Robotic System	languages and			
			Multimedia Projector		Architecture	frameworks for			
	3.2. Explain the	Discuss the	and Screen, Case			robotics			
	programming languages	programming	studies, Power point						
	and frameworks for	languages and	slides, Internet,	Program Intelligent	Guide student to	Explain real-			
	robotics	frameworks for	Textbooks,	Robotic Systems	program Intelligent	world applications			
		robotics	Computer, Flip		Robotic Systems	of intelligent			
			charts, research			robotic system			
	3.3. Explain AI and	Explain AI and	papers etc.		Guide student to				
	machine learning	machine learning		Implement Machine	implement				
	techniques for robotics.	techniques for		Learning in Robotic	Machine Learning				
		robotics.		Applications	in Robotic				
					Applications				
	3.4. Explain the concept of	Discuss the concept of							
	sensory perception in	sensory perception in							
	robotics	robotics		T 1 (C '	Guide student to				
				Implement Sensing	implement Sensing				
	3.5. Explain real-world	Discuss the real-world		and Perception in	and Perception in				
	applications of intelligent	applications of		Robotic Systems	Robotic Systems				
	robotic system	intelligent robotic							
		system			Guide student to				
					build and Test				
					Dunu and Test				

	3.6. Explain the	Explain the		Build and Test	Intelligent Robotic	
	importance of ethical	importance of ethical		Intelligent Robotic	Prototypes	
	considerations in robotic	considerations in		Prototypes		
	systems	robotic systems			Guide student to	
					Troubleshoot and	
				Troubleshoot and	Debug Intelligent	
				Debug Intelligent	Robotic Systems	
				Robotic Systems		
					Guide student to.	
					Integrate Ethical	
				Integrate Ethical	Principles in	
				Principles in Robotic	Robotic System	
				System Development	Development	
GENE	RAL OBJECTIVE 4.0: Unde	erstand Artificial Intelligo	ence and Machine Learni	ng techniques in robotics	for enhanced decision	-making and
autono	3	T	T	1	1	
7-9	4.1. Explain the principles	Discuss the	Marker board,	Implement AI	Guide student to	Explain the
	of Artificial Intelligence	principles of	Markers,	Algorithms in Robotic	implement AI	principles of
	(AI) in robotics	artificial intelligence	Documentary films,	Systems	Algorithms in	artificial
		(AI) in robotics	Multimedia Projector		Robotic Systems	intelligence (AI)
			and Screen, Case			in robotics
	4.2. Explain machine	Discuss machine	studies, Power point	Develop Autonomous	Guide student to	
	learning techniques for	learning techniques	slides, Internet,	Robotic Systems with	develop	Explain machine
	robotic applications	for robotic	Textbooks, Computer,	ML	Autonomous	learning
		applications	Flip charts, research		Robotic Systems	techniques for
			papers etc.		with ML	robotic
	4.3. Explain AI-based	Explain AI-based				applications
	decision-making in robotic	decision-making in		Integrate	Guide student to	
	systems	robotic systems		Reinforcement	Integrate	
					Reinforcement	

	4.4. Explain the concept of	Explain the concept	Learning in Robotic	Learning in	Describe the
	robot autonomy and its	of robot autonomy	Control	Robotic Control	concept of robot
	significance	and its significance			autonomy and its
	4.5. Explain AI-driven path	Explain AI-driven			significance
	planning and navigation in	path planning and	Simulate Autonomous	Guide student to	
	robotics	navigation in	Robotic Behaviors	Simulate	Explain the
		robotics		Autonomous	importance of
	4.6. Explain the importance	Explain the		Robotic Behaviors	safety and
	of safety and robustness in	importance of safety			robustness in AI-
	AI-driven robotics	and robustness in AI-	Implement AI	Guide student to	driven robotics
		driven robotics	Navigation in Mobile	Implement AI	
			Robots	Navigation in	
				Mobile Robots	
			Troubleshoot AI and	Guide student to	
			ML Integration in	Troubleshoot AI	
			Robotic Systems	and ML	
				Integration in	
				Robotic Systems	
			I1	January Cafe (
			Implement Safety	Implement Safety	
			Measures in AI-	Measures in AI-	
			Enabled Robotic	Enabled Robotic	
1			Systems	Systems	

10-11	5.1Explain the principles of	Discuss the principles	Marker board,	Analyze and Optimize	Guide student in	Explain the
	robotic algorithms	of robotic algorithms	Markers,	Robotic Algorithms	Analyzing and	principles of
	_	_	Documentary films,	_	Optimizing	robotic
	5.2 Explain optimization	Discuss optimization	Multimedia Projector		Robotic	algorithms
	techniques for robotic	techniques for	and Screen, Case		Algorithms	Explain
	systems	robotic systems	studies, Power point	Implement		optimization
			slides, Internet,	Optimization in	Guide student in	techniques for
	5.3 Explain the efficiency	Explain the	Textbooks, Computer,	Robotic Behaviors	Implementing	robotic systems
	and effectiveness of	efficiency and	Flip charts, research		Optimization in	Describe the
	robotic algorithms	effectiveness of	papers etc.		Robotic Behaviors	efficiency and
		robotic algorithms				effectiveness of
				Improve Robotic Path	Guide student in	robotic
	5.4 Explain the challenges	Discuss the		Planning and	Improving Robotic	algorithms
	and complexities of	challenges and		Navigation	Path Planning and	
	robotic behaviors	complexities of			Navigation	
		robotic behaviors				
				Debug and Enhance	Guide student to	
	5.5 Explain machine	Explain machine		Robotic Behaviors	Debug and	
	learning techniques for	learning techniques			Enhance Robotic	
	behavior optimization	for behavior			Behaviors	
		optimization		т 1		
	5 C Francis di l'imperiore	Diagnas 4h -		Implement	Guide student in	
	5.6 Explain the importance	Discuss the		Reinforcement	Implementing	
	of iterative refinement	importance of		Learning in Behavior	Reinforcement	
	in robotics	iterative refinement in robotics		Optimization	Learning in Behavior	
		in robotics			Optimization	
					Opulliization	
İ						

				Troubleshoot Algorithmic Issues in Robotic Systems	Guide students In Troubleshooting Algorithmic Issues in Robotic Systems	
	Objective 6.0: Design projects				<u></u>	
12-14	6.1 Explain the importance of hands-on experience in robotics	Explain the importance of hands-on experience in robotics	Marker board, Markers, Documentary films, Multimedia Projector	Build and Assemble Robotic Systems Simulate Robotic	Guide student in Building and Assembling Robotic Systems	List the various robotic system components and functions
	6.2 List the various robotic system components and functions	List the various robotic system components and functions	and Screen, Case studies, Power point slides, Internet, Textbooks, Computer, Flip charts, research	Behaviors Integrate Sensors and Actuators in Practical	Guide student in Simulating Robotic Behaviors Guide students in	
	6.3 Explain how to interpret simulation results for robotic systems	Explain how to interpret simulation results for robotic systems	papers etc.	Projects	Integrating Sensors and Actuators in Practical Projects	Explain how to interpret simulation results for robotic
	6.4 Explain the process of experimental design in robotics	Discuss the process of experimental design in robotics		Collaborate in Project Development	Guide student to in Collaborative Project Development	systems
	6.5 Enumerate different sensors and actuators in practical projects	Enumerate different sensors and actuators in practical projects		Document and Reflect on Practical Projects	Guide student in Documentation	

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	6.6 Explain documentation	Discuss			and Reflection on				
	and reflection in	documentation and			Practical Projects				
	practical projects	reflection in practical							
		projects							
GENERA	GENERAL OBJECTIVE: 7.0 . Comprehend ethical considerations and practices in the use of robotic systems.								
15	7.1 Explain the ethical	Explain 7.1 to 7.6	•	Carry out Ethical	Guide student to	Explain the			
	implications in robotic	with detailed note.		Analysis of Robotic	Carry out Ethical	ethical			
	system design			System Designs	Analysis of	implications in			
				~ J * * * * * * * * * * * * * * * * * *	Robotic System	robotic system			
	7.2. Explain responsible				Designs	design			
	practices for deploying				Designs	design			
	robotic systems								
	Tobolic systems			Davidan Daananaihla	0:1 . 1 .:	Evaloia actoutical			
	72 5 1:			Develop Responsible	Guide student in	Explain potential			
	7.3. Explain potential			Deployment Strategies	Developing	ethical challenges			
	ethical challenges in the				Responsible	in the use of			
	use of robotic systems				Deployment	robotic systems			
					Strategies				
	7.4. Explain the importance					Explain the			
	of transparency in robotic			Address Ethical	Guide student in	importance of			
	decision-making			Challenges in Robotic	Addressing Ethical	transparency in			
				System	Challenges in	robotic decision-			
	7.5. Explain fairness and			, and the second	Robotic System	making			
	accountability in robotic				Robbite System				
	systems				G :1 , 1 , ,				
	- Systems			Implement	Guide student to				
	7.6. Explain continuous			Transparent Decision-	Implement				
	_			1 -	Transparent				
	learning and adaptation of			Making in Robotic	Decision-Making				
	ethical practices			Systems	in Robotic				
					Systems				

		Evaluate Fairness and	Guide student to
		Accountability in	Evaluate Fairness
		Robotic Systems	and Accountability
			in Robotic
			Systems
		Carry out Ethical	Guide student to
		Dilemma Role-	Carry out Ethical
		Playing and Analysis	Dilemma Role-
			Playing and
			Analysis
		Carry out Reflective	Guide student to
		Ethical Practice in	Carry out
		Robotic System	Reflective Ethical
		Development	Practice in
			Robotic System
			Development

ASSESSMENT: The continuous assessment; tests and quizzes will be awarded 40% of the total score. The end of the Semester Examination will make up for the remaining 60% of the total score.

Web and Mobile Application Development

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE									
COURSE TITLE: Web and Mobile Application Development Course Code: AIT 423 Contact Hours: 4 Hours/week									
CREDIT UNIT: 2	PRE-REQUISITE:	Theoretical: 2 Hours/week							
YEAR: TWO	YEAR: TWO SEMESTER: TWO Practical: 2 Hours/week								

GOAL: This course is designed to provide the student with the knowledge and skills required to develop and deploy web and mobile applications

General Objectives: On completion of the course, the student should be able to:

- 1.0 Understand Web Technologies such as HTML, CSS, and JavaScript
- 2.0 Understand Mobile Application Development for both Android and iOS platforms using relevant Frameworks
- 3.0 Understand Backend Development in Server-side Programming Languages
- 4.0 Understand User Experience (UX) Design
- 5.0 Understand Responsive Design Techniques.
- 6.0 Understand Version Control Systems.
- 7.0 Understand Project Management and Deployment of Web and Mobile Applications

PROGRAMME: HIGHER NATIONAL DIPLOMA ARTIFICIAL INTELLIGENCE									
	Web and Mobile Applica	ation	COUF	RSE CODE: AIT 423 Contact		Hours: 4 Hours/week			
Develop									
CREDI	T UNIT: 2		PRE-H	REQUISITE: Nil			Practica	d: 2 Hours/week	
						,	Theoret	ical: 2 Hours/weel	ζ
	This course is designed to						and mobile applic	ations.	
COURS	SE SPECIFICATION: T					cal Content			
	General Objective: 1.0								
WEEK	Specific Learning	Teachers Activit	ies	Learning Resour	rces	Specific L	earning	Teachers	Evaluation
	Outcomes					Outcomes		Activities	
1-3	1.1 Explain how to	Discuss how to d	evelop	Slide presentation	-	Develop		Guide student	Explain how to
	develop structured and	structured and		textbooks, and on	line	structured	and	to develop	develop
	semantically correct	semantically corr	ect	resources for lectu	ures.	semantically		structured and	structured and
	web pages using	web pages using		Access to case studies		correct web		semantically	semantically
	HTML.	HTML		and research pape	ers on	pages using	g	correct web	correct web pages
				data science and A	AI.	HTML.		pages using	using HTML.
	1.2Explain how to	Explain HTML s	yntax	Computer with da	Computer with data			HTML.	
	create different types	and elements.		analysis software	(e.g.,	Design and style		Guide student	
	of web pages (e.g.,			Python with librar	ries	visually		to Design and	Explain how to
	basic static page,	Explain how to ca	reate	like pandas, Num	Py,	appealing	web	style visually	create different
	forms, tables) to	different types of	web	scikit-learn) for		pages using	g CSS.	appealing web	types of web
	practice HTML	pages (e.g., basic	static	demonstrating the	data			pages using	pages (e.g., basic
	coding.	page, forms, table	es) to	science process.				CSS.	static page, forms,
		practice HTML c	oding.	Python with					tables) to practice
	1.3 Explain how to			TensorFlow, Keras)		Implement		Guide students	HTML coding.
	create multi-page	Explain create m	ulti-			interactive	and	to Implement	
	websites with proper	page websites wi				dynamic		interactive and	
	page structure and	proper page struc	ture			behavior of	n web	dynamic	
	semantic HTML.	and semantic HT	ML.			pages using	g	behavior on	
						JavaScript.		web pages	

	1.4 Describe how to design and style visually appealing web pages using CSS.	Explain how to design and style visually appealing web pages using CSS properties, selectors, and styling techniques.			using JavaScript.	
	1.5 Explain how to Implement interactive and dynamic behavior on web pages using JavaScript.	Explain how to Implement interactive and dynamic behavior on web pages using JavaScript:				
	1.6 Explain the fundamentals of JavaScript, including variables, functions, and event handling.	Discuss the fundamentals of JavaScript, including variables, functions, and event handling.				
	1.7 Explain how to build dynamic components or web applications that respond to user actions.	Explain how to build dynamic components or web applications that respond to user actions.				
		Understand Mobile Appli	cation Development for b	ooth Android and iO	S platforms using	relevant
4	2.1 Explain how to develop mobile applications for	Explain how to develop mobile applications for	Node.js, Python, or Ruby on Rails	Develop mobile applications for Android using	Guide students to develop mobile	Explain how to develop mobile applications for

	Android using relevant	Android using relevant		relevant	applications for	Android using	
	frameworks like React	frameworks like React		frameworks like		relevant	
					Android using		
	Native.	Native.		React Native.	relevant	frameworks like	
					frameworks like	React Native.	
	2.2 Explain mobile	Discuss mobile			React Native.	Discuss mobile	
	applications for iOS	applications for iOS				applications for	
	using relevant	using relevant		Develop mobile	Guide student	iOS using	
	frameworks like React	frameworks like React		applications for	to develop	relevant	
	Native or Flutter.	Native or Flutter.		iOS using	mobile	frameworks like	
				relevant	applications for	React Native or	
	2.3 Explain mobile	Discuss mobile		frameworks like	iOS using	Flutter.	
	application	application architecture		React Native or	relevant		
	architecture and	and design patterns for		Flutter.	frameworks like		
	design patterns for	cross-platform			React Native or		
	cross-platform	development			Flutter.		
	development				1 100001		
	General Objective 3.0	: Understand Backend Dev	velopment in Server-side	de Programming Languages			
5-6	3.1 Explain	Discuss proficiency in	Node.js, Python, or	Use server-side	Guide student	Explain	
	proficiency in server-	server-side	Ruby on Rails	programming	to use server-	proficiency in	
	side programming	programming		languages like	side	server-side	
	languages.	languages like Node.js,		Node.js, Python,	programming	programming	
		Python, or Ruby on		or Ruby on	using Node.js,	languages like	
		Rails		Rails.	Python, or Ruby on Rails.	Node.js, Python,	
		110115			on Raiis.	or Ruby on Rails.	
	3.2 Explain how to	Explain how to build		Build and	Guide student	or ready on realis.	
	build and manage	and manage databases		manage	on how to build		
	databases for web and	for web and mobile		databases for	and manage	Explain how to	
	mobile applications.	applications:		web and mobile	databases for	build and manage	
	moone applications.	applications.			web and mobile	databases for web	
				applications.	applications.	uatabases for web	

3.3 Explain sessions	Describe sessions for	Develop	Guide students	and mobile
for each programming language, covering core concepts, syntax, and common libraries/frameworks	each programming language, covering core concepts, syntax, and common libraries/frameworks.	RESTful APIs and implement server-side logic to handle client requests.	to develop RESTful APIs and implement server-side logic to handle client requests.	applications.
3.4 Explain the fundamentals of database design, including data modeling and schema creation.	Explain the fundamentals of database design, including data modeling and schema creation.	Design databases for specific application scenarios	Guide students to design databases for specific application scenarios	
3.5 Describe how to use database management systems 3.6 Explain how to develop RESTful APIs	Describe how to use database management systems (e.g., MySQL, PostgreSQL, MongoDB) to interact with databases. Explain how to develop RESTful APIs and	Create a functional backend for a web or mobile application, which includes developing RESTful APIs and server-side logic.	Guide students to create a functional backend for a web or mobile application, which includes developing RESTful APIs and server-side logic.	
and implement server- side logic to handle client requests.	implement server-side logic to handle client requests:			

	3.7 Explain the	Explain the concept of RESTful APIs the role of APIs in web and mobile application development.				
	process of designing API endpoints and handling HTTP requests (GET, POST, PUT, DELETE) using their preferred	Explain the process of designing API endpoints and handling HTTP requests (GET, POST, PUT, DELETE) using their preferred				
	backend language Congral Objective 4.0:	backend language. Understand User Experies	nce (HX) Design			
7-8	4.1 Explain the	Discuss the core	Computers equipped	Create	Guide students	Explain the
/-0	principles of user-	principles of user-	with machine learning	wireframes and	to create	principles of user-
	centered design and its	centered design,	software (like Python's	prototypes to	wireframes and	centered design
	importance in creating	usability, and user	scikit-learn,	visualize and	prototypes to	and its
	effective digital	experience.	TensorFlow, PyTorch).	communicate	visualize and	importance in
	experiences.	Highlight the impact of	Access to a variety of	design concepts.	communicate	creating effective
	onp offices.	user-centered design on	real-world business		design	digital
		product success.	datasets for practicing		concepts.	experiences.
			machine learning.		_	_
	4.2 Explain	Explain wireframes and	Access to resources on	Apply usability	Guide students	
	wireframes and	prototypes to visualize	machine learning	principles to	to apply	
	prototypes to visualize	and communicate	algorithms and	evaluate and	usability	
	and communicate	design concepts.	techniques.	improve the user	principles to	
	design concepts.		Access to resources	experience of	evaluate and	
			for effective data	web and mobile	improve the	
				applications.	user experience	

4 4 Exectain 41. a	Digayag tha minain1an	magantation and		of web and
4.4 Explain the	Discuss the principles	presentation and communication.		
principles of user-	of user-centered design	communication.		mobile
centered design and its	and its importance in	wireframing tools		applications.
importance in creating	creating effective	(e.g., Balsamiq,		
effective digital	digital experiences	Sketch, Figma) and	Create	Guide students
experiences	design concepts:	prototyping software	wireframes and	to create
		(e.g., InVision, Adobe	interactive	wireframes and
4.5 Explain how to	Discuss usability how	XD).	prototypes for	interactive
Apply usability	to apply principles to	MD).	different screen	prototypes for
principles to evaluate	evaluate and improve		sizes and	different screen
and improve the user	the user experience of		devices.	sizes and
experience of web and	web and mobile			devices.
mobile applications.	applications			
			Design	Guide student
4.6 Explain usability	Explain usability		wireframes and	to design
testing methodologies	testing methodologies		prototypes based	wireframes and
and techniques.	and techniques.		on specific	prototypes
_	_		application	based on
4.9 Explain how to	Explain how to conduct		scenarios.	specific
conduct usability tests	usability tests and			application
and gather feedback	gather feedback from			scenarios.
from users.	users.			
			Conduct	Guide student
			usability testing	to conduct
			on existing	usability testing
			applications or	on existing
			prototypes and	applications or
			analyze the	prototypes and
			results.	

					analyze the results.	
	General Objective 5.0:	Understand Responsive D	Design techniques			
9-10	General Objective 5.0: 5.1 Explain the concept of responsive design and its importance in creating adaptive user interfaces. 5.2 Explain media queries and flexible layouts to create responsive web pages that adjust to different screen sizes. 5.3 Explain responsive design frameworks like Bootstrap to streamline the development of responsive web applications. 5.4 Explain responsive websites and applications to	Explain the concept of responsive design and its importance in creating adaptive user interfaces Explain media queries and flexible layouts to create responsive web pages that adjust to different screen sizes: Explain how to Implement responsive design frameworks like Bootstrap to streamline the development of responsive web applications: Explain responsive websites and applications to illustrate the concept in	Access to relevant literature, industry reports, and databases for identifying business problems. Project management tools for planning and monitoring the project. Computers with necessary data science software installed for project implementation. Presentation tools and equipment for communicating the results.	Apply media queries and flexible layouts to create responsive web pages that adjust to different screen sizes. Implement responsive design frameworks like Bootstrap to streamline the development of responsive web applications.	Guide students to apply media queries and flexible layouts to create responsive web pages that adjust to different screen sizes. Guide student to implement responsive design frameworks like Bootstrap to streamline the development of responsive web applications.	Explain the concept of responsive design and its importance in creating adaptive user interfaces. Explain media queries and flexible layouts to create responsive web pages that adjust to different screen sizes.

illustrate the concept		Use different	Guide students	
in practice.		CSS techniques,	to experiment	
		like fluid grids	with different	
5.5 Explain the	Discuss the challenges	and flexible	CSS techniques,	
challenges and	and considerations of	images, to create	like fluid grids	
considerations of	designing for multiple	adaptive designs.	and flexible	
designing for multiple	screen sizes and		images, to	
screen sizes and	devices.		create adaptive	
devices.			designs.	
5 6 Evaloin	Explain for domantals			
5.6 Explain fundamentals of	Explain fundamentals of responsive design	Build web	Guide students	
responsive design and	and its benefits.	applications	to build web	
its benefits.	and its beliefits.	using responsive	applications	
its beliefits.		design	using	
5.7 Explain media	Explain media queries	frameworks	responsive	
queries in CSS to	in CSS to adapt layouts		design	
adapt layouts based on	based on viewport size.		frameworks	
viewport size				
5.8 Explain how to	Explain how to apply			
apply media queries to	media queries to an			
an existing web page	existing web page to			
to make it responsive.	make it responsive.			
5.9 Describe how to	Describe how to use			
use these frameworks	these frameworks to			
to create responsive	create responsive			

	layouts and UI	layouts and UI				
	components.	components.				
	1	1				
Genera	l Objective 6.0: Understa	and Version Control Syster	ns		<u> </u>	l
11-13	6.1 Explain the	Discuss the	Access to relevant	Use version	Guide student	Explain the
	fundamentals of	fundamentals of	literature, industry	control systems	to proficiently	fundamentals of
	version control and its	version control and its	reports, and databases	like Git for code	use version	version control
	significance in	significance in	for identifying	management and	control systems	and its
	collaborative software	collaborative software	business problems.	collaboration.	like Git for code	significance in
	development.	development	Project management		management	collaborative
			tools for planning and		and	software
	6.2 Explain control	Explain proficiency in	monitoring the project.		collaboration.	development.
	systems like Git for	using version control	Computers with			_
	code management and	systems like Git for	necessary data science	Manage code	Guide student	Demonstrate
	collaboration.	code management and	software installed for	repositories,	to effectively	proficiency in
		collaboration:	project	including	manage code	using version
			implementation.	creating	repositories,	control systems
	6.3 Explain the	Discuss the benefits of	Presentation tools and	branches,	including	like Git for code
	benefits of version	version control in	equipment for	merging	creating	management and
	control in facilitating	facilitating teamwork,	communicating the	changes, and	branches,	collaboration.
	teamwork, code	code sharing, and	results.	resolving	merging	Discuss the
	sharing, and codebase	codebase stability.		conflicts.	changes, and	benefits of
	stability.				resolving	version control in
					conflicts.	facilitating
	6.4 Explain how to	Explain version control				teamwork, code
	manage code	concepts, including		Collaborate on	Guide student	sharing, and
	repositories, including	versioning, branching,		codes with peers	to collaborate	codebase stability.
	creating branches,	and merging.		using Git,	on codes with	
	merging changes, and			working on	peers using Git,	
	resolving conflicts.			branches, and	working on	

6.5 Explain step-by-	Explain step-by-step	resolving merge	branches, and	
step tutorials on	tutorials on setting up	conflicts.	resolving merge	
setting up and	and configuring Git		conflicts.	
configuring Git	repositories locally and			
repositories locally	remotely.	Create branches	Guide student	
and remotely		and merging	to create	
		code changes	branches and	
6.6 Explain common	Explain common Git	using different	merging code	
Git commands for	commands for staging,	Git workflows.	changes using	
staging, committing,	committing, and		different Git	
and pushing code	pushing code changes		workflows.	
changes			~	
		Carry out	Guide student	
		branching,	to Carry out	
		merging, and	branching,	
		conflict	merging, and conflict	
		resolution on		
		practice	resolution on	
		repositories.	practice	
			repositories.	
		Perform shared	Guide student	
		codebase using	to Carry out	
		Git, employing	shared codebase	
		branching and	using Git,	
		merging	employing	
		effectively.	branching and	
			merging	
			effectively.	

Genera	l Objective 7.0: Understa	and Project Management a	and Deployment of Web a	nd Mobile Applicat	ions.	
14-15	7.1 Explain the	Discuss the principles	Access to relevant	Carry out	Guide student	Explain software
	principles of project	of project management	literature, industry	software	to Carry out	development
	management and its	and its role in	reports, and databases	development	software	projects,
	role in successful	successful application	for identifying	projects.	development	including
	application development.	development	business problems.		projects,	defining
	development.		Project management		including	objectives, tasks,
	7.2 Explain software	Explain software	tools for planning and		defining	and timelines.
	development projects,	development projects,	monitoring the project.		objectives,	
	including defining	including defining	Computers with		tasks, and	
	objectives, tasks, and	objectives, tasks, and	necessary data science		timelines.	
	timelines.	timelines.	software installed for			
	725 1:1		project	Deploy web and	Guide students	
	7.3 Explain how to deploy web and	Explain how to deploy	implementation.	mobile	to deploy web	
	mobile applications to	web and mobile	Presentation tools and	applications to	and mobile	
	production	applications to	equipment for	production	applications to	
	environments.	production	communicating the	environments.	production	
		environments.	results.		environments.	
				Manage real-	Guide students	
	7.4 Explain project	Explain project		world successful	to manage real-	
	management	management		project	world	
	methodologies	methodologies, such as		Figure	successful	
	memodologies	Agile, Scrum, or			project	
		Waterfall.				
				Break down a	Guide student	
	7.5 Explain how to	Explain how to plan		project into	to break down a	
	plan and organize	and organize software		manageable	project into	
	software development	development projects,		tasks and	manageable	
	projects	including defining		estimating effort.	tasks and	

	objectives, tasks, and timelines		estimating effort.	
7.6 Explain the guidelines and templates for creating project plans, task lists, and Gantt charts. 7.7 Explain proficiency in deploying web and mobile applications to production environments 7.8 Explain the deployment process, including server setup, domain configuration, and database management	Discuss guidelines and templates for creating project plans, task lists, and Gantt charts. Discuss proficiency in deploying web and mobile applications to production environments: Explain the deployment process, including server setup, domain configuration, and database management.	Deploy applications to various hosting platforms (e.g., AWS, Heroku). Deploy completed web or mobile applications to live servers.	Guide student to deploy applications to various hosting platforms (e.g., AWS, Heroku). Guide student to deploy completed web or mobile applications to live servers.	

List of Tools/Equipment for HND Artificial Intelligence (AI) Laboratory

Category	Tools and Equipment	Quantity
Powerful Computer	Laptop or Desktop Computer with following specification. > Storage: 512 - SSD Minimum > Processor: 3.5 GHz -to- 4.0 GHz > RAM: 16GB -to- 32GB > OS: 64 bits	40 (i.e., One for each student for maximum of 2 - Streams)
Internet Access	High speed Internet connectivity	30-50 mbps of Internet Access
Programming Languages	Python (with compilers or interpreters)	1 each
IDEs	Jupyter Notebook, PyCharm, Visual Studio Code, Anaconda, Google Colab	1 each
Machine Learning Frameworks	TensorFlow, PyTorch, Keras, scikit-learn, MindSpore, ModelArts,	1 each
Version Control	Git, GitHub, GitLab	1 each
Mathematics and Visualization	MATLAB, Simulink, Mathematica, NumPy, Matplotlib, Seaborn, Plotly, Pandas, MAPLE	1 each
Database Management Systems MySQL, PostgreSQL, SQLite		1 each
Cloud Services	AWS, Google Cloud Platform (GCP), Microsoft Azure, Huawei Ascent AI Processor	1 each

Virtualization	Docker	1 each
Simulation Tools	Gazebo (robotics simulation), Unity (game development)	1 each
Text Editors	Sublime Text, Atom, Notepad++	1 each
Hardware (Optional)	GPUs, TPUs, such as; Huawei Ascend AI Processors, Intel Nervana Neural Network Processors, NVIDIA GPUs, Google Tensor Processing Unit.	1 each
Others	Office 365, Microsoft project	1 each
Online Learning Platforms	Coursera, edX, Udacity, UDEMY, Blackboard, Moodle, Edmodo	1 each
Books and Reference Material	Textbooks, research papers, online resources	Provide physical AI related books, research papers, and Subscribe to some Online Databases

NOTE: In addition to the above-mentioned tools/equipment's Artificial Intelligence Programme can equally share Electrical Electronics Lab for circuit and other practical's, and Mechatronic Lab for robotic practical's,

Necessary with following tools/equipment's.

No.	Equipment	Description	Purpose/Usage
1	Microcontroller Boards	Arduino, Raspberry Pi, ESP8266, ESP32	To create and program smart devices or robots
2	Sensors	Accelerometers, Gyroscopes, Proximity Sensors	Gather data from the environment for analysis
3	Motors and Actuators	DC Motors, Servo Motors, Stepper Motors	Enable robotic movement and interaction
4	Motor Drivers	H-bridges, Motor Shields	Control the speed and direction of motors
5	Prototyping Components	Breadboards, Jumper Wires, Resistors, LEDs	Build and test circuits for AI applications
6	Robotics Kits	DIY robot kits with various components	Provide a starting point for building robots
7	Cameras	USB Cameras, Raspberry Pi Camera Module	Capture visual data for computer vision tasks
8	LiDAR Sensors	Light Detection and Ranging for mapping	Create detailed maps and perform object detection
9	NVIDIA Jetson Platform	High-performance embedded AI computing platform	Accelerate AI computations in robotics projects
10	3D Printer	Creating custom robot parts and enclosures	Create custom components for robots and devices

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