



**AFRICA CENTRE OF EXCELLENCE ON TECHNOLOGY ENHANCED LEARNING  
(ACETEL)**

# **COURSE DESIGN**

*FOR*

**Academic Programmes**

*July 2019*



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**Vision:** To be recognised for excellence in research and development of ICT digital solutions and their secure deployment for learning with application to all sectors.

**Mission:** Development of digital expertise to drive economic growth and transformation in the West African sub-region and beyond

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Glossary of Terms:

## Background Information

ACETEL is housed in National Open University of Nigeria (NOUN). NOUN is the largest single mode open and distance learning university in West Africa. ACETEL leveraged on the context and profile of NOUN students; the need analysis of the learners and industries; the national academic benchmark; national policy documents and other relevant professional bodies to design ACETEL academic programmes and courses. Table 2 shows the situation analysis.

**Table 2: Situation Analysis**

Learners' Context	<ul style="list-style-type: none"> <li>• The course will be an online course except for examination that will be done face-to-face</li> <li>• Courses will be facilitated online (including video conferencing)</li> <li>• There is accommodation for student researchers</li> <li>• Some students may receive free tablets</li> <li>• Learners sometimes experience low internet bandwidth</li> </ul>
Learners' Profile	<ul style="list-style-type: none"> <li>• Personal characteristics/Demographics: <ul style="list-style-type: none"> <li>○ Age 20 and above</li> <li>○ Gender – male and female</li> <li>○ Mixed marital status – single, married, divorce, separated with and without children</li> <li>○ Some are visual learners</li> <li>○ Majority want to be tutored (instructional videos)</li> <li>○ They want to learn any time any where</li> <li>○ Some want to take examinations on demand</li> <li>○ There are few with learning disabilities – sight and hearing impairment</li> </ul> </li> <li>• Expectations/Reason for studying: <ul style="list-style-type: none"> <li>○ To fit into job demand</li> <li>○ To pursue higher degree</li> <li>○ For economic value</li> <li>○ For self-satisfaction</li> <li>○ For social demand</li> </ul> </li> <li>• Prior Knowledge: <ul style="list-style-type: none"> <li>○ Learners have relative qualifications at first degree</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Most learners haste reading lengthy text</li> <li>○ The learners tend to assimilate faster with learning provided in flexible format</li> <li>• Prior study skills: <ul style="list-style-type: none"> <li>○ The main study skills learners are used to is face-to-face</li> <li>○ Most learners lacks basic IT skills</li> <li>○ Time management is a major problem. Most learners do not cover their study materials</li> </ul> </li> <li>• Study circumstances: <ul style="list-style-type: none"> <li>○ The learners have access to personal computers/laptops/mobile phones</li> <li>○ Learners have access to internet facilities</li> <li>○ Learners have access to virtual and face-to-face laboratories</li> </ul> </li> <li>• Cultural background: <ul style="list-style-type: none"> <li>○ There is diversity in language and culture</li> <li>○ Sensitive areas are religion and politics</li> </ul> </li> <li>• Employment: <ul style="list-style-type: none"> <li>○ Some have never worked</li> <li>○ Some have about 1 – 5 years working experience and above 5.</li> <li>○ Some are self-employed and some are employees</li> <li>○ Some are job seekers</li> </ul> </li> </ul>
Support	<ul style="list-style-type: none"> <li>• Learners will receive technical support</li> <li>• There 24/7 communication channels</li> <li>• The learners will also receive guidance on academic progress</li> </ul>

## The Design Structure

The process for the design is in two parts – pre-design information and the course design. The pre-design information provides basic information required for the courses in each programme. This information was adopted from the programme design and development. This include:

- The programme
- The programme competencies

- Courses in the programme
- Mapping of Courses to Programme Competences

The second part is the actual course design which was structured in the following order:

- Course Information
- Course competency(s)
- Course Objectives
- Structure. Derived the Modules and Units from the course objectives to meet the expected course competency(s)
- Alignment. Defined Unit Intended Learning Outcomes (ILOs) and align the teaching approach, learning activities, resources/learning devices, assessments and Required Hours for Study required.
- Course/Programme Evaluation

Each study unit represents one week of self-study and one-hour video conferencing each week in addition to asynchronous online facilitation.

A teamwork approach was used in the design which comprised the Subject Matter Experts (SMEs), sectoral partners, and instructional designer.

### **Next Stage: Course Development**

The course development stage will include:

- Development of the learning resources. This include instructional videos, animations, simulations and other graphic designs as specified in the course design
- Writing the Content. Expanding each module and units by adding texts and integrating the learning resources and devices; and interactive devices (learning activities, and assessment). The structure for writing a Unit of Study is as presented thus
  - Introduction
  - Intended Learning Outcomes (ILOs)
  - The Main Text

- Conclusion
  - Summary
  - Further Readings and References
- Develop the site map
  - Integrate the site map into the Learning Management System (LMS). ACETEL LMS is Moodle.
  - Upload content into the LMS
  - Pilot testing
  - Review course based on outcome from pilot test
  - Course Launch

### Student Workload and Study Hours Required

The student study hours are determined by considering **credit unit, hours of self-study, hours to respond to forum discussions and posts, hours to do learning activities and assignments, hours to participate in facilitation through video conferencing**. Every Unit will have one hour of facilitation through video conferencing.

Due consideration was also given to:

- |                                  |   |          |
|----------------------------------|---|----------|
| • The number of hours per day    | - | 24 hours |
| • Recommended hours of sleep     | - | 8 hours  |
| • Official working hours per day | - | 8 hours  |
| • Other Activities               | - | 8 hours  |

Other activities could include time for worship/prayers, relaxation, time for travelling including going from home to office and back and doing house chores.

Note: Officially work is not done every day in a week. Official work free days differ from countries and regions. In West Africa, the official working days in a week are Mondays to Fridays. This implies that in most of the hours the students will be very busy during the week and therefore may not have much time except weekends. The total weekend hours will be 48 hours while the total hours within the week will be 120 hours which make a total of **168 hours** per week.

On the average, the M.Sc. students have 11 courses and the Ph.D. six courses in an academic year of two semesters. There are 26 contact weeks in an academic year before examination. A week is 7 days. Therefore,  $26 \times 7 = 182$  days. A day has 24 hours per week. So,  $24 \times 182 = 4,368$  hours in an academic year.

Reading ability and assimilation were also considered. From previous researches, it was found that most students loose interest in reading text after **30 minutes**, and on the average students can read and assimilate between 2,400 and 7,000 words per hour. Based on this premise a **Unit will be between 2 to 4 pages or between 1,200 – 3,200 words**. Where a lesser number of words are used, there will be more interactivity in the areas of **scenarios, animations, videos, web links, etc for further explanations**. But should be such that can be covered within the recommended hours.

Therefore, the required hours of study are determined thus:

S/N	Weekly Activities per Unit	Hours per Week		
		2 Credit Units	3 Credit Units	
1.	Video conferencing per week	1	2	
2.	To read and respond to posts including facilitation comments	1	1	
3.	Self-study including reading text (may or may not include illustrations), listening to instructional videos if any and responding to self-assessment exercises.	2	3	
4.	Assignments (Assignment is at the end of each module and it covers all the units in the module)	1	1	
<b>Weekly minimum hours required for study per course</b>		<b>5</b>	<b>7</b>	

For 2 credit units, the number of hours required per course per semester of 13 weeks -  $5 \times 13 = 65$  hours of study  
 A student with six courses in a semester for instance will require -  $6 \times 65 = 390$  hours of study

For 3 credit units, the number of hours required per course per semester of 13 weeks -  $7 \times 13 = 91$  hours of study

## Assessment

There are two forms of assessments – formative and summative. The formative assessments are designed to support the students to learn. This include the in-text questions, self-assessment exercises and major Assignments which may be Tutor Marked Assignments (TMAs) or Computer Marked Assignments (CMAs). However, the assignments scores forms are part of the final score in each course. **All Assignments must be accompanied with Rubrics.** All the students must have a **portfolio**.

The summative assessment will be one time shot. This shall be taken as examination once in a term and twice in an academic year.

## Resources/Learning Devices

The resources and learning devices that are compulsory in all the units are classified as Generic Resources. These are:

- Computer/Tablet/Laptop/Mobile Phone
- Internet
- Course Materials
- Instructional Videos of 5 – 10 mins (will be available in all the Units)

Therefore, may not be mentioned and where mentioned may be classified as generic resources.

# Course Template

A course is presented in two parts: The Course Guide and the Main Text. The course guide gives direction to the students on the course expectations. It is a must do. The main text contains step by step of the knowledge to be acquired.

## Course Information

Course Code:  
Course Title:  
Credit Unit:  
Course Status:  
Course Blub:  
Semester:  
Course Duration:  
Required Hours for Study:

## Course Guide

Introduction  
Course Competencies  
Course Objectives  
Working Through this Course  
Study Units  
References and Further Readings  
Presentation Schedule  
Assessment  
How to get the Most from the Course  
Facilitation

## Course Team

Course Developer: ACETEL  
Course Writer:  
Instructional Designer:  
Learning Technologists:  
Content Editor:  
Copy Editors:

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**Module 1: History of AI and its Applications**

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**Introduction of Module**

- Unit 1: History of AI and Projections for the Future
- Unit 2: Emerging AI Applications I
- Unit 3: Emerging AI Applications II
- Unit 4: AI Ethics and Privacy Concerns in Africa And International Context.
- Unit 5: Case Studies Demonstrating History, Privacy and Ethics In AI

**Unit 1: History of AI and Projections for the Future**

**Contents**

- 1.0 Introduction
- 2.0 Intended Learning Outcomes (ILOs)
- 3.0 Main Content
  - 3.1 mmmmm
  - 3.2 mmmmmm
    - 3.2.1 mmmmmmmm
- 4.0 Conclusion
- 5.0 Summary
- 6.0 References/Further Reading

# Part I

## **Artificial Intelligence (AI) Programmes**

## **M.Sc. Artificial Intelligence**

## Programme Competencies

The competency areas focus on the:

1. Use Algorithm Design and Analysis to solve emerging problems
2. Use of Probability and Statistics in providing solutions to societal needs
3. The ability to Work with Big Data
4. The ability to develop Software that Incorporate AI
5. The ability to represent and reason with Knowledge

## Courses

S/N	Course Code	Course Title	Credit Unit	Status
1	ATI801	Principles and Techniques of Artificial Intelligence	3	C
2	ATI802	Natural Language Processing	3	C
3	ATI804	Machine Learning II	3	C
4	ATI805	Machine Learning I	3	C
5	ATI806	Introduction to Robotics	3	C
6	ATI803	Programming for artificial Intelligence	3	C
7	ATI808	Probability and Statistics	3	C
8	ATI899	Project	6	C
9	ATI821	Basic Probability, Statistics and Algebra	2	E
10	ATI822	Computational Logic	2	E
11	ATI823	Introduction to Algorithms	2	E

Table 1: Mapping of Courses to Programme Competences

S/N	Competences	COURSE CODE (ATI)									
		801	802	803	804	805	806	808	823	821	822
1	Use Algorithm Design and Analysis to solve emerging problems	*		*					*		
2	Use of Probability and Statistics in providing solutions to societal needs	*	*					*		*	
3	The ability to Work with Big Data		*	*	*	*		*			
4	The ability to develop Software that Incorporate AI	*	*	*	*	*	*	*	*		*
5	The ability to represent and reason with Knowledge	*	*		*	*	*	*			*

## Course Information

Course Code:	ATI801
Course Title:	Principles and Techniques of Artificial Intelligence
Credit Unit:	3
Course Status:	Core
Course Description/Blub:	This course presents introductory topics in AI such as the History, Ethics and Privacy concerns. It also demonstrates the limitation of algorithmic approach to problem solving and presents an overview of the techniques used in developing intelligent systems
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

1. Competency in Algorithm Design and Analysis
2. Competency in Probability and Statistics
3. Ability to develop Software that Incorporate AI
4. Ability to represent and reason with Knowledge

## Course Objectives

The course objectives are to:

- Provide background information on AI
- Create awareness on the problems suitable for AI solutions
- Gain an overview of the various techniques of AI
- Create awareness on privacy and ethical concerns

## Modules and Units

Module 1: History of AI and its Applications

- Unit 1: History of AI and projections for the future
- Unit 2: Emerging AI applications I
- Unit 3: Emerging AI applications II
- Unit 4: AI Ethics and Privacy concerns in Africa and International context.
- Unit 5: Case Studies Demonstrating History, Privacy and Ethics in AI

Module 2: Algorithmic computation and the AI Approach

- Unit 1: Limitations of algorithms.
- Unit 2: Combinatorial Explosion
- Unit 3: Laboratory Exercises Demonstrating limitations of Algorithms
- Unit 4: The working of AI Algorithms

Module 3: Introduction to AI Techniques

- Unit 1: Data Acquisition
- Unit 2: Knowledge Representation and Reasoning I
- Unit 3: Knowledge Representation and Reasoning II
- Unit 4: Search as a Problem-Solving Technique

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1:</b> History of AI and its Applications						
<b>Unit 1:</b> History of AI and projections for the future	<ul style="list-style-type: none"> <li>Discuss the historical background of AI</li> <li>Create new ideas for AI systems</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Reality of pedagogy <ul style="list-style-type: none"> <li>Use scenarios</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Read the unit in the course material</li> <li>Take the in-text and self-assessment exercises</li> <li>Respond to the scenario</li> <li>Participate in the online facilitation</li> </ul>	<ul style="list-style-type: none"> <li>Personal computer or laptop or mobile phone or all; internet facilities will be required in all the units in this course.</li> <li>The course material will all be required in all the units.</li> <li>Provide e-textbook(s) for further reading in all units</li> <li>5 – 15 mins documentary video presenting a scenario on the history of AI</li> </ul>	<ul style="list-style-type: none"> <li>One self-assessment. Ask questions that will make the student apply what he/she learnt from the video. Provide feedback.</li> <li>Students are to create portfolio to record all their activities in each unit.</li> </ul>	7
<b>Unit 2:</b> Emerging AI applications I	<ul style="list-style-type: none"> <li>Describe emerging AI technologies such as: Blockchain Technology, IoT and Data Science/Big</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Read the unit in the course material</li> <li>Take the in-text and self-assessment exercises</li> <li>Contribute to discussion forum</li> </ul>	<ul style="list-style-type: none"> <li>Computer, internet, and course materials will hence forth be referred to as <b>generic resources</b> for the course.</li> <li>Forum</li> </ul>	<ul style="list-style-type: none"> <li>On the discussion forum, ask question that will enable students express the unethical issues in their context.</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	Data Technologies <ul style="list-style-type: none"> <li>Discuss emerging AI technologies such as: Blockchain Technology, IoT and Data Science/Big Data Technologies</li> </ul>	self-assessment exercises <ul style="list-style-type: none"> <li>Reality of pedagogy               <ul style="list-style-type: none"> <li>Use forum discussion</li> </ul> </li> </ul>			<ul style="list-style-type: none"> <li>Student should review at least two other posts of their colleagues and re-post.</li> </ul>	
<b>Unit 3:</b> Emerging AI applications II	<ul style="list-style-type: none"> <li>Describe specific AI products (e.g. IBM Watson, Self Driving Car, and Face Recognition App)</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Reality of pedagogy               <ul style="list-style-type: none"> <li>Scenario</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Students the unit in the course material and respond to in-text and self-assessment exercises.</li> <li>Respond to the scenario as self-assessment exercise.</li> </ul>	<ul style="list-style-type: none"> <li>A text-based scenario of not more than 500 words showing the danger in using non-allowable acquisition and processing of data for software development.</li> </ul>	<ul style="list-style-type: none"> <li>Self-assessment exercise drawn from the scenario</li> </ul>	7
Unit 4: AI Ethics and Privacy concerns in Africa and International context.	<ul style="list-style-type: none"> <li>Identify ethical and unethical use of AI in Africa and the International Community</li> <li>Describe precautions to</li> </ul>	Case study method	Students read and work through the cases	<ul style="list-style-type: none"> <li>Present four case studies</li> </ul>	<ul style="list-style-type: none"> <li>Assignment 1, to assess students' comprehension and application on the topics in module 1</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>unethical use of AI</li> <li>Distinguish between allowable and non allowable acquisition and processing of data for development of AI software</li> <li>Identify the rules and regulations governing the acquisition and processing of data</li> </ul>					
Unit 5: Case Studies Demonstrating History, Privacy and Ethics in AI	<ul style="list-style-type: none"> <li>Analyse the history of AI, and observe ethical and privacy concerns in selected applications</li> </ul>	Process Oriented Guided Inquiry Lessons	Students respond to cases studies	Textual cases	Self-assessment exercise	7
<b>Module 2:</b> Algorithmic computation and the AI approach						7
Unit 1: Limitations of algorithms.	<ul style="list-style-type: none"> <li>Identify the formal mathematical models of computation.</li> </ul>	Problem-Solving Scenarios	Students identify and solve problems that require the theory of computability	<ul style="list-style-type: none"> <li>Data</li> <li>Basic software</li> </ul>	Two Self-Assessment exercises that will	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Recognised the limitations of formal mathematical models of computation</li> </ul>				require problem solving	
Unit 2: Combinatorial Explosion	<ul style="list-style-type: none"> <li>Analyse algorithm relevant for complexity classes</li> <li>Distinguish between algorithm and complexity classes</li> </ul>	<ul style="list-style-type: none"> <li>Differential Instruction strategies               <ul style="list-style-type: none"> <li>Considers the learning styles</li> <li>Provide support</li> <li>Provide support</li> <li>Group students by shared interest</li> </ul> </li> <li>Problem solving scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Students study the theory</li> <li>Students participate in forum discussions</li> <li>Students comment on other posts in their interest areas</li> <li>Students read response from facilitations</li> </ul>	<ul style="list-style-type: none"> <li>Create two text-based scenarios.</li> <li>Group students according to interest areas for further assignment</li> </ul>	<ul style="list-style-type: none"> <li>Students to comment on five post of their colleagues on the forum page with guideline on the areas of focus for the comment.</li> </ul>	7
Unit 3: Laboratory Exercises Demonstrating limitations of Algorithms	<ul style="list-style-type: none"> <li>Run complex algorithms and observe their computational behaviours</li> </ul>	<ul style="list-style-type: none"> <li>Case Study method</li> <li>Problem solving scenarios</li> </ul>	Respond to case studies and scenarios	<ul style="list-style-type: none"> <li>Design two case studies on problem solving using heuristics</li> <li>Create text-based scenarios where students can apply data driven technique in solving problem.</li> </ul>	Self-assessment for students to review cases with guidelines	7
Unit 4: The working of AI Algorithms	<ul style="list-style-type: none"> <li>Solve problem using heuristics application in AI</li> </ul>	<ul style="list-style-type: none"> <li>Experiential method</li> </ul>	<ul style="list-style-type: none"> <li>Students contextualise the use of algorithms</li> </ul>	<ul style="list-style-type: none"> <li>Provide data</li> <li>Provide the software</li> </ul>	Assignment 2: that will be required hands-on	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Teacher explains and transfer knowledge while the learners develop knowledge and skills through experience</li> <li>Simulation</li> </ul>	<ul style="list-style-type: none"> <li>Students derive idea</li> <li>Students apply developed idea</li> </ul>			
<b>Module 3:</b> Introduction to AI Techniques						7
<b>Unit 1:</b> Acquisition of data	<ul style="list-style-type: none"> <li>Identify adequate and suitable data for AI development</li> </ul>	<ul style="list-style-type: none"> <li>Exploratory method (inductive, inquiry, high student involvement)</li> <li>Scenario based method</li> </ul>	<ul style="list-style-type: none"> <li>Students collect data</li> <li>Students organize data for AI</li> </ul>	Data	Self-assessment exercise to test students' proficiency in data gathering	7
Unit 2: knowledge representation and reasoning I	<ul style="list-style-type: none"> <li>Apply knowledge representation formalisms on data: semantic networks and frames</li> </ul>	Problem solving	Students provide solution to generated problems in their context	Generic Resources	Self-assessment exercises	7
Unit 3: knowledge representation and reasoning II	<ul style="list-style-type: none"> <li>Apply knowledge representation formalisms on data: Logic and rule-based systems</li> </ul>	Problem solving	Students provide solution to generated problems in their context	Generic Resources and forum	Self-assessment exercise	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
<b>Unit 4:</b> Search as a problem solving technique	<ul style="list-style-type: none"> <li>• Demonstrate the use of AI search techniques: Blind and Heuristic in solving AI problems</li> <li>• Demonstrate the use of search to solve AI problems: constraint satisfaction, games playing and optimisation</li> </ul>	<ul style="list-style-type: none"> <li>• Project method</li> <li>• Problem solving techniques</li> </ul>	<ul style="list-style-type: none"> <li>• Students are to carry out a mini project using data in their context</li> <li>• Single or group presentation in PowerPoint narration</li> </ul>	<ul style="list-style-type: none"> <li>• Data</li> <li>• Software</li> </ul>	Assignment 3: <ul style="list-style-type: none"> <li>• put students in group according to country to solve an identified challenge in the country.</li> <li>• Students submit/present Portfolio</li> </ul>	7

## Course Information

Course Code:	AIT802
Course Title:	Natural Language Processing
Credit Unit:	3
Course Status:	Core
Course Description/Blurb:	This course presents Natural Language Processing (NLP) as an AI task. It covers the tools and techniques for text pre-processing, representation and analysis
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

1. To equip learners on probability and statistics techniques in the development of AI systems
2. To develop learners abilities to work with Big Data
3. Develop Software that incorporate AI
4. Ability to represent knowledge and get computers to reason with knowledge

## Course Objectives

The objectives of this course are to:

- Create awareness of the various distinctions between natural language and formal language
- Develop skills in the use of tools and techniques of natural language processing
- Build capacity for the Natural Language Processing for AI applications

## Modules and Units

Module 1: Introduction to Natural Language Processing (NLP) and Text Pre-Processing

- Unit 1: Computational Properties of Natural Language
- Unit 2: Text Pre-Processing I
- Unit 3: Text Pre-Processing II
- Unit 4: Text Pre-Processing III

Module 2: Text Representation and Analysis

- Unit 1: Parts of Speech Tagging
- Unit 2: Typed Dependency Parsing and Co-Reference Resolution
- Unit 3: Limitations of Current Natural Language Processing (NLP) Tools for African Languages
- Unit 4: Text Representation

Module 3: Natural Language Processing Tasks

- Unit 1: Text Classification
- Unit 2: Text Summarization
- Unit 3: Sentiment Analysis
- Unit 4: Question-Answering
- Unit 5: Recommender Systems

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1, Unit 1:</b> Computational Properties of Natural Language	<ul style="list-style-type: none"> <li>Explain the difficulty associated with processing natural language</li> <li>Analyse a piece of natural language text</li> <li>Identify the difficulties machines may face in understanding the text</li> <li>Explain why NLP is an AI task</li> </ul>	<ol style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Unit 1 in the course material followed with in-text and self-assessment exercises</li> </ul> </li> <li>Reality of Pedagogy: <ul style="list-style-type: none"> <li>Text-Scenarios with graphics</li> <li>Discussion Forum</li> </ul> </li> </ol>	<ul style="list-style-type: none"> <li>Read Unit 1 of Module I in the Course material</li> <li>Take the self-assessment exercise</li> <li>Respond to text with graphic based scenarios</li> <li>Contribute in the discussion forum</li> <li>Review two posts in the discussion forum</li> </ul>	<ul style="list-style-type: none"> <li>The Course Material</li> <li>Computer, tablet, mobile phone</li> <li>Internet</li> <li>Instructional video of 5 – 10 mins</li> <li>LMS</li> </ul>	<ul style="list-style-type: none"> <li>One in-text question</li> <li>Two self-assessment exercises with feedback</li> </ul>	7
<b>Module 1, Unit 2:</b> Text Pre-Processing I	Develop a program to perform text pre-processing: tokenisation, stop-words removal.	<ul style="list-style-type: none"> <li>Demonstration Method</li> <li>Cooperative Learning</li> </ul>	<ul style="list-style-type: none"> <li>Learners develop an individual and a group program to solve an identified challenge using text pre-processing</li> </ul>	<ul style="list-style-type: none"> <li>A programming environment as a plug-in (Python or Java) in the LMS</li> <li>Course material to complement</li> </ul>	<ul style="list-style-type: none"> <li>Simulated self-assessment exercise with feedback</li> <li>Portfolio</li> </ul>	<ul style="list-style-type: none"> <li>7</li> </ul>

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1</b> , Unit 3: Text Pre-Processing II	Perform lemmatisation, stemming and text normalisation	<ul style="list-style-type: none"> <li>Cooperative Learning</li> <li>Problem Solving Scenario</li> </ul>	Perform lemmatization and text normalization through simulation	<ul style="list-style-type: none"> <li>Programming <b>software and plug-ins</b> that will enable the learners perform their activities</li> <li>Forum</li> </ul>	<ul style="list-style-type: none"> <li>Develop one self-assessment exercise that will be problem based with feedback</li> <li>Portfolio</li> </ul>	<ul style="list-style-type: none"> <li>7</li> </ul>
<b>Module 1</b> , Unit 4: Text Pre-Processing III	Explain the suitability or otherwise of each pre-processing operation to a given NLP task	<ol style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Unit 4 in the course material followed with in-text and self-assessment exercises</li> </ul> </li> </ol>	<ul style="list-style-type: none"> <li>Answer the self-assessment questions</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Electronic devices – computer and mobile phone</li> <li>Internet</li> </ul>	Assignment 1: A project assignment that will cover all activities in module 1 and the score will form part of the final score. This will be marked by the facilitator(s)	7
<b>Module 2</b> , Unit 1: Parts of Speech Tagging	<ul style="list-style-type: none"> <li>Analyse a piece of text for parts of speech</li> <li>Type dependencies and co-references to solve a given challenge</li> <li>Analyse a piece of text with the use of an existing software: StanfordCoreNLP</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem based scenario</li> </ul>	Learners are to choose from a variety of at least four software to analyse texts for a specific purpose	<ul style="list-style-type: none"> <li>StanfordCoreNLP software</li> <li>Integrated Slides in the course material</li> <li>Two 5-10 mins demonstration videos</li> <li>A programming environment as a plug-in (Python or Java)</li> </ul>	<ul style="list-style-type: none"> <li>One self-assessment exercise with feedback to test the learner ability on parts of speech tagging</li> <li>Portfolio</li> </ul>	<ul style="list-style-type: none"> <li>7</li> </ul>

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 2</b> , Unit 2: Typed Dependency Parsing and Co-Reference Resolution	Interpret output from a text analysis software (StanfordCoreNLP)	<ul style="list-style-type: none"> <li>Scenario based simulation</li> <li>Problem based scenario</li> <li>Case Study Method</li> </ul>	<ul style="list-style-type: none"> <li>Learners are to work on two case studies</li> </ul>	<ul style="list-style-type: none"> <li>Slide show</li> <li>Simulated problem based case or short video</li> </ul>	<ul style="list-style-type: none"> <li>Forum</li> <li>Multiple choice self-assessment with feedback</li> </ul>	7
<b>Module 2</b> , Unit 3: Limitations of Current Natural Language Processing (NLP) Tools for African Languages	Analyse the limitations of existing software in handling African languages	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Scenario-based simulation</li> </ul>	<ul style="list-style-type: none"> <li>Learners are to work on one scenario and one case study</li> </ul>	<ul style="list-style-type: none"> <li>A scenario-based video</li> </ul>	<ul style="list-style-type: none"> <li>Ponder activity as self-assessment exercise with feedback</li> </ul>	7
<b>Module 2</b> , Unit 4: Text Representation	<ul style="list-style-type: none"> <li>Represent text using n-gram, syntactic information and semantic indexing approaches</li> <li>Apply various feature weighting schemes: Binary, Term frequency and inverse document frequency in text representation.</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding (show and tell, give them for students' inputs, pause, ask question and review.)</li> <li>Problem solving scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Learners are to respond to listen and respond to the video</li> </ul>	<ul style="list-style-type: none"> <li>StanfordCoreNLP software</li> <li>Slides and Course material</li> <li>Short demonstration videos</li> <li>A programming environment as a plug-in (Python or Java)</li> </ul>	Assignment 2: Assignment that will cover the knowledge gained in Module 2 and the score will form part of the final score for the course	7
<b>Module 3</b> , Unit 1: Text Classification	Prepare input and perform text classification: spam filtering problem and subject classification in AI	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving scenarios</li> </ul>	Respond to scenarios	<ul style="list-style-type: none"> <li>StanfordCoreNLP software</li> <li>Slides and Course material</li> <li>Short demonstration videos</li> </ul>	Ponder activity as self-assessment exercise with feedback	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
				<ul style="list-style-type: none"> <li>A programming environment as a plug-in (Python or Java)</li> </ul>		
Unit 2: Text Summarization	<ul style="list-style-type: none"> <li>Describe approaches to Text Summarization</li> <li>Prepare input and perform text summarization task</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Based Learning</li> </ul>	Exploration of real situation and analysis	<ul style="list-style-type: none"> <li>Scenario based video or simulation</li> </ul>	<ul style="list-style-type: none"> <li>Learners are to post their exploration findings into discussion forum</li> <li>And respond to two other post</li> </ul>	<ul style="list-style-type: none"> <li>7</li> </ul>
<b>Module 3</b> , Unit 3: Sentiment Analysis	<ul style="list-style-type: none"> <li>Describe the approaches to Sentiment Analysis</li> <li>Differentiate the difficulty level of sentiment analysis from text classification</li> <li>Prepare input and perform binary sentiment classification to solve specific problem</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Based Learning</li> </ul>	<ul style="list-style-type: none"> <li>watch to the video</li> <li>Read the course material</li> </ul>	Short instructional video of about 5 -10 mins	Case study self-assessment with feedback	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 3</b> , Unit 4: Question-Answering	<ul style="list-style-type: none"> <li>Explain the approaches for developing question-answering system</li> <li>Develop a simple question-answering system</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Based scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Watch the video and note salient points</li> <li>Do self-assessment exercise</li> </ul>	Short instructional video of about 5 -10 mins	Scenario based self-assessment with feedback	7
<b>Module 3</b> , Unit 5: Recommender Systems	<ul style="list-style-type: none"> <li>Evaluate the approaches for developing recommender systems</li> <li>Develop recommender systems</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Based scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Watch the video and note salient points</li> <li>Do self-assessment exercise</li> </ul>	Short instructional video of about 5 -10 mins	Assignment 3: <ul style="list-style-type: none"> <li>Assignments that will cover the knowledge gained from module one to three. The score will form part of the course final score.</li> <li>Submit/present Portfolio</li> </ul>	7

## Course Information

Course Code:	ATI808
Course Title:	Probability and Statistics
Credit Unit:	3
Course Status:	Core
Course Description/Blub:	This course presents probabilistic modeling techniques for representing imprecise data. It offers methods for analyzing the relative frequencies of events and making inferences relevant to intelligent decision making.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

1. Competency in Probability and Statistics
2. Ability to Work with Big Data
3. Ability to develop Software that Incorporate AI
4. Ability to represent and reason with Knowledge

## Course Objectives

By the end of the course, you will be able to:

- Apply statistical measures of central tendencies and dispersion to describe elements of intelligent behaviour.
- Apply probabilistic modelling techniques to manage noise and incomplete information in planning, problem solving and decision making.

- Develop applications that use Probability and statistical methods to exhibit intelligent behaviour.

## **Modules and Units**

### Module 1: Foundation of Probability

- Unit 1: Frequentism
- Unit 2: Bayesian Probability
- Unit 3: Modelling Uncertainty Using Probabilities
- Unit 4: Application of Probability in AI
- Unit 5: Probabilistic Machine Learning

### Module 2: Foundations of Statistics

- Unit 1: Descriptive Statistics
- Unit 2: Graphs and Charts
- Unit 3: Evaluation Metrics

### Module 3: Statistical Tests

- Unit 1: Samples and Populations
- Unit 2: Parametric Tests I
- Unit 3: Parametric Tests II
- Unit 4: Non-Parametric Tests I
- Unit 5: Non-Parametric Tests II

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1, Unit 1:</b> Frequentism	Solve imprecision problems using relative frequencies.	Scaffolding: <ul style="list-style-type: none"> <li>Provide examples through course materials</li> <li>Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Students attempt exercises</li> </ul>	Test slide	Self-assessment exercise of 10 multiple choice questions	7
<b>Module 1, Unit 2:</b> Bayesian Probability	Solve conditional probability problems using the Bayesian approach	Scaffolding: <ul style="list-style-type: none"> <li>Provide examples through course materials</li> <li>Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>Text Slide</li> <li>Instructional video on how to solve conditional and Bayesian probability problems</li> <li>Instructional video on how to apply probabilistic modelling to address imprecision and uncertainty in AI</li> </ul>	Develop 10 multiple choice questions with four options online that gives immediate score to students and correct workings for failed questions.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1, Unit 3:</b> Modelling Uncertainty Using Probabilities	Apply statistical methods to automate inferencing and enable machine learning	Scaffolding: <ul style="list-style-type: none"> <li>Provide examples through course materials</li> <li>Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>Students read the course material</li> <li>Programming exercises in Python</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Instructional video on how to automate inferencing using Python</li> <li>Instructional video on how to enable machine learning using Python</li> <li>Software: Atom</li> </ul>	Project: Develop at least one python program to automate inferencing or to enable machine learning.	7
<b>Module 1, Unit 4:</b> Application of Probability in AI	Solve the problem of imprecision and uncertainty in AI with the use of probabilistic modelling	Scaffolding: <ul style="list-style-type: none"> <li>Provide examples through course materials</li> <li>Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>Students read the course material</li> <li>Students follow the text slides presentation</li> <li>Students respond to forum</li> </ul>	<ul style="list-style-type: none"> <li>Text slides</li> <li>Forum</li> </ul>	Self-assessment exercise using matching exercise	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
<b>Module 1, Unit 5:</b> Probabilistic machine learning	Describe techniques for dimensionality reduction for feature selection and classification	Scaffolding: <ul style="list-style-type: none"> <li>• Provide examples through course materials</li> <li>• Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>• Students read the course material</li> <li>• Students follow the text slides presentation</li> </ul>	Text slides	Assignment 1: Develop 10 multiple choice questions with four options online that tests comprehension from the course material.	7
<b>Module 2, Unit 1:</b> Descriptive statistics	Solve problems involving measures of central tendency and dispersion.	Scaffolding: <ul style="list-style-type: none"> <li>• Provide examples through course materials</li> <li>• Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>• Students follow examples</li> <li>• Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>• Text Slides</li> <li>• Instructional video on how to solve central tendency</li> <li>• Instructional video on how to solve dispersion</li> </ul>	Develop 10 multiple choice questions with four options online that gives immediate score to students and correct workings for failed questions.	7
<b>Module 2, Unit 2:</b> Graphs and Charts	Illustrate characteristics of data through graphs and charts.	Scaffolding: <ul style="list-style-type: none"> <li>• Provide examples through course materials</li> <li>• Flipped Classroom</li> </ul>	Students study the course material and attempt the exercises	Graphs and charts	Self-assessment exercise. Present a case for the student to interpret	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
<b>Module 2, Unit 3:</b> Evaluation metrics	Analyse evaluation metrics and their biases	<ul style="list-style-type: none"> <li>• Provide course materials</li> <li>• Ask questions based on the course material</li> </ul>	Students read the course material and attempt the exercises	Text slides	Assignment 2: give a scenario that will require evaluation metrics	7
<b>Module 3, Unit 1:</b> Samples and Populations	Apply sample parameters to infer population parameters	Scaffolding: <ul style="list-style-type: none"> <li>• Provide examples through course materials</li> <li>• Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>• Students read the course material</li> <li>• Students follow the text slides presentation</li> </ul>	Text slides with narration	Self-Assessment Exercise. Develop 10 multiple choice questions with four options online that gives immediate score to students and correct workings for failed questions.	7
<b>Module 3, Unit 2:</b> Parametric Tests I	Determine conditions for using parametric tests	<ul style="list-style-type: none"> <li>• Provide examples through course materials</li> <li>• Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>• Students follow examples</li> <li>• Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>• Text Slides</li> <li>• Instructional video on how to solve central tendency</li> <li>• Instructional video on how to solve dispersion</li> </ul>	Self-Assessment Exercise. Develop 10 multiple choice questions with four options online that gives immediate score to students and correct workings for failed questions.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 3, Unit 3:</b> Parametric Tests II	Apply t-test and F-test for determination of significance	<ul style="list-style-type: none"> <li>Provide examples through course materials</li> <li>Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Instructional video on how to solve central tendency</li> <li>Instructional video on how to solve dispersion</li> </ul>	Self-Assessment Exercise. Develop 10 multiple choice questions with four options online that gives immediate score to students and correct workings for failed questions.	7
<b>Module 3, Unit 4:</b> Non-parametric tests I	<ul style="list-style-type: none"> <li>Determine conditions for using non-parametric tests</li> <li>Solve real life problems with the use of chi-squared</li> <li>Apply Chi-squared and Mann-Whitney test for determination of significance</li> <li>Resolve existing challenges in specific real time situations with non-parametric tests</li> </ul>	<ul style="list-style-type: none"> <li>Provide examples through course materials</li> <li>Problem Based Scenario</li> </ul>	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Instructional video on how to solve central tendency</li> <li>Instructional video on how to solve dispersion</li> </ul>	Develop 10 multiple choice questions with four options online that gives immediate score to students and correct workings for failed questions.	7
<b>Module 3, Unit 5:</b> Non-parametric Tests II	<ul style="list-style-type: none"> <li>Apply Chi-squared and Mann-Whitney test for determination of significance</li> </ul>	<ul style="list-style-type: none"> <li>Provide examples through course materials</li> </ul>	<ul style="list-style-type: none"> <li>Students follow examples and</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Instructional video on how to solve central tendency</li> <li>Instructional video on how to solve dispersion</li> </ul>	Assignment 3: <ul style="list-style-type: none"> <li>Assignment that will require the knowledge of</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Resolve existing challenges in specific real time situations with non-parametric tests</li> </ul>	<ul style="list-style-type: none"> <li>Ask students to solve similar problems of provided examples</li> </ul>	<ul style="list-style-type: none"> <li>respond to scenarios</li> <li>Students attempt exercises</li> </ul>		<ul style="list-style-type: none"> <li>comprehension in the module</li> <li>Submit/present Portfolio</li> </ul>	

## Course Information

Course Code: ATI804  
Course Title: Machine Learning II  
Credit Unit: 3  
Course Status: Core  
Course Description/Blurb:  
Basic Requirements:  
Academic Year: 2020  
Semester: Second  
Course Duration: 13 weeks  
Required Hours for Study: 91

## Course Core Competencies

1. Ability to Work with Big Data
2. Ability to develop Software that Incorporate AI
3. Ability to represent and reason with Knowledge

## Course Objectives

The course objectives are:

- To explain the concepts of Neural Networks, Deep learning and reinforcement learning
- Develop solution to real life problems using neural networks deep learning and reinforcement learning

## Modules and Units

### Module 1: Neural Networks

- Unit 1: Biological Neurons
- Unit 2: Artificial neural networks
- Unit 3: Basic technologies and methodologies of artificial neural network I
- Unit 4: Basic technologies and methodologies of artificial neural network II
- Unit 5: Problem-solving using artificial neural network I
- Unit 6: Problem-solving using artificial neural network II

### Module 2: Deep Learning

- UNIT 1: Convolutional neural networks
- UNIT 2: Application of Convolutional Neural Network
- UNIT 3: Recurrent neural network
- UNIT 4: Application Recurrent Neural Networks

### Module 3: Reinforcement Learning

- UNIT1: Introduction to Reinforcement Learning
- UNIT2: Reinforcement learning algorithms I
- UNIT3: Reinforcement learning algorithms II

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1:</b> Neural Networks						
<b>Unit 1:</b> Biological Neurons	Explain the structure and function of biological neurons	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Respond to activities	<ul style="list-style-type: none"> <li>short video demonstration</li> <li>forum</li> </ul>	Self-assessment exercises	7
Unit 2: Artificial neural networks	<ul style="list-style-type: none"> <li>Explain how biological neurons lead to the development of artificial neural network</li> <li>Develop Perceptrons</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problemsolving technique</li> </ul>	<ul style="list-style-type: none"> <li>Read and participate in laboratory works</li> </ul>	<ul style="list-style-type: none"> <li>Short video demonstration</li> <li>Forum</li> </ul>	Self-assessment exercise	7
<b>Unit 3:</b> Basic technologies and methodologies of artificial neural network I	Evaluate basic technologies and methodologies of artificial neural network and their applications	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	<ul style="list-style-type: none"> <li>Short video demonstration</li> </ul>	Self-assessment exercise	7
<b>Unit 4:</b> Basic technologies and methodologies of artificial neural network II	Compare the basic technologies and methodologies of artificial neural network and their applications	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	<ul style="list-style-type: none"> <li>Short video demonstration</li> </ul>	Self-assessment exercise	7
<b>Unit 5:</b> Problem-solving using artificial neural network I	Design solutions to real life problems using artificial neural network	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	Tensorflow , Deep learning studio	Self-assessment exercise	7
<b>Unit 6:</b> Problem-solving using artificial neural network II	Develop solutions to solve real life problems using artificial neural network	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	Tensorflow , Deep learning studio	Assignment 1: Mini project	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 2:</b> Deep learning						7
<b>UNIT 1:</b> Convolutional neural networks	Explain the Convolutional Neural Network Framework	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	<ul style="list-style-type: none"> <li>Short video demonstration</li> </ul>	Self-assessment exercise	7
<b>UNIT 2:</b> Application of Convolutional neural network	Build object classification application that require Convolutional Neural Network	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	Tensorflow , Deep learning studio	Self-assessment exercise	7
<b>UNIT 3:</b> recurrent neural network	Explain the Recurrent Neural Networks Framework	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	<ul style="list-style-type: none"> <li>Short video demonstration</li> </ul>	Self-assessment exercise	7
<b>UNIT 4:</b> Application recurrent neural network	Develop a speech recognition application for an African language using Recurrent Neural Network	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	Tensorflow , Deep learning studio	Assignment 2: Mini project and presentation of the project	7
<b>Module 3:</b> reinforcement Learning						7
<b>UNIT1:</b> Introduction to reinforcement learning	<ul style="list-style-type: none"> <li>Explain the concept of reinforcement learning</li> <li>Compare the problems that require supervised and unsupervised learning to those that require reinforcement learning</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	<ul style="list-style-type: none"> <li>Short video demonstration</li> </ul>	Self-Assessment Exercise	7
<b>UNIT2:</b> Reinforcement learning algorithms I	<ul style="list-style-type: none"> <li>Explain reiYahoo thank you OK I said no we request material nforcement Learning algorithms</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	<ul style="list-style-type: none"> <li>Short video demonstration</li> </ul>	Self-assessment exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Compare reinforcement learning algorithm: Deep reinforcement learning, inverse reinforcement learning and apprenticeship learning</li> </ul>					
<b>UNIT 3:</b> Reinforcement learning algorithms II	Develop a classification software using reinforcement learning	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem solving technique</li> </ul>	Read and participate in laboratory works	Tensorflow	Assignment 3: Mini project	7

## Course Information

Course Code:	ATI805
Course Title:	Machine Learning I
Credit Unit:	3
Course Status:	Core
Course Description/Blub:	This course presents the concept of machine learning and its techniques. It describes how to prepare input for learning, the application of appropriate learning algorithm to relevant learning situations, and the evaluation of learned concepts.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

1. Ability to Work with Big Data
2. Ability to develop Software that Incorporate AI
3. Ability to represent and reason with Knowledge

## Course Objectives

- Explain the concept of machine learning, describe its input and output
- Apply machine learning algorithm on real life data sets, and develop solutions to new problems
- Evaluate machine learning solution to problems

## Modules and Units

Module 1: learning theories, input and output

Unit 1: Learning theory

Unit 2: Input to machine learning I

Unit 3: Input to machine learning II

Unit 4: output from machine learning I

Unit 5: output from machine learning II

Module 2: learning algorithms

Unit 1: Supervised learning algorithms I

Unit 2: Supervised learning algorithms II

Unit 3: Unsupervised learning algorithms I

Unit 4: Unsupervised learning algorithms II

Module 3: Evaluation of learned concepts

Unit 1: Philosophy of learning evaluation

Unit 2: Machine learning Evaluation methods

Unit 3: Evaluation metrics I

Unit 4: Evaluation metrics II

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1:</b> learning theories, input and output						
<b>Unit 1:</b> Learning theory	<ul style="list-style-type: none"> <li>Explain the different learning theories</li> <li>Develop new ideas from the learning theories</li> </ul>	<ul style="list-style-type: none"> <li>Scenarios</li> <li>Problem based techniques</li> </ul>	Read and attempt self-assessment exercises	Generic Resources	Self-assessment exercise with feedback	7
<b>Unit 2:</b> Input to machine learning I	Discuss the structure and characteristics of input to a machine learning algorithm	Scenarios	Students demonstrates knowledge	WEKA Software	Self-assessment exercise with feedback	7
<b>Unit 3:</b> Input to machine learning II	Prepare and convert data to a format suitable for machine learning (ARFF format)	Problem based techniques	Students demonstrates knowledge	Generic Resources	Self-assessment exercise with feedback	7
<b>Unit 4:</b> output from machine learning I	<ul style="list-style-type: none"> <li>Describe the relationship between learning algorithms and their outputs</li> </ul>	Scenarios	Students demonstrates knowledge	WEKA Software	Self-assessment exercise with feedback	7
<b>Unit 5:</b> output from machine learning II	<ul style="list-style-type: none"> <li>Interpret the output from machine learning</li> <li>Solve real life problems using machine learning</li> </ul>	Problem based techniques	Students demonstrates knowledge	WEKA Software	Assignment 1: Mini project	7
<b>Module 2:</b> learning algorithms						
<b>Unit 1:</b> Supervised learning algorithms I	<ul style="list-style-type: none"> <li>Solve a classification problem Using Naïve Bayes algorithm</li> </ul>	Problem based techniques	Students demonstrates knowledge	<ul style="list-style-type: none"> <li>WEKA Software</li> <li>Forum</li> </ul>	Self-assessment exercise with feedback	7
<b>Unit 2:</b> Supervised learning algorithms II	Solve a classification problem Using Decision Trees	Scenarios	Students demonstrates knowledge through hands on	WEKA Software	Self-assessment exercise with feedback	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Unit 3:</b> Unsupervised Learning Algorithms I	<ul style="list-style-type: none"> <li>Discover knowledge from data using Association Rule Mining</li> </ul>	Problem based techniques	Students demonstrates knowledge through hands on	WEKA Software	Self-assessment exercise with feedback	7
<b>Unit 4:</b> Unsupervised Learning Algorithms II	<ul style="list-style-type: none"> <li>Discover knowledge from data using clustering algorithms</li> </ul>	Scenarios	Students demonstrates knowledge through hands on	WEKA Software	Assignment 2: Mini project	7
<b>Module 3:</b> Evaluation of learned concept						
<b>Unit 1:</b> philosophy of learning evaluation	Explain the philosophical aspect of evaluation: Minimum Description Length and Occam's Razor	Scenarios	Students demonstrates knowledge through hands on	Generic Resources	Self-assessment exercise with feedback	7
<b>Unit 2:</b> machine learning Evaluation methods	Critique evaluation methods: Holdout and Cross Validation	Problem based techniques	Students demonstrates knowledge through hands on	WEKA Software	Self-assessment exercise with feedback	7
<b>Unit 3:</b> Evaluation metrics I	Assess the effectiveness of learned models: Accuracy, Precision, Recall, F-measure and Error Rate using various evaluation methods.	Scenarios	Students demonstrates knowledge through hands on	WEKA Software	Self-assessment exercise with feedback	7
<b>Unit 4:</b> Evaluation metrics II	Compare various evaluation metrics: Accuracy, Precision, Recall, F-measure and Error Rate	Problem based techniques	Students demonstrates knowledge	Generic Resources	Assignment 3: <ul style="list-style-type: none"> <li>Mini project and presentation</li> <li>Submit/present Portfolio</li> </ul>	7

## Course Information

Course Code:	ATI806
Course Title:	Robotics
Credit Unit:	3
Course Status:	Core
Course Description/Blurb:	This course introduces students to robotic design and autonomous agents through the integration of mechanical devices, sensors and intelligent agents.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- Ability to develop Software that Incorporate AI
- Ability to represent and reason with Knowledge

## Course Objectives

- Explain robotics as an AI field and distinguish between its software and hardware aspects
- Analyse approaches to robot development and the applications
- Formulate robotic solution to a given real life scenario

## **Modules and Units**

Module 1: History, types and uses of Robots

Unit1: History of Robotics

Unit 2: Asimov Laws of Robotics

Unit 3: Types of Robots I

Unit 4: Types of Robots II

Unit 5: Uses of Robots

Module 2: Physics and Mathematics of Robotics

Unit 1: Kinematics of robotic systems

Unit 2: Statics and Dynamics of robotics systems

Unit 3: Matrices in robotics.

Unit 4: Case studies

Module 3: Design and Operation of Robotic Systems

Unit 1: Components of Robotic systems

Unit 2: Knowledgebase of Robotics I

Unit 3: Knowledgebase of Robotics II

Unit 4: Control Systems

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1:</b> History, types and uses of Robots						
<b>Unit 1: History of Robotics</b>	Explain the present state to project future Robots.	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video	Self-Assessment Exercise: Evaluation of assignments and projects.	7
Unit 2: Asimov Laws of Robotics	<ul style="list-style-type: none"> <li>Explain the Asimov Laws of Robotics</li> <li>Solve AI problems using Asimov Laws of Robotics</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video	Self-Assessment Exercise: Evaluation of assignments and projects.	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
<b>Unit 3:</b> Types of Robots I	Solve problems using Manipulators, legged and wheeled Robots	Demonstration	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, <a href="#">Instructional Video</a>	Evaluation of assignments and projects. Examination	7
<b>Unit 4:</b> Types of Robots II	Differentiate between autonomous and unmanned vehicles.	Demonstration	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video, Forum	Evaluation of assignments and projects. Examination	7
<b>Unit 5: Uses of Robots</b>	Demonstrate the use of Robots as human replacement in dangerous, repetitive and menial jobs	Demonstration	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video	Assignment 1: Mini Projects	7
<b>Module 2:</b> Physics and Mathematics of Robotics						
<b>Unit 1:</b> Kinematics of Robotic Systems	Develop competency in the Kinematics of robotics	Demonstration	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video. Robotic Kits	Self-Assessment Exercise: Evaluation of assignments and projects.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Unit 2:</b> Statics And Dynamics of Robotics Systems	Solve problems relating to Statics and Dynamics of Robotic Systems.	Demonstration	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Robotic Kits	Evaluation of assignments and projects. Examination	7
Unit 3: Matrices In Robotics.	Solve problems concerned with forward transformation of matrices applied to robotics	Demonstration	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Robotic Kits	Evaluation of assignments and projects. Examination	7
Unit 4: Case Studies	Evaluate real-life robotic systems	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and watch Instructional Videos. Undertake Programming Assignments	Computer, Internet Connectivity, Instructional Video Robotic Kits and Open Source Python Interpreter, IDE and libraries	Assignment 2: Evaluation of programming assignments and projects. Examination	7
Module 3: Design And Operation Of Robotic Systems						
Unit 1: Components Of Robotic Systems	Build robotic systems cobining Mechanical, Power Suply and Sensor Systems, Signal Processing and Control Systems.	Demonstration	Students read supplied texts and watch Instructional Videos. Undertake Programming Assignments	Computer, Internet Connectivity, Instructional Video Robotic Kits and Open Source Python Interpreter, IDE and libraries, Forum	Self-Assesment Exercise: Evaluation of programming assignments and projects. Examination	7
<b>Unit 2:</b> Knowledgebase of Robotics I	Explain feedback control systems Sensors and signals	Demonstration	Students read supplied texts and watch Instructional Videos.	Instructional videos	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	Actuators and power electronics Interfacing with computers					
<b>Unit 3:</b> Knowledgebase of Robotics II	Analyse dynamic systems	Demonstration	Students read supplied texts and watch Instructional Videos. Undertake Programming Assignments	Instructional Videos	Self-Assessment Exercise	7
<b>Unit 4:</b> Control Systems	Process information from sensors to provide control for intelligent motion by computing <ul style="list-style-type: none"> <li>control commands for actuators and other prime movers.</li> </ul>	Demonstration	Students read supplied texts and watch Instructional Videos. Undertake Programming Assignments	Instructional Videos	Assignment 3: <ul style="list-style-type: none"> <li>Mini project</li> <li>Submit/present Portfolio</li> </ul>	7

## Course Information

Course Code:	ATI803
Course Title:	Programming for Artificial Intelligence
Credit Unit:	3
Course Status:	Core
Course Description/Blurb:	This course treats python programming for Artificial Intelligence to equip you with knowledge and skills in the use of Python programming language for implementing algorithms that exhibit Intelligent behaviour.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competenciess

- Ability to Work with Big Data
- Ability to develop Software that Incorporate AI

## Course Objectives

To develop capacity of students for to use Python to implement huristic search, classification and clustering as well as other Machine learning algorithms which make machines put up intelligent behaviour.

## Modules and Units

Module 1: Basic programing in Python

Unit 1: Variables, Iteration and Recurssion

Unit 2: LAB – Demonstrating Variables, Iteration, and Recursion

Unit 3: From Variables to functions

Unit 4: LAB – Demonstrating Functions

Unit 5: File I/O

Unit 6: LAB – Demonstrating File I/O

Module 2: Object Oriented Programming Techniques

Unit 1: Objects, Variables and Methods

Unit 2: Composition, inheritance

Unit 3: Delegation and Polymorphism

Unit 4: LAB – Object Oriented Programming (OOP)

Module 3: Python for AI problems

Unit 1: Python Scientific Libraries

Unit 2: Applictaiion of Python to AI problems

Unit 3: LAB – Demonstrating Python Libraries for AI

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1:</b> Basic programing in Python						
<b>Unit 1:</b> Variables, Iteration and Recursion	<ul style="list-style-type: none"> <li>Represent data as variables</li> <li>Lists variables</li> <li>Process the data and variables within iterative and recursive routines.</li> </ul>	Reality of Pedagogy	Students will read supplied texts, watch videos and then Undertake programming assignments	<ul style="list-style-type: none"> <li>Computer,</li> <li>Internet Connectivity,</li> <li>Instructional Video and</li> <li>Open Source Python Interpreter and IDE</li> </ul>	Self-Assessment Exercise: Evaluation of programming assignments and projects. Examination	7
<b>Unit 2:</b> LAB – Demonstrating Variables, Iterations, and Recursions	Write and Execute programs demonstrating the use of variables iterations and recursions	Reality of Pedagogy	Students will read supplied texts, watch videos and then Undertake programming assignments	<ul style="list-style-type: none"> <li>Open Source Python Interpreter and IDE</li> <li>Instructional Video</li> </ul>	Self-Assessment Exercise: present exercise that will enable students demonstrate the skills	7
<b>Unit 3:</b> From Variables to functions	Write modules and functions that carry out specific programming task and output relevant results as variables or lists of variables	Reality of Pedagogy	Students read supplied texts. Watch Videos Undertake programming assignments	<ul style="list-style-type: none"> <li>Computer,</li> <li>Internet Connectivity,</li> <li>Instructional Video and</li> <li>Open Source Python Interpreter and IDE</li> </ul>	Self-Assessment Exercise: Evaluation of programming assignments and projects. Examination	7
<b>Unit 4:</b> LAB – Demonstrating Functions	Develop python functions to solve specific challenges in the society	Demonstration	Students follow instructions	<ul style="list-style-type: none"> <li>Computer,</li> <li>Internet Connectivity,</li> <li>Instructional Video and</li> <li>Open Source Python Interpreter and IDE</li> </ul>	Self-Assessment Exercise: Evaluation of programming assignments and projects. Examination	7
<b>Unit 5:</b> File I/O	Read and write to text, CSV and binary files.	Reality of Pedagogy	Students read supplied texts. Watch Videos	<ul style="list-style-type: none"> <li>Computer,</li> <li>Internet Connectivity,</li> <li>Instructional Video and</li> </ul>	Self-Assessment: Evaluation of programming	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
			Undertake programming assignments	<ul style="list-style-type: none"> <li>Open Source Python Interpreter and IDE</li> </ul>	assignments and projects. Examination	
<b>Unit 6:</b> LAB – Demonstrating File I/O	Demonstrate the use of File I/O in solving basic problems	Reality of Pedagogy	Students read text and watch video	Instructional Video	Assignment 1: Mini Project	7
<b>Module 2:</b> Object Oriented Programming Techniques	Demonstrate the use of File I/O in solving basic problems	Reality of Pedagogy	Students read text and watch video	Instructional Video	Self-Assessment Exercise	7
<b>Unit 1:</b> Objects, Variables and Methods	Recognise relevant fields and procedures required to make objects behave intuitively and efficiently	Reality of Pedagogy	Students read supplied texts. Watch Videos Undertake programming assignments	Computer, Internet Connectivity, Instructional Video and Open Source Python Interpreter and IDE	Self-Assessment Exercise: Evaluation of programming assignments and projects. Examination	7
<b>Unit 2:</b> Composition, inheritance, delegation and Polymorphism	Apply complex objects derived from simpler ones, hierarchical classes that inherit variables and methods from lower hierarchies and operators whose functions depend on the conditions of use.	Reality of Pedagogy	Students read supplied texts. Watch Videos Undertake programming assignments	Computer, Internet Connectivity, Instructional Video and Open Source Python Interpreter and IDE	Self-Assessment Exercise: Evaluation of programming assignments and projects. Examination	7
<b>Unit 3:</b> LAB – Object Oriented Programming (OOP)	Demonstrate Object Oriented concepts in Programming	Demonstration	Students read supplied texts. Watch Videos Undertake programming assignments	Computer, Internet Connectivity, Instructional Video and Open Source Python Interpreter and IDE	Assignment 2: Mini project	7
<b>Module 3:</b> Python for AI problems	Demonstrate the use of Python for AI problems	Scenario Based Simulations	Students read supplied texts. Watch Videos	Simulation using Python for AI problems	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
			Undertake programming assignments			
<b>Unit 1:</b> Python Scientific Libraries	Explain Python Scientific libraries such as NumPy, Scikit-learn, iPython Notebook, and Matplotlib	Reality of Pedagogy	Students read supplied texts. Watch Videos Undertake programming assignments	Computer, Internet Connectivity, Instructional Video and Open Source Python Interpreter, IDE and libraries	Self-Assessment: Evaluation of programming assignments and projects. Examination	7
<b>Unit 2:</b> Application of Python to AI problems	Demonstrate the use of Python AI Libraries such as TensorFlow and NLTK skills in solving problems in the society	Reality of Pedagogy	Students read supplied texts. Watch Videos Undertake programming assignments	Computer, Internet Connectivity, Instructional Video and Open Source Python Interpreter, IDE and libraries, Simulation	Self-Assessment Exercise: Evaluation of programming assignments and projects. Examination	7
<b>Unit 3:</b> LAB- Demonstrating Python libraries in AI	Solve problems using Python libraries for AI: TensorFlow and NLTK	Reality of Pedagogy	Read text and take the exercises	TensorFlow and NLTK	Assignment 3: <ul style="list-style-type: none"> <li>To cover the module content</li> <li>Submit/present Portfolio</li> </ul>	7

## Course Information

Course Code:	ATI823
Course Title:	Introduction to Algorithms
Credit Unit:	2
Course Status:	Elective
Course Description/Blurb:	This is an introductory course to algorithms and data structures to equip you to design complex algorithm from simple ones and implement them using appropriate data structures and analyse the performance of these algorithms to decide which may be more applicable in various situations.
Basic Requirements:	
Academic Year:	2020
Semester:	
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Explore the basics of algorithms, and data structures

## Course Objectives

The objective of the course is to:

- Synthesize simple algorithms and data structures
- Compare algorithmic performance

## Modules and Units

Module 1: Introduction to Algorithms

Unit 1: The Role of Algorithms in Computing

Unit 2: Basic and advanced algorithms

Unit 3: Performance of algorithms

Module 2: Sorting and Order Statistics

Unit 1: Divide and Conquer

Unit 2: Sorting Algorithms

Unit 3: Search Algorithms

Module 3: Data Structures

Unit 1: Stacks and Queues

Unit 2: Binary search trees

Unit 3: Hash Tables

Unit 4: Skip Lists

Unit 5: Augmenting Data Structures

Module 4: Selected Topics

Unit 1: Dynamic Programming

Unit 2: Greedy Algorithms

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1: Introduction to Algorithms</b>						
Unit 1: The Role of Algorithms in Computing	Discuss the integral part of algorithm towards computing	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read the texts and answer questions	Generic Resources	Self-Assessment Exercise: To test student understanding on the role of algorithms	5
Unit 2: Basic and Advanced Algorithms	<ul style="list-style-type: none"> <li>Identify basic and advanced algorithms</li> <li>Classify basic and advanced algorithms</li> </ul>	<ul style="list-style-type: none"> <li>Flipped Classroom <ul style="list-style-type: none"> <li>Assign reading, from course material</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Present algorithms for identification with immediate feedback</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides in course material</li> <li>Instructional video</li> </ul>	Self-Assessment Exercise: Develop a fill in the gap questions to test comprehension of Basic and Advanced algorithms online	5
Unit 3: Performance of Algorithms	Analyze average-case, best-case, worst-case running times of algorithms	<ul style="list-style-type: none"> <li>Problem Solving Scenarios <ul style="list-style-type: none"> <li>Students are presented with already developed algorithms to analyse</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Students are given algorithms whose running time is probabilistic to analyze their running time</li> <li>Students are given algorithms to analyze their running time using asymptotic analysis</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Instructional video with a step on step guide on how to analyze performances of algorithms</li> </ul>	Self-Assessment Exercise: A CA assignment that they will be tested on concept, techniques, and the importance of analyzing the performance of an algorithm	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 2: Sorting and Order Statistics						5
Unit 1: Divide and Conquer	<ul style="list-style-type: none"> <li>• Divide problems into parts,</li> <li>• Solve the problems recursively,</li> <li>• Combine problems solutions, and present them as a whole again</li> </ul>	<ul style="list-style-type: none"> <li>• Flipped Classroom <ul style="list-style-type: none"> <li>○ Present instructions</li> </ul> </li> </ul>	Students work through the text	Generic Resources	Self-Assessment Exercise to test the knowledge gained	5
Unit 2: Sorting Algorithms	Identify the use of sorting algorithms: insert, heap, and quick sort	<ul style="list-style-type: none"> <li>• Flipped Classroom <ul style="list-style-type: none"> <li>○ Present instructions</li> </ul> </li> <li>• Tutorial session in which different arrays are sorted</li> </ul>	<ul style="list-style-type: none"> <li>• Students read text and respond to questions</li> <li>• Students participate in video conferencing</li> </ul>	<ul style="list-style-type: none"> <li>• Text Slides Step by step diagram of how sorting is done</li> </ul>	Self-Assessment Exercise: Students are to find out the challenges of each sorting algorithm discussed during the unit.	5
Unit 3: Search Algorithms	Identify the use of search algorithms: Binary, and Linear Search algorithms	<ul style="list-style-type: none"> <li>• Flipped Classroom <ul style="list-style-type: none"> <li>○ Present instructions</li> </ul> </li> <li>Tutorial session in which different search are employed</li> </ul>	<ul style="list-style-type: none"> <li>• Students read text and respond to questions</li> <li>• Students participate in video conferencing</li> </ul>	<ul style="list-style-type: none"> <li>• Text Slides Step by step diagram of how search is done</li> </ul>	Assignment 1: Students are to find out the challenges of each searching algorithm discussed during the unit.	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 3: Data Structures						5
Unit 1: Stacks and Queues	<ul style="list-style-type: none"> <li>Design an algorithm that populates and depopulate a stack and a queue</li> </ul>	<ul style="list-style-type: none"> <li>Flipped Classroom <ul style="list-style-type: none"> <li>Present instructions</li> </ul> </li> <li>Tutorial session in which questions are asked and the answers can be found in the course material</li> </ul>	<ul style="list-style-type: none"> <li>Students read text and respond to questions</li> <li>Students participate in video conferencing</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> </ul> <p>Step by step diagram of how to populate a stack</p>	Self-Assement Exercise: Develop 10 multiple choice questions with four options on the portal that tests comprehension, answers can be found on the course material and it is time sensitive.	5
Unit 2: Binary search trees	<ul style="list-style-type: none"> <li>Demonstrate how search trees are represented in memory</li> </ul>	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Present course material</li> </ul> </li> <li>Tutorial session in which questions are asked and the answers can be found on the course material</li> </ul>	<ul style="list-style-type: none"> <li>Students read text and respond to questions</li> <li>Students participate in video conferencing</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> </ul>	Self-Assessment Exercise: Develop 10 multiple choice questions with four options on the portal that tests comprehension, answers can be found on the course material and it is time sensitive.	5
Unit 3: Hash Tables	Identified the roles of keys and values in a hash table	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Present course material</li> </ul> </li> <li>Tutorial session in which questions are asked and the answers can be found on the course material</li> </ul>	<ul style="list-style-type: none"> <li>Students read text and respond to questions</li> <li>Students participate in video conferencing</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Diagram description of a hash table</li> </ul>	Self-Assessment Exercise: Develop 10 multiple choice questions with four options on the portal that tests comprehension, answers can be found on the course material and it is time sensitive.	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Unit 4: Skip Lists	Perform a search algorithm employing Skip Lists	Problem Solving Technique	Students respond to real-world problem using skip lists	Generic Resources	Self-Assessment Exercise	5
Unit 5: Augmenting Data Structures	Identify the likelihood of a presented data structure for a problem requiring augmentation	Cooperative Learning	Students share their experience through forum discussion	<ul style="list-style-type: none"> <li>• Forum</li> <li>• Instructional Video</li> </ul>	Assignment 2: Students Review five comments on the discussion forum	5
Module 4: Selected Topics						5
Unit 1: Dynamic Programming	Apply dynamic-programming to solve a subsubproblem	Problem Solving Scenarios	Students share their experience through forum discussion	Forum	Self-Assessment Exercise	5
Unit 2: Greedy Algorithms	Solve real life problem by employing Greedy Algorithm	Problem Solving Scenarios	Students read the text and do the exercises	Generic Resources	Assignment 3: <ul style="list-style-type: none"> <li>• To cover the content in the module.</li> <li>• Submit/present Portfolio</li> </ul>	5

## Course Information

Course Code:	ATI821
Course Title:	Basic Probability, Statistics and Algebra
Credit Unit:	2
Course Status:	Elective
Course Description/Blub:	This course will introduce the basic concept of Probability, Statistics, and Linear Algebra to enhance the mathematical skills you require for quantitative problem solving.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

Fundamental understanding of concepts and basic properties, ability to interpret and communicate data

## Course Objectives

The objectives of this course are to:

- Design concepts to make decisions under uncertainty
- Represent entities as symbols or alphabets in a mathematical relationship and its equation

## Modules and Units

### Module 1: Introduction to Probability

Unit 1: Fundamental Counting Principles

Unit 2: Permutations

Unit 3: Combinations

Unit 4: Probability of Events: Multiple, Independent, Dependent, and Codependent

Unit 5: Binomial Theorem

### Module 2: Exploratory Data Analysis

Unit 1: Examining Distributions

Unit 2: Examining Relationships

### Module 3: Producing Data

Unit 1: Source of Data

Unit 2: Design Experiments

Unit 3: Sampling Design

### Module 4: Basics of Linear Algebra

Unit 1: Systems of Linear equations

Unit 2: Vectors and matrices

Unit 3: Analytical and Numerical methods

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Introduction to Probability						
Unit 1: Fundamental Counting Principles	Demonstrate the use of a tree diagram to show the number of choices that can be made from a given a set	Problem solving Scenarios	Students work on examples	Generic Resources	Self-Assessment Exercise with feedback	5
Unit 2: Permutations	Distinguish between distinct and not distinct objects.	Problem solving Scenarios	Students work on examples	Generic Resources	Self-Assessment Exercise with feedback	5
Unit 3: Combinations	<ul style="list-style-type: none"> <li>Differentiate between Permutations and Combinations</li> <li>Identify combinations of objects given</li> </ul>	Problem solving Scenarios	Students work on examples	Generic Resources	Self-Assessment Exercise with feedback	5
Unit 4: Probability of Events: Multiple, Independent, Dependent, and Codependent	Calculate the probability of events in Multiple, Independent, Dependent, and Codependent events	Case Study	Student work through the case studies	Text Slides with narration	Self-Assessment Exercise with feedback	5
Unit 5: Binomial Theorem	Describe the algebraic expansion of powers of a binomial using Pascal's Triangle	Problem solving Scenarios	Students work on examples	Generic Resources	Self-Assessment Exercise with feedback	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 2: Exploratory Data Analysis						5
Unit 1: Examining Distributions	<ul style="list-style-type: none"> <li>Choose the probability distribution function that best indicates the likelihood of an event or an outcome occurring based on the supplied data</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Students reads the course material</li> <li>List and explain the use of probability distributions in Discrete, and Continuous</li> </ul>	<ul style="list-style-type: none"> <li>Text slides</li> <li>Diagrams of probability distributions</li> </ul>	Discuss one other probability distribution apart from Discrete and Continuous on the discussion forum	5
Unit 2: Examining Relationships	Identify and model the relationship between two quantitative variables	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Diagrams of relationships between two quantitative variables</li> <li>Textual Case Studies</li> </ul>	Assignment 1: Create a real world scenario based problem for students to solve	5
Module 3: Producing Data						
Unit 1: Source of Data	<ul style="list-style-type: none"> <li>Identify sources of data</li> <li>Explain when to use the identified</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> </ul>	<ul style="list-style-type: none"> <li>Students reads the course material and</li> </ul>	<ul style="list-style-type: none"> <li>Text slides</li> </ul>	Self-Assessment Exercise: Develop 10 multiple choice questions with four	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	data to make informed decisions	<ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul>	respond to the exercises		options online that tests comprehension from the course material.	
Unit 2: Design Experiments	Perform a treatment to observe a response	Problem Solving Scenario	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Perform experiments and observe a response</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Step by step diagram of how to perform an experiment</li> <li>Instructional video, taking you through the process of performing and observing experiment</li> </ul>	Presentation of poster on the experiment performed on the forum page	5
Unit 3: Sampling Design	Collect data from a sample, and make inferences for its population	Problem Solving Scenario	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Student do mini sampling</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Instructional video on how to collect data from a sample, and make inferences for its population</li> <li>Textual Scenarios</li> </ul>	Assignment 2: <ul style="list-style-type: none"> <li>Presentation of poster on sampling design on the forum page</li> <li>Students to comment on five other posts on the forum</li> </ul>	5
Module 4: Basics of Linear Algebra						5
Unit 1: Systems of Linear equations	<ul style="list-style-type: none"> <li>Solve real life problems using systems of linear equations</li> </ul>	Problem Solving Scenario	<ul style="list-style-type: none"> <li>Students follow examples</li> </ul>	<ul style="list-style-type: none"> <li>Text Slides</li> <li>Instructional video on how to solve algebraic expressions</li> </ul>	Self-Assessment Exercise: Develop 10 multiple choice questions with four	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
			Students attempt exercises	<ul style="list-style-type: none"> <li>Textual Scenarios</li> </ul>	options online that gives immediate score to students that tests comprehension	
Unit 2: Vectors and matrices	<ul style="list-style-type: none"> <li>Solve real life problem with systems of linear equations and matrices within a specified time.</li> <li>Solve real life problems with the use of Vector algebra within a specified time</li> </ul>	Problem Solving Scenario	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>Text Slide</li> <li>Instructional video on how to solve algebraic fractions</li> <li>Scenarios</li> </ul>	Self-Assessment Exercise: Develop 10 multiple choice questions with four options online that gives immediate score and comment to students that tests comprehension	5
Unit 3: Analytical and Numerical methods	<ul style="list-style-type: none"> <li>Distinguish between problems that can be solve analytically from those that require numerical methods</li> <li>Apply Numerical methods to solve real life problems</li> </ul>	Problem Solving Scenario	<ul style="list-style-type: none"> <li>Students follow examples</li> <li>Students attempt exercises</li> </ul>	<ul style="list-style-type: none"> <li>Text Slide</li> <li>Instructional video on how to solve quadratic equations</li> <li>Scenarios</li> </ul>	Assignment 3: Mini project that will the knowledge acquire in this module	5

## Course Information

Course Code: AT1822  
Course Title: Computational Logic  
Credit Unit: 2  
Course Status: Elective

### Course Description/Blurb:

Basic Requirements:  
Academic Year: 2020  
Semester: Second  
Course Duration: 13 weeks  
Required Hours for Study: 65

## Course Core Competencies

Ability to develop Software that Incorporate AI  
Ability to represent and reason with Knowledge

## Course Objectives

To develop the understanding of the use of logic as a necessary connector of information and rules to enable deductive reasoning by machines through logic programming

## Modules and Units

Module 1: Logic as a formalism for Knowledge representation

Unit 1: Logic and reasoning

Unit 2: Propositional logic

Unit 3: Predicate logic

Unit 4: Formal Logics

Module 3: Decision procedure

Unit 1: Boolean decisions diagram

Unit 2: Linear Arithmetic

Unit 3: Combining decision procedures

Unit 4: Case studies

Module 3: Logic Programming

Unit 1: Automated Reasoning

Unit 2: Logic Programming I

Unit 3: LAB-Prolog I

Unit 4: Logic Programming II

Unit 5: LAB-Prolog II

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1:</b> Logic As A Formalism for Knowledge Representation						
<b>Unit 1:</b> Logic And Reasoning	<ul style="list-style-type: none"> <li>Distinguish between data, information and knowledge</li> <li>Differentiate between data-bases and knowledge-bases</li> <li>Apply Logic and reasoning in solving real life problems</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and take the exercises	Computer, Internet Connectivity, Instructional video	Self-Assessment Exercise: Create a Scenario and ask questions based on the scenario	5
Unit 2: Propositional Logic	<ul style="list-style-type: none"> <li>Distinguish between the syntax and semantics in propositional logic</li> <li>Proof theory of propositional logic</li> <li>Represent Natural Language statements using propositional logic</li> <li>Apply propositional logic in solving real life problems</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and take the exercises	Computer, Internet Connectivity, Instructional video	Self-Assessment Exercise: Create a Scenario and ask questions based on the scenario	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Unit 3: Predicate Logic	<ul style="list-style-type: none"> <li>Distinguish between the syntax and semantics in predicate logic</li> <li>Proof theory of predicate logic</li> <li>Represent Natural Language statements using predicate logic</li> <li>Compare and contrast between propositional and predicate logic</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and take the exercises	Computer, Internet Connectivity	Self-Assessment Exercise: Create a Scenario and ask questions based on the scenario	5
<b>Unit 4: Formal Logics</b>	Develop familiarity with propositional and predicate logics	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts. Undertake programming assignments	Computer, Internet Connectivity	Assignment 1: Give an assignment that will require solving real life problem using the knowledge in Module 1.	5
Module 2: Decision Procedure						
<b>Unit 1:</b> Boolean Decisions Diagram	<ul style="list-style-type: none"> <li>Explain Boolean decision diagrams and their applications</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> </ul>	Students read text, take part in video conferencing	Short video	Self-Assessment Exercise	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Draw Boolean decision diagram for given real life problems</li> </ul>	<ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> <li>Problem Solving Scenarios</li> </ul>	and do the exercises			
Unit 2: Linear Arithmetic	<ul style="list-style-type: none"> <li>Explain Linear arithmetic in relation to computaional logic</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Student read text and do the exercises	Slide videos	Self-Assessment Exercise	5
Unit 3: Combining Decision Procedures	<ul style="list-style-type: none"> <li>Discuss the state-of-the-art methods for combining decision procedures</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students work through the scenarios	Text Slides	Self-Assessment Exercise	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Unit 4: Case Studies	<ul style="list-style-type: none"> <li>Review of computational logic scenarios in AI applications</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies	Textual, simulated and video Case studies	Assignment 2: should give opportunity for students to solve real life problems using the knowledge learnt	5
<b>Module 3: Logic Progmming</b>						
<b>Unit 1: Automated Reasoning</b>	<p>Apply the various methods and tools employed to make machines to do deductions automatically.</p> <p>Develop capacity to express Natural language and mathematical expressions in logic</p>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts. Undertake programming assignments	Computer, Internet Connectivity	Evaluation of home work and projects. Examination	5
<b>Unit 2: Logic Programming I</b>	Analyse given problems and design Prolog solutions.	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-</li> </ul> </li> </ul>	Students read supplied texts. Undertake programming assignments	Computer, Internet Connectivity SWI Prolog (Open source) IDE	Evaluation of programming assignments and projects. Examination	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		assessment exercises <ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> </ul>				
Unit 3: Lab-Prolog I	Write and execute programs in Prolog	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Problem Solving Scenarios</li> </ul>	Students practice program writing	<ul style="list-style-type: none"> <li>• SWI Prolog (Open source) IDE</li> <li>• Simulation</li> </ul>	Self-Assessment Exercise	5
Unit 4: Logic Programming Ii	Analyse advanced problems to design Prolog solutions.	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Problem Solving Scenarios</li> </ul>	Students practice how to analyse problems and design solutions	<ul style="list-style-type: none"> <li>• SWI Prolog (Open source) IDE</li> <li>• Simulation</li> </ul>	Self-Assessment Exercise	5
Unit 5: Lab-Prolog II	Write and execute programs in Prolog	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions</li> </ul> </li> </ul>	Students practice program writing	SWI Prolog (Open source) IDE	Assignment 3: Mini project and presentation through short video.	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		and self-assessment exercises • Problem Solving Scenarios				

## **Ph.D. Artificial Intelligence**

## Programme Competencies

1. Ability to work with Big data
2. Ability to develop software that incorporate AI
3. Ability to represent and reason with knowledge
4. Ability to conduct innovative research in AI

## Courses

Course Code	Course Title	Credit Unit	Status
ATI901	Research Methodology I	3	C
ATI902	Data Science	3	C
ATI903	Advanced Programming for AI	3	C
ATI904	Research Methodology II	3	C
ATI909	Advanced Natural Language Processing 1	2	E
ATI911	Advanced Machine Learning 1	2	E

Table 1: Programme Competences and Courses

Competences	ATI 901	ATI 902	ATI 903	ATI 907	ATI 909	ATI 911
Ability to work with Big data		*	*			*
Ability to develop software that incorporate AI		*	*		*	*
Ability to represent and reason with knowledge		*			*	*
Ability to conduct innovative research in AI	*	*		*		

## Course Information

Course Code:	ATI901
Course Title:	Research Methodology I
Credit Unit:	2
Course Status:	Elective
Course Description/Blub:	This course provides you with the background knowledge needed to carryout scientific research.You will know the philosophical dimensions of research which lead to the development of different research methods and be able to apply specific methods to AI research.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	`65

## Course Core Competencies

Ability to conduct innovative research in AI

## Course Objectives

- To acquire background knowledge on research
- To recognise and apply research methods to AI research

## **Modules and Units**

### **Module 1: Introduction to Research**

Unit 1: Fundamentals of Research methods

Unit 2: Philosophies and the language of research theory building

Unit 3: Dimensions of a researcher

### **Module 2: Problems and Hypothesis**

Unit 1: Defining the research problem

Unit 2: Formulation of the research question

Unit 3: Formulation of the research hypothesis

### **Module 3: Research design**

Unit 1: Experimental research design

Unit 2: Experimental research design in Artificial Intelligence

Unit 3: Nonexperimental research design

Unit 4: Field research I

Unit 5: Field research II

Unit 6: Survey research I

Unit 7: Case Studies

Table 3: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Introduction to Research						
Unit 1: Fundamentals of Research methods	<ul style="list-style-type: none"> <li>State the role of research in day-to-day activities,</li> <li>State the purpose of research,</li> <li>Explain the structure and process of a research in solving identified challenges</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read text and take the exercises	Generic Resources	Self-Assessment Exercise	5
Unit 2: Philosophies and the language of research theory building	<ul style="list-style-type: none"> <li>Apply philosophical thoughts in theory building</li> <li>Apply the language of research theory building in solving real life problem</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies	Generic Resources	Self-Assessment Exercise	5
Unit 3: Research Methods	<ul style="list-style-type: none"> <li>Distinguish between qualitative and quantitative research methods</li> <li>Integrate research method into appropriate philosophy</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenarios</li> </ul>	Students practice different research methods	- Statistical Software packages	Assignment 1: Mini Research	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 2: Problems and Hypothesis						
Unit 1: Defining the Research Problem	<ul style="list-style-type: none"> <li>Develop research problems</li> <li>Identify the research method appropriate to a given research problem</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenarios</li> </ul>	Students practice development of researches from given problem scenarios	Generic Resources	Self-Assessment	5
Unit 2: Formulation of the research questions	Derive research questions from given research problems	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenarios</li> </ul>	Students practice how to state research questions from problem-based scenarios	Text Slides	Self-Assessment	5
Unit 3: Formulation of the research hypothesis	<ul style="list-style-type: none"> <li>Distinguish between research questions and research hypotheses</li> <li>Formulate research hypotheses from problem based scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenarios</li> </ul>	Students practice how to formulate research hypothesis from problem-based scenarios	Text Slides	Assignment 2: This will cover all the knowledge gained in Module 2	5
Module 3: Research design						
Unit 1: Experimental research design	Design an experimental research	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenarios</li> </ul>	Students practice design process	Text Slides	Self-Assessment Exercises	5
Unit 2: Experimental research design in Artificial Intelligence	Design an experimental research for AI problems	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenarios</li> </ul>	Students practice design process	Text Slides	Self-Assessment Exercises	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Unit 3: Nonexperimental research design	<ul style="list-style-type: none"> <li>• Distinguish between nonexperimental and experimental research in real life situation</li> <li>• Identify scenarios that require the use of nonexperimental research.</li> <li>• Solve AI problems with the use of nonexperimental research</li> </ul>	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• The students will read and do the exercises</li> <li>• Watch the video</li> </ul>	Generic Resources	Self-Assessment Exercise	5
Unit 3: Field research I	Evaluate the importance of Field Reseach	Problem Solving Scenarios	<ul style="list-style-type: none"> <li>• Students respond to scenarios</li> <li>• Watch the video</li> </ul>	Generic Resources	Self-Assessment Exercise	5
Unit 4: Field research II	Design Field Reseach in given scenarios	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>• Students respond to scenarios</li> <li>• Watch the video</li> </ul>	Generic Resources	Self-Assessment Exercise	5
Unit 5: Survey research I	Evaluate the importance of Survey Reseach	Problem Solving Scenarios	<ul style="list-style-type: none"> <li>• Students practice how to design survey research</li> <li>• Students solve problems using survey research</li> <li>• Students go through the</li> </ul>	Generic Resources	Self-Assessment Exercise	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
			materials provided			
Unit 6: Survey research II	Design Survey Research in given scenarios	Problem Solving Scenarios	<ul style="list-style-type: none"> <li>Students practice how to design survey research</li> <li>Students solve problems using survey research</li> <li>Students go through the materials provided</li> </ul>	Generic Resources	Self-Assessment Exercise	5
Unit 7: Case Study	<ul style="list-style-type: none"> <li>Choose appropriate research design</li> <li>Apply the chosen research design to solve real life problems</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Students respond to cases and scenarios to solve problems</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>One shot video Scenario</li> </ul>	Assignment 3: Mini-Project	5

**Course Information:**

- Course Code: ATI902
- Course Title: Data Science
- Credit Unit: 3
- Course Status:
- Course Description/Blub: This course introduces students to Data Science and Big Data. It equips them with the capability to extract knowledge from unstructured textual data by the application of data mining techniques.
- Basic Requirements:
- Academic Year: 2020
- Semester: Second
- Course Duration: 13 weeks
- Required Hours of study: 91

**Course Core Competencies**

1. Ability to work with Big data
2. Ability to develop software that incorporate AI
3. Ability to represent and reason with knowledge
4. Ability to conduct innovative research in AI

**Course Objectives:**

- Develop proficiency in techniques used for Data science and Big Data
- Implement social media knowledge mining applications
- Implement applications for Data visualization
- Determine unethical usage of private data

## **Modules and Units**

### **Module 1: Introduction**

- Unit 1: Big Data and Statistical Inferencing
- Unit 2: Online data acquisition
- Unit 3: Exploratory Data Analyssis I
- Unit 4: Exploratory Data Analyssis
- Unit 5: Learning Algorithms I
- Unit 6: Learning Algorithms II

### **Module 2: Extracting Meaning From Data**

- Unit 1: Feature Generation
- Unit 2: Mining Knowledge from Social Media
- Unit 3: Data Visualiation

### **Module 3: Ethics of Data Sicence**

- Unit 1: Ethics of Privacy and security
- Unit 2: Anonymity of private data and ethics of data sharing
- Unit 3: Transparency of Data use
- Unit 4: Human will and biases

**Table 3: Course Units Intended Learning Outcomes (ILOs)**

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
<b>Module 1: Introduction</b>						
Unit 1: Big Data and Statistical Inferencing	<ul style="list-style-type: none"> <li>Describe Data Science</li> <li>Enumerate the set of skills required to work with Data</li> <li>Distinguish between traditional collection of data and accumulation of large volumes of data.</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts and participate in forum discussion	<ul style="list-style-type: none"> <li>Computer, Internet Connectivity</li> <li>Python IDE</li> <li>Forum</li> </ul>	Self-Assessment: Evaluation of assignments and projects.	7
Unit 2: Online data acquisition	Scrap data from the Internet using Python API.	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and watch instructional video.	Computer, Internet Connectivity Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7
<b>Unit 3:</b> Exploratory Data Analysis I	Illustrate graphical description of statistical data using Python API	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and do given exercises	Computer, Internet Connectivity Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7
<b>Unit 4:</b> Exploratory Data Analysis	Develop familiarity with statistical inferencing in the use of samples to infer the behaviour of the populations from which they were drawn.	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course</li> </ul> </li> </ul>	Students read supplied texts and do given exercises	Computer, Internet Connectivity Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
		material with in-text questions and self-assessment exercises <ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> </ul>				
<b>Unit 5:</b> Learning Algorithms I	Demonstrate the skills in the use of Linear Regression, k-Nearest Neighbors (k-NN), k-means and Naive Bayes as learning algorithms	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and do given exercises	Computer, Internet Connectivity Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7
<b>Unit 6:</b> Learning Algorithms II	Solve real life problems with the use of Association Rule Mining and Support Vector Machine	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts and do given exercises	Computer, Internet Connectivity Python IDE	Assignment 1: <ul style="list-style-type: none"> <li>Mini Project</li> <li>Poster Presentation of the project</li> </ul>	7
<b>Module 2:</b> Extracting Meaning From Data						
<b>Unit 1:</b> Feature Generation	Implement dimensionality reduction based on PCA and SVD	Texts, Programming examples and assignments	Students read supplied texts.	Computer, Internet Connectivity Python IDE	Evaluation of assignments and projects.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
<b>Unit 2:</b> Mining Knowledge from Social Media	Create social-Network graphs and detect communities and explore neighborhood properties.	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts. Undertake programming assignments	Computer, Internet Connectivity Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7
<b>Unit 3:</b> Data Visualiation	Create intuitive and enfficient charts and graphs from data	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts. Undertake programming assignments	Computer, Internet Connectivity Python IDE	Assignment 2: Evaluation of real life assignments and projects.	7
Module 3: Ethics of Data Sicence						
Unit 1: Ethics of Privacy and security	Recognise ethical issues of privacy and security in the accumulation and procecing of large volumes of data.	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and</li> </ul> </li> </ul>	Students read supplied texts participate in the exercise and forum	Computer, Internet Connectivity, Forum	Self-Assessment Exercise: Evaluation of assignments and projects. Exammination	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
		self-assessment exercises				
Unit 2: Anonymity of private data and ethics of data sharing	Recognise the conditions for ethical data sharing in programme development and implementation	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts.	Computer, Internet Connectivity	Self-Assessment Exercise: Evaluation of assignments and projects. Examination	7
Unit 3: Transparency of Data Use	Solve real life problem through transparency of data use	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Scenarios</li> </ul>	Students read supplied texts, and respond to scenarios	Computer, Internet Connectivity	Self-Assessment Exercise: Evaluation of assignments and projects.	7
Unit 4: Human will and biases	Create Big Data that does not affect human will and does not create, reinforce or institutionalise unfair biases	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Scenarios</li> </ul>	Students analyse the creation of Big Data from given scenarios	Computer, Internet Connectivity	Assignment 3: Mini Project	7

**Course Information:**

Course Code:	ATI903
Course Title:	Advanced Programming for Artificial Intelligence (AI)
Credit Unit:	3
Course Status:	Core
Course Description/Blub:	The Advanced Programming course is designed to give students the necessary level of programming skills to engage programming demands of their thesis with confidence.
Basic Requirements:	Programming for Artificial Intelligence
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours of study:	91

**Course Core Competencies**

- Ability to work with Big data
- Ability to develop software that incorporate AI

**Course Objectives:**

- Develop proficiency in advanced AI programming
- Write programs for AI tasks using relevant data structures
- Write programs to manipulate text using regular expressions
- Write programs to read and write to persistent storage (files)

## Modules and Units

### Module 1: Programming Basics

Unit 1: Variables, Expressions, Loops and Conditions

Unit 2: DataTypes, Structures and Classes

Unit 3: Data Encoding Systems

### Module 2: Modules, Exceptions and File Operations

Unit1: Modules

Unit2: Exceptions

Unit3: File I/O

### Module 3: Advanced File Operations

Unit 1: File Objects I

Unit 2: File Objects II

Unit 3: File Paths

Unit 4: Low-Level File I/O

### Module 4: String Functions and Regular Expressions

Unit 1: The string Module

Unit 2: Regular Expressions I

Unit 3: Regular Expressions II

**Table 3: Course Units Intended Learning Outcomes (ILOs)**

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
Module 1: Python Basics						
Unit 1: Variables, Expressions, Loops and Conditions	Solve real life AI problems using variables, expressions, loops and conditions.	Case Studies and Scenarios	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects. Examination	7
Unit 2: DataTypes, Structures and Classes	Build Numbers and Strings into Lists, Tuples, Hash Tables and Classes	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects. Examination	7
Unit 3: Data Encoding Systems	<ul style="list-style-type: none"> <li>• Identify the limitations of ASCII and how UNICODE makes up for the limitations.</li> <li>• Explain the incompatibilities of Windows CP1252 with UTF8 and how to anticipate them.</li> <li>• Solve AI problems using data encoding systems</li> </ul>	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Cases Studies</li> </ul>	Students read supplied texts and watch Instructional Videos; and respond to scenarios	Computer, Internet Connectivity, Instructional Video Python IDE	Assignment 1: This will cover what the student have learnt in this module.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
Module 2: Modules, Exceptions and File Operations						
Unit:1 Modules	Distinguish the importance between Large and Complex programs, and more easily manageable units using 'import' and 'def' facilities	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects. Examination	7
Unit :2 Exceptions	<ul style="list-style-type: none"> <li>Solve real life problem with the use of 'try' and 'raise' statements to anticipate errors.</li> <li>Identify and provide solution for Uncaught Exceptions</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects. Examination	7
Unit 3: File I/O	<ul style="list-style-type: none"> <li>Apply the use of 'open', 'read', and 'write' file keywords in solving AI problems</li> <li>Demonstrate the use Formatted file I/O in providing solutions to</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects. Examination	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
	identified challenges or problems.	in-text questions and self-assessment exercises				
Module 3: Advanced File Operations						
Unit 1: File Objects I	<ul style="list-style-type: none"> <li>Demonstrate the different methods in file opening modes</li> <li>Explain the different attributes of each file opening method</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE, Forum	Self-Assessment Exercise: Evaluation of assignments and projects.	7
Unit 2: File Objects II	Manage Standard file input, Output and Error to solve specific problems in AI	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Case study</li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
Unit 3: File Paths	Demonstrate the use of 'os.path' functions, portable filenames inquiries and file globbing effectively in solving problems in real life situation	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to cases and scenarios, and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7
Unit 4: Low-Level File I/O	<ul style="list-style-type: none"> <li>Demonstrate the use 'os.open' flags, modes and I/O functions</li> <li>Apply Low-level File and Directory manipulations in providing solutions to AI problems</li> </ul>	<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> </ul>	Students respond to scenarios and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Assignment 2. To reflect practical application	7
Module 4: String Functions and Regular Expressions						7
Unit 1: The string Module	Demonstrate the use of String processing functions in problem solving	Problem Based Scenarios	Students respond to scenarios and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7
Unit 2: Regular Expressions I	Evaluate Regular Expressions, Pattern Rules, Special Characters and Raw Strings in AI	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-</li> </ul> </li> </ul>	Students read supplied texts and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
		assessment exercises				
Unit 3: Regular Expressions II	<ul style="list-style-type: none"> <li>Develop familiarity with the 're' Module, compilation and methods.</li> <li>Develop familiarity with Grouping Rules</li> <li>Develop familiarity with Match information.</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students read supplied texts, respond to scenarios and watch Instructional Videos.	Computer, Internet Connectivity, Instructional Video Python IDE	Assignment 3: Mini Project	7

## Course Information

Course Code:	ATI904
Course Title:	Research Methodology II
Credit Unit:	2
Course Status:	Elective
Course Description/Blurb:	This is an advanced course to Research Methodology I. It provides you with the details of research methods applied to specific case studies. You will be able to conceptualise and design a scientific research using appropriate techniques at every stage of the research, from problem formulation to report writing and referencing.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

Ability to conduct innovative research in AI

## Course Objectives

- Conceptualise research and design research problems
- Apply relevant techniques at various stages of research
- interpret and disseminate research outcome

## **Modules and Units**

Module 1: Methods of Data Collection

Unit 1: Methods of Data Collection

Unit 2: Interview

Unit 3: questionnaire

Unit 4: Crowdsourcing

Module 2: Sampling Techniques

Unit 1: Sampling Techniques I

Unit 2: Sampling Techniques II

Module 3: Processing and Analysis of Data

Unit 1: Quantitative Data Analysis

Unit 2: Qualitative Data Analysis

Module 4: Ethics and privacy in research

Unit 1: Ethical Issues in Conducting Research

Unit 2: Privacy concerns in Conducting Research

Module 5: Reports Generation

Unit 1: Journals and Journal article writing

Unit 2: Thesis Writing

Unit 3: Referencing

Table 3: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Methods of Data Collection						
Unit 1: Methods of Data Collection	Select appropriate technique for data collection to meet specific research problem	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment Exercise	5
Unit 2: Interview	<ul style="list-style-type: none"> <li>Design instrument for data collection using interview technique</li> <li>Analyse data collected through interview technique</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment Exercise	5
Unit 3: Questionnaire	<ul style="list-style-type: none"> <li>Design questionnaire for data collection to meet specific research problem in a given scenario</li> <li>Classify respondents' data shown in an administered questionnaire for analysis</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment Exercise	5
Unit 4: Crowd-sourcing	<ul style="list-style-type: none"> <li>Discuss crowd-sourcing as a data collection method</li> <li>Identify existing crowd-sourcing environments e.g. Amazon Mechanical Turk</li> <li>Design Crowd-sourcing approach to given scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and	Generic Resources	Assignment 1: <ul style="list-style-type: none"> <li>Give a scenario that requires research and ask questions that will help</li> </ul>	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
			take the activities		the learner demonstrate his/her knowledge <ul style="list-style-type: none"> <li>Questions that will lead to mini project</li> </ul>	
Module 2: Sampling Techniques						
Unit 1: Sampling Techniques I	Select appropriate sampling techniques for given scenarios	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment	5
Unit 2: Sampling Techniques II	Discuss and apply sampling techniques such as Purposeful sampling, Quota sampling and Snowballing sampling	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment	5
Module 3: Processing and Analysis of Data						5
Unit 1: Quantitative Data Analysis	<ul style="list-style-type: none"> <li>Substantiate the need for quantitative data analysis</li> <li>Analyse quantitative data in given scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and	Generic Resources	Self-Assessment	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
			take the activities			
Unit 2: Qualitative Data Analysis	<ul style="list-style-type: none"> <li>Discuss qualitative data analysis methods</li> <li>Apply qualitative data analysis methods to given scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Assignment 2: Give an assignment that will enable the students collect data in their context and analyse	5
Module 4: Ethics and privacy in research						5
Unit 1: Ethical Issues in Conducting Research	<ul style="list-style-type: none"> <li>Discuss ethical and unethical practices in research</li> <li>manage ethical concerns in given research scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment	5
Unit 2: Privacy concerns in Conducting Research	<ul style="list-style-type: none"> <li>Discuss privacy concerns in research</li> <li>Manage privacy concerns in given research scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment	5
Module 5: Reports Generation						
Unit 1: Journals and Journal article writing	<ul style="list-style-type: none"> <li>Write articles publishable in academic journals</li> <li>Evaluate journal credibility</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts,	Generic Resources	Self-Assessment	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
			watch video and take the activities			
Unit 2: Thesis Writing	<ul style="list-style-type: none"> <li>Explain the components in Thesis Writing</li> <li>Write a thesis that meets academic standard</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Self-Assessment Exercises	5
Unit 3: Referencing	<ul style="list-style-type: none"> <li>Demonstrate academic referencing skills at the body of the writing and on the reference page</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Students read through texts, watch video and take the activities	Generic Resources	Assignment 3: Mini project and defense	5

## Course Information

Course Code:	ATI909
Course Title:	Advanced Natural Language Processing
Credit Unit:	2
Course Status:	Elective
Course Description/Blub:	The Advanced Natural Language Processing course is delivered as a set of projects and seminar presentations targeted at four important NLP problems. It provides opportunity for students to hone their programming skills and further develop their knowledge of NLP. This is aimed at building their confidence in the processing of natural language as a precursor to work for their theis.
Basic Requirements:	Natural Language Processing
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours of study:	65

## Course Core Competencies

- Ability to develop software that incorporate AI
- Ability to represent and reason with knowledge

## Course Objectives

- Develop proficiency in advanced Natural Language Processing techniques
- Implement applications for Machine Translation and Fake News
- Evaluate the applications

## Modules and Units

Module 1: Language Identification

Unit 1: Text Representation

Unit 2: Text classification according language of writing

Unit 3: Presentation of results

Module 2: Word Clustering

Unit 1: On-line Data Acquisition pre-Processing

Unit 2: Data Clustering

Unit 3: Presentation of results

Module 3: Machine Translation

Unit 1: Acquisition and Pre-Processing of parallel corpora

Unit 2: Data Pre-Processing

Unit 3: Machine translation

Unit 4: Presentation of results

Module 4: Fake News Classifier

Unit 1: Data Acquisition

Unit 2: Classifier Training

Unit 3: Presentation of results

**Table 3: Course Units Intended Learning Outcomes (ILOs)**

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Approaches/Methods</b>	<b>Learning Activities</b>	<b>Resources/learning Devices</b>	<b>Assessment</b>	<b>Required Hours for Study</b>
<b>Module 1: Language Identification</b>						
Unit 1: Text Representation	Evaluate Text representation assignments and projects	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpreter and IDE	Self-Assessment	5
<b>Unit 2:</b> Text classification according to language of writing	Build character-based n-gram models of some African languages to be used as a text classifier according to the languages in which the texts are written.	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpreter and IDE	Self-Assessment	5
<b>Unit 3:</b> Presentation of results	Present results in on-line seminar	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Solving Scenario</li> </ul>	Students work through the activities	Computer, Internet Connectivity Python interpreter and IDE	Assignment 1: Students prepare and make presentations	5
<b>Module 2: Word Clustering</b>						
<b>Unit 1:</b> On-line Data Acquisition pre-Processing	Develop tools for crawling the web to scrape and clean textual data	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpreter and IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
	Preprocessing of textual data					
<b>Unit 2:</b> Data Clustering	Cluster words from a large corpus based on semantic similarity	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpreter and IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	5
<b>Unit 3:</b> Presentation of results	<ul style="list-style-type: none"> <li>Present results in on-line seminar</li> <li>Evaluate projects in word cluster cleaning</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students read and do the activities	Computer, Internet Connectivity Python interpreter and IDE	Self-Assessment Exercise	5
<b>Module 3:</b> Machine Translation						
<b>Unit 1:</b> Acquisition and Pre-Processing of parallel corpora	Build parallel textual corpora for two African Languages.	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpreter and IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	5
<b>Unit 2:</b> Data Pre-Processing	Clean text and align parallel corpora	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpreter and IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/learning Devices	Assessment	Required Hours for Study
<b>Unit 3:</b> Machine traslation	<ul style="list-style-type: none"> <li>Buld a machine translator for two African languages</li> <li>Evaluate machine translators for languages</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpretaer and IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	5
<b>Unit 4:</b> Presentation of results	<ul style="list-style-type: none"> <li>Present results in on-line seminar</li> <li>Evaluate Machine translated projects</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students prepare and make presentations	Computer, Internet Connectivity Python interpretaer and IDE	Assignment 2: Projects Evaluation	5
<b>Module 4:</b> Fake News Classifier						5
<b>Unit 1:</b> Data Acquisition	Collect and manually classify textual training data for supervised learning of the features of fake news	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpretaer and IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	5
<b>Unit 2:</b> Clasiffier Ttraining	Train a fake news classifier	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students read supplied texts and engage prescribed project assignment	Computer, Internet Connectivity Python interpretaer and IDE	Self-Assessment Exercise: Evaluation of assignments and projects.	5
<b>Unit 3:</b> Presentation of results	Present and discuss results in on-line seminar	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students prepare and make presentations	Computer, Internet Connectivity Python interpretaer and IDE	Assignment 3: Evaluation of project.	5

## Course Information

Course Code:	ATI911
Course Title:	Advanced Machine Learning
Credit Unit:	2
Course Status:	Elective
Course Description/Blub:	This course develop your machine learning skills further. Making use of projects and case studies it gives you competence in machine learning applications development
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	`65

## Course Core Competencies

1. Ability to work with Big data
2. Ability to develop software that incorporate AI
3. Ability to represent and reason with knowledge

## Course Objectives

- Develop proficiency in advanced machine learning techniques
- To develop advanced machine learning applications
- Evaluate the applications

## Modules and Units

Module 1: Text classification

Unit 1: Input Preparation

Unit 2: Develop the Classifier

Unit 3: Evaluate the Classifier

Module 2: Sentiment analysis

Unit 1: Input Preparation

Unit 2: Develop the Classifier

Unit 3: Evaluate the Classifier

Module 3: Topic Modelling

Unit 1: Latent Semantic Indexing

Unit 2: Latent Dirichlet Allocation

Module 4: Association Rule Mining

Unit 1: Association Rule Mining Using Apriori Algorithm

Unit 2: The Shopping Basket Problem

Module 5: Clustering

Unit 1: K-Means Clustering

Unit 2: Agglomerative Hierarchical Clustering

Unit 3: Expectation–Maximization (Em) Clustering Using Gaussian Mixture Models (GMM)

Table 3: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: text classification						
Unit 1: input preparation	Prepare input for text classification task	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students follow procedure to do the given activities	Python IDE	Self-Assessment Exercise	5
Unit 2: develop the classifier	Develop text classification system	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students follow procedure to do the given activities	Python IDE	Self-Assessment Exercise	5
Unit 3: evaluate the classifier	Evaluate the effectiveness of the text classification system	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students follow procedure to do the given activities	Python IDE	Assignment 1: Mini project	5
Module 2: sentiment analysis						5
Unit 1: input preparation	Prepare input for sentiment classification task	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students follow procedure to do the given activities	Python IDE	Self-Assessment Exercise	5
Unit 2: develop the classifier	Develop sentiment classification system	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students follow procedure to do the given activities	Python IDE	Self-Assessment Exercise	5
Unit 3: evaluate the classifier	Evaluate the effectiveness of the sentiment classification system	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Project Based Learning</li> </ul>	Students follow procedure to do the given activities	Python IDE	Self-Assessment Exercise	5
Module 3: Topic Modelling						
Unit 1: Latent Semantic Indexing	Analyse the concept of Latent semantic indexing and its application to topic modelling	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Project Based Learning</li> </ul>	Students respond to case studies	Python IDE	Self-Assessment Exercise	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Unit 2: Latent Dirichlet Allocation	Evaluate the concept of Latent Dirichlet Allocation and its application to topic modelling	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Project Based Learning</li> </ul>	Students respond to case studies	Python IDE	Assignment 2: To evaluate real life projects	5
Module 4: Association rule mining						
Unit 1: Association rule mining using apriori algorithm	Apply Apriori algorithm in project building	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Project Based Learning</li> </ul>	Students respond to case studies and scenarios	Python IDE and WEKA	Self-Assessment Exercise	5
Unit 2: the shopping basket problem	Perform association rule mining in the shopping basket problem	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Project Based Learning</li> </ul>	Students respond to case studies and scenarios	Python IDE and WEKA	Self-Assessment Exercise	5
Module 5: Clustering						
Unit 1: k-means clustering	<ul style="list-style-type: none"> <li>Apply k-means clustering on a document clustering problem</li> <li>Interpret generated clusters</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students respond to given activities	Python IDE and WEKA	Self-Assessment Exercise	5
Unit 2: Agglomerative Hierarchical Clustering	<ul style="list-style-type: none"> <li>Apply Agglomerative Hierarchical Clustering on a document clustering problem</li> <li>Interpret generated clusters</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students work through the material, watch the video and do the activities	Python IDE and WEKA	Self-Assessment Exercise	5
Unit 3: Expectation–Maximization (EM) Clustering using Gaussian Mixture Models (GMM)	<ul style="list-style-type: none"> <li>Explain Expectation–Maximization (EM) Clustering and the Gaussian Mixture Models (GMM)</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students work through the material, watch the video and do the activities	Python IDE and WEKA	Assignment 3: Mini Project	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	Develop clustering application using EM and GMM					

# Part 2

## Cyber Security Programmes

## **M.Sc. Cyber Security**

## Programme Competencies

Performing Forensic Analysis of Data, Systems and Network.  
Performing Malware Analysis of Data, Systems and Network  
Protecting Data at Rest and During Transmission  
Protecting System and Network Infrastructure  
Assessing Software Development Vulnerabilities  
Regulatory Compliance and Auditing

## Courses

1. CST801: Fundamentals of Cyber Security & Cyber Crime
2. CST803: Advanced Cryptography
3. CST805: Computer and Network Security
4. CST807: Secure Software Engineering
5. CST809: Security Architecture and Design
6. CST802: Malware and Digital Forensics
7. CST804: Ethical Hacking and Penetration Testing
8. CST806: Cyber war and Cyber Deterrence
9. CST808: Incidence Management and Disaster Recovery
10. CST810: Web Security
11. CST812: Cyber Law and Ethics

Table 1: Mapping of Courses to Programme Competences

Competences	CST801	CST803	CST805	CST807	CST809	CST802	CST804	CST806	CST808	CST810	CST812
Performing Forensic Analysis of Data, Systems and Network.	X					X					
Performing Malware Analysis of Data, Systems and Network	X					X					
Protecting Data at Rest and During Transmission	X	X	X				X		X	X	
Protecting System and Network Infrastructure	X		X			X	X	X			
Assessing Software Development Vulnerabilities				X	X		X			X	
Regulatory Compliance and Auditing			X					X	X		X

## Course Information

Course Code:	CST801
Course Title:	Fundamentals of Cyber Security & Cyber Crime
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blub:	This course is an overview of the various branches of computing security, cybersecurity concepts, challenges, and tools that are critical in solving problems in the computing security domain.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

To have competency in:

- Performing forensic analysis of data, systems and network
- Performing Malware analysis of data, systems and network
- Protecting Data at rest and during transmission
- Protecting system and network infrastructure

## Course Objectives

The objectives of the course are to:

- Introduce student to the basic concepts of digital investigations;
- Provide fundamental cryptographic concepts like encryption and signatures.
- Provide understanding of the main issues related to security in modern networked computer systems and IT infrastructure.

- Provide basic concepts of vulnerability assessment and penetration testing

## **Modules and Units**

### **Module 1: Overview of Computer Security**

- Unit 1: Cybersecurity Fundamentals
- Unit 2: Foundation of Security
- Unit 3: Types of Threats
- Unit 4: Types of Attacks

### **Module 2: Basics of Network Security**

- Unit 1: Introduction to Network
- Unit 2: Concepts of Network and Data Security

### **Module 3: Cybercrime**

- Unit 1: Introduction to Cybercrime
- Unit 2: Impact and Challenges
- Unit 3: Laws Enforcement Roles
- Unit 4: Trends and Policies Implications

### **Module 4: Incidence Management**

- Unit 1: Incidence Discovery
- Unit 2: Incidence Management Cycle
- Unit 3: Computer Emergency Response

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1:Unit1: Cybersecurity fundamentals	Describe the basic concepts required in cybersecurity	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Cooperative Learning</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Self-Assessment Exercise – Two multiple choice self assesment excercises with feedback	5
Module1:Unit2 Foundation of security	Classify the types of security related to cyberspace	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Cooperative Learning</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Self-Assessment Exercise – Two multiple choice self assesment excercises with feedback	5
Module1:Unit3 Types of Threats and attacks	Determine the various type of threats in the cyber	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-</li> </ul> </li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Self-Assessment Exercise – Two multiple choice self assesment excercises with feedback	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>assessment exercises</li> <li>Cooperative Learning</li> </ul>				
Module1: Unit4 Types attacks	Classify the various type of attacks in the cyber	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Learners read the material, watch video and do the activities	Generic Resources	Assignment 1: To cover the activities in Module 1	5
Module2:Unit1 Introduction to Network	Analyse the concepts of computer networking	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Cooperative Learning</li> <li>Problem Solving Scenarios</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module 2: Unit 2: Concepts of network and data security	Critique the concepts of networks and data security towards the development of new ideas	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions</li> </ul> </li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		and self-assessment exercises <ul style="list-style-type: none"> <li>Cooperative Learning</li> <li>Problem Solving Scenarios</li> </ul>				
Module3: Unit 1: Introduction to cybercrime	<ul style="list-style-type: none"> <li>Explain what cybercrime is.</li> <li>Differentiate the types of cybercrime</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Cooperative Learning</li> <li>Problem Solving Scenarios</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module3: Unit 2: Impact and challenges	<ul style="list-style-type: none"> <li>Evaluate the impact of cybercrimes</li> <li>Manage the challenges in curbing cybercrime</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Cooperative Learning</li> <li>Problem Solving Scenarios</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Self-Assessment Exercise: Formative –Two multiple choice self assesment excercises with feedback	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module3: Unit 3:  Laws enforcement roles	Explore the roles of laws enforcement agencies in managing cybercrime	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Cooperative Learning</li> <li>Problem Solving Scenarios</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Self-Assessment Exercise – Two multiple choice self assesment excercises with feedback	5
Module3: Unit 4: Defensive trends and policies implications	Evaluate the approaches for defensive attacks	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Cooperative Learning</li> <li>Problem Solving Scenarios</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Assignment 2: Create real life scenario that will demand the use of the knowledge gained in this module	5
Module4: Unit 1:  Incidence discovery	Critique the techniques used to detect cybercrime	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions</li> </ul> </li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Self-Assessment Exercise – Two multiple choice self assesment excercises with feedback	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>and self-assessment exercises</li> <li>• Cooperative Learning</li> <li>• Case Study</li> </ul>				
Module4: Unit 2: Incidence management cycle	Measure incident management concepts, workflows, and best practices	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Cooperative Learning</li> <li>• Case study</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Self-Assessment Exercise – Two multiple choice self assesment excercises with feedback	5
Module4: Unit 3: Computer emergency response	Review the techniques used in dealing with the evolution of malware, viruses and other cyberattacks	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>• Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Cooperative Learning</li> <li>• Case study</li> </ul>	Learners read the material, watch video and participate in forum discussion	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Assignment 3: Create a Problem Solving Scenario for the students to respond	5

- Laptop/mobile phone and internet access is required for all.

## Course Information

Course Code:	CST803
Course Title:	Advanced Cryptography
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blurb:	This course explains cryptography from a theoretical and practical perspective. Topics treated in this course will cover how cryptography works, how security is analysed theoretically, and how exploits work.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

Protecting data at rest and during transmission

## Course Objectives

To introduce students to the design and implementation of security applications

## Modules and Units

Module 1:	Cryptanalysis and Shannon Theory
Unit 1:	Introduction to simple cryptosystem
Unit 2:	Types, Techniques and application of Cryptanalysis
Unit 3:	Probability theory
Unit 4:	Entropy
Unit 5:	Product Cryptosystem

Module 2: Block Cypher and Advanced Encryption Scheme

Unit 1: Linear Cryptanalysis

Unit 2: Differential Cryptanalysis

Unit 3: Data and Advanced Encryption Standard

Module 3: Public Key Cryptography and Discrete Logarithm

Unit 1: ElGamal Cryptosystem

Unit 2: Algorithm for the discrete logarithm problem

Unit 3: Elliptics Curves

Module 4: Private Key Encryption

Unit 1: Symetric Encryption Scheme

Unit 2: Issues in Privacy

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 1 Introduction to Simple Cryptosystem	Explain simple classical cryptosystem	<ul style="list-style-type: none"><li>Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text.</li><li>Cooperative Learning</li></ul>	<ul style="list-style-type: none"><li>Forum discussion on the types of cryptosystem and cryptanalysis.</li><li>Interactive quiz on which gives feedback on the answers</li></ul>	<ul style="list-style-type: none"><li>Laptop</li><li>mobile devices</li><li>and internet</li><li>Course materials and further reading</li></ul>	Self-Assessment Exercise – 2 <ul style="list-style-type: none"><li>Multiple choice self assessment exercises with feedback</li><li>Group work on forum page. The group will have poster presentation to be critique by other groups</li></ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1: Unit 2</b> Types, Techniques and application of Cryptanalysis	Demonstrate the techniques, types and application of cryptanalysis	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Students do the activities</li> <li>Participate in the lab exercise</li> </ul>	<ul style="list-style-type: none"> <li>Laptop,</li> <li>Internet</li> <li>Workbook</li> </ul>	Self-Assessment Exercise: <ul style="list-style-type: none"> <li>Short answer questions</li> <li>Lab Exercise</li> </ul>	7
Module 1: Unit 3: Probability theory	Use probability theory to make viable decisions in given scenarios	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Students respond to case studies and scenarios</li> <li>Students participate in group discussion</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>mobile devices</li> <li>and internet</li> <li>Course materials and further reading</li> <li>Forum</li> </ul>	Self-Assessment Exercise – <ul style="list-style-type: none"> <li>2 multiple choice self assessment exercises with feedback</li> <li>Group work,</li> </ul>	7
Module 1: Unit 4: Entropy	Identify the concepts of perfect secrecy and entropy	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lesson (POGIL)-               <ul style="list-style-type: none"> <li>Assign text and followup with questions that will require the text</li> </ul> </li> <li>Cooperative Learning</li> </ul>	<ul style="list-style-type: none"> <li>Group work to present the concept of perfect secrecy and entropy</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Course materials and further reading,</li> <li>Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise– 2 multiple choice self-assessment exercises with feedback</li> <li>Forum Discussion</li> </ul>	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 1: Unit 4: Product cryptosystem	Demonstrate the use of information theory in Cryptography	<ul style="list-style-type: none"> <li>• Problem solving scenario</li> <li>• Experimental Method on cryptosystem</li> <li>• Cooperative Learning</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exercise on the use of information theory in cryptography</li> <li>• Group work</li> </ul>	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos that demonstrate the use of information theory</li> <li>• Course materials and further reading</li> </ul>	Assignment I: <ul style="list-style-type: none"> <li>• Lab work with the use of cryptanalysis tool</li> <li>• Short answer questions</li> </ul>	7
Module2: Unit 1 Linear Cryptanalysis	Demonstrate the use of substitution-permutation networks as a mathematical model to introduce many of the concept of modern block cipher design and analysis including differential and linear analysis	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lesson (POGIL): Assign text and followup with questions that will require the text</li> <li>• Project Based Learning</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exercise on the use of information theory in cryptograp</li> <li>• Group work</li> </ul>	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos on modern block cipher design and analysis</li> <li>• Course materials and further reading</li> <li>• Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Lab exercise</li> <li>• Formative – 2 multiple choice self assessment exercises with feedback</li> <li>• Group work,</li> </ul>	7
Module2: Unit 2 Differential Cryptanalysis	Demonstrate the use of substitution-permutation model to introduce many of the concept of modern block cipher design	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exercise on the use of information theory in cryptograp</li> <li>• Group work</li> </ul>	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos on modern block cipher design and analysis</li> <li>• Course materials and further reading</li> <li>• Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Lab exercise</li> <li>• 2 multiple choice self-assessment exercises with feedback</li> <li>• Group work,</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 2: Unit 3 Data and Advanced Encryption Standard	<ul style="list-style-type: none"> <li>Interpret the general principles of block cipher</li> <li>Apply general principle of block cipher</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text</li> <li>Problem solving scenario</li> </ul>	<ul style="list-style-type: none"> <li>Lab Exercise on the use of information theory in cryptography</li> <li>Group work</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Course materials and further reading</li> <li>Forum</li> </ul>	<ul style="list-style-type: none"> <li>2 multiple choice self assessment exercises with feedback</li> <li>Group work presented in the discussion forum</li> </ul>	7
Module 3: Unit 1 ElGamal Cryptosystem	Illustrate public-key cryptosystems, such as the <i>ElGamal Cryptosystem</i> , that are based on the <b>Discrete Logarithm</b> problem	<ul style="list-style-type: none"> <li>Problem solving scenario</li> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Lab Exercise on cryptanalysis</li> <li>Forum discussion on the basic discrete logarithm problem.</li> <li>Interactive quiz</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Course materials and further reading</li> <li>Cryptanalysis tools</li> <li>Forum</li> </ul>	<ul style="list-style-type: none"> <li>2 multiple choice self assessment exercises with feedback</li> <li>Post group work to Forum and discussion of the group work</li> </ul>	7
Module 3: Unit 2 Algorithm for the discrete logarithm problem	Solve the discrete logarithm problem and apply to real life situation	<ul style="list-style-type: none"> <li>Problem solving scenario</li> <li>Case Studies</li> <li>Cooperative Learning</li> </ul>	<ul style="list-style-type: none"> <li>Lab exercises on discrete algorithm problem.</li> <li>Participation in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Course materials and further reading</li> <li>Forum</li> </ul>	<ul style="list-style-type: none"> <li>2 multiple choice self assessment exercises with feedback</li> <li>Group work</li> </ul>	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 3: Unit 3 Elliptic Curves	Compute discrete logarithms, elliptic curves, and the Diffie-Hellman problems	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lesson (POGIL) – Assign text and follow up with questions that will require the text</li> <li>Problem solving scenario</li> </ul>	<ul style="list-style-type: none"> <li>Forum discussion on discrete logarithm</li> <li>Take the assignment</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Course materials and further reading</li> <li>Forum</li> </ul>	Assignment 2: Create real life scenario where the student can apply the knowledge in this module	7
Module 4: Unit 1 Symmetric Encryption Scheme	Apply symmetric settings that considers two parties and use the key to communicate data with various security attributes	<ul style="list-style-type: none"> <li>Problem solving scenario</li> </ul>	<ul style="list-style-type: none"> <li>Lab Exercise on symmetric encryption scheme</li> <li>Participate in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Course materials and further reading</li> <li>Forum</li> </ul>	<ul style="list-style-type: none"> <li>2 multiple choice self assessment exercises with feedback</li> <li>Lab Exercise on symmetric encryption scheme</li> <li>Forum Discussion on outcome of the lab exercise</li> </ul>	7
Module 4: Unit 2 Issues in Privacy	Adopt symmetric encryption scheme to solve problems of privacy	<ul style="list-style-type: none"> <li>Problem solving scenario</li> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Lab Exercise on symmetric encryption scheme</li> </ul>	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Course materials and further reading</li> </ul>	Assignment 3: Mini Project to cover module content and will be problem solving	7

- Laptop/mobile phone and internet access is required for all.

## Course Information

Course Code:	CST805
Course Title:	Computer and Network Security
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blub:	This course focuses on the Contemporary Security, Network Intrusion detection systems, network threat and mitigation, Password Cracking, Port Scanning. Attacks and threats on computer; transmission protocols and layers. attacks on DNS and leveraging P2P deployments; Data analytics, monitoring real-time network activities enables agile decision making, detection of suspected malicious activities, utilization of a real-time visualization dashboard, and employment of a set of hardware and software to manage such detected suspicious activities.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- Protecting Data at Rest and During Transmission
- Protecting System and Network Infrastructure
- Regulatory Compliance and Auditing

## Course Objectives

By the end of this course, you will be able to:

- Explain the principles security in computer and network systems.
- Identify and troubleshoot different forms of computer and network systems attacks

- Explain cybersecurity compliance and regulatory landscape.

## **Modules and Units**

### Module 1: Fundamentals of Computer and Network Security

- Unit 1: Computer Security
- Unit 2: Overview of Networks and Internet
- Unit 3: Cryptography
- Unit 4: Web Security
- Unit 5: Program Security

### Module 2: Threats and Attacks

- Unit 1: Malware
- Unit 2: Intrusion Detection Systems (IDS)
- Unit 3: Cyber Terrorism

### Module 3: Security Management

- Unit 1: Risk Analysis
- Unit 2: Security Policies
- Unit 3: Vulnerability Assessment

### Module 4: Cyber Law and Ethics

- Unit 1: Security and Law
- Unit 2: Privacy and Ethics

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 1 Computer Security	Explain the concept of computer security and their applications	<ul style="list-style-type: none"> <li>• POGIL (Process Oriented Guided Inquiry Lessons)</li> </ul>	<ul style="list-style-type: none"> <li>• Group discussion</li> </ul>	<ul style="list-style-type: none"> <li>• Slideshows(Showing a summary of all the aspects of the computer security)</li> <li>• Laptops</li> <li>• Mobile Devices</li> <li>• Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise</li> </ul>	7
Module 1: Unit 2 Networks and Internet	Describe key networking protocols and their hierarchical relationship in the context of a conceptual model such as the OSI and TCP/IP	<ul style="list-style-type: none"> <li>• POGIL (Process Oriented Guided Inquiry Lessons)</li> <li>• Experiential teaching</li> </ul>	Lab Exercise	<ul style="list-style-type: none"> <li>• Laptops</li> <li>• Mobile Devices</li> <li>• Discussion forum</li> <li>• Software/Online resources</li> </ul>	Self-Assessment Exercise – Present CBT assessment for students to analyse	7
Module 1: Unit 3 Cryptography	Apply cryptographic technique to secure information systems	<ul style="list-style-type: none"> <li>• Experiential teaching</li> <li>• Project based learning</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exercise</li> <li>• Group Project</li> </ul>	<ul style="list-style-type: none"> <li>• Laptops</li> <li>• Mobile Devices</li> <li>• Forum</li> <li>• Software/Online resources</li> </ul>	<ul style="list-style-type: none"> <li>• Lab exercise</li> <li>• Forum Discussion</li> </ul>	7
Module 1: Unit 4 Web Security	Manage security flaws on websites and web applications and proffer solutions to identified flaws.	<ul style="list-style-type: none"> <li>• Project based learning</li> <li>• Flipped classroom</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exercise</li> <li>• Individual Project</li> </ul>	<ul style="list-style-type: none"> <li>• Laptops</li> <li>• Mobile Devices</li> <li>• Discussion forum</li> <li>• Software/Online resources</li> </ul>	<ul style="list-style-type: none"> <li>• Two self-assessment exercises</li> <li>• Individual project work</li> </ul>	7
Module 1: Unit 5 Program Security	Detect vulnerabilities in software and outline countermeasures of the vulnerabilities	<ul style="list-style-type: none"> <li>• Project based learning</li> <li>• Flipped classroom</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exercise</li> <li>• Individual Project</li> </ul>	<ul style="list-style-type: none"> <li>• Laptops</li> <li>• Mobile Devices</li> <li>• Discussion forum</li> <li>• Software/Online resources</li> </ul>	Assignment 1: Poster presentation of Project	7
Module 2: Unit 1 Malware	<ul style="list-style-type: none"> <li>• Analyse various malware</li> </ul>	<ul style="list-style-type: none"> <li>• POGIL ( Process Oriented</li> </ul>	Students participate in	<ul style="list-style-type: none"> <li>• Laptops</li> <li>• Mobile Devices</li> <li>• Instructional videos</li> </ul>	<ul style="list-style-type: none"> <li>• Lab exercise</li> <li>• Short answer questions as self-</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Demonstrate methods and techniques that can be used to protect a network from malware</li> </ul>	Guided Inquiry Lessons) <ul style="list-style-type: none"> <li>Experiential teaching</li> <li>Project based learning</li> </ul>	the lab sessions on malware	<ul style="list-style-type: none"> <li>Discussion forum</li> <li>Software/Online resources</li> </ul>	assessment exercise	
Module 2: Unit 2 Intrusion Detection Systems(IDS)	Secure a network from attacks using IDS	<ul style="list-style-type: none"> <li>Scaffolding Problem Based Learning</li> </ul>	Lab sessions DoS	<ul style="list-style-type: none"> <li>Laptops</li> <li>Mobile Devices</li> <li>Instructional videos</li> <li>Discussion forum</li> <li>Software/Online resources</li> </ul>	<ul style="list-style-type: none"> <li>Lab exercise</li> </ul>	7
Module 2: Unit 3 Cyber terrorism and cyber espionage	<ul style="list-style-type: none"> <li>Interpret the concepts and motivations for cyber terrorism</li> <li>Apply preventive measure against cyber espionage</li> </ul>	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem Based Learning</li> </ul>	Participate in group project	<ul style="list-style-type: none"> <li>Laptops</li> <li>Mobile Devices</li> <li>Instructional videos</li> <li>Discussion forum</li> <li>Software/Online resources</li> </ul>	Students begin work on group project	7
Module 3: Unit 1: Risk Analysis	Analyse potential threats to information systems	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem Based Learning</li> </ul>	Participate in group project	<ul style="list-style-type: none"> <li>Laptops</li> <li>Mobile Devices</li> <li>Instructional video</li> <li>Forum</li> </ul>	Create chat room for students to meet in group to work on their projects	7
Module 3: Unit 2 Security Policies	Develop security policies based on international best practices	<ul style="list-style-type: none"> <li>Problem Solving Scenarios,</li> <li>Project Based Learning (PBL),</li> </ul>	Participate in group project	<ul style="list-style-type: none"> <li>Laptops</li> <li>Mobile Devices</li> <li>Instructional videos</li> <li>Virtual Library</li> <li>Forum</li> </ul>	Continue work on the project but with self-assessment exercises to guide the project	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 3: Unit 3 Vulnerability Assessment	Perform vulnerability assessment on a network to identify security flaws	Problem Solving Scenarios	Participate in group projects	<ul style="list-style-type: none"> <li>Laptops</li> <li>Mobile Devices</li> <li>Instructional videos</li> <li>Virtual Laboratory</li> <li>Discussion forum</li> </ul>	Assignment 2: Group submit and defend project through video conferencing	7
Module 4: Unit 1 Security and Law	Evaluate and select appropriate laws that relate to network security and apply them to a security breach	<ul style="list-style-type: none"> <li>Problem Solving Scenarios,</li> <li>Project Based Learning (PBL),</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>Laptops</li> <li>Mobile Devices</li> <li>Instructional videos</li> <li>Physical Laboratory</li> <li>Discussion forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: Students evaluate case study with real data from industry</li> </ul>	7
Module 4: Unit 2 Privacy and Ethics	<ul style="list-style-type: none"> <li>Analyse ethical issues in security breach investigations</li> <li>Develop privacy policies for information systems</li> </ul>	<ul style="list-style-type: none"> <li>Problem Solving Scenarios,</li> <li>Project Based Learning (PBL)</li> </ul>	Group project	<ul style="list-style-type: none"> <li>Laptops</li> <li>Mobile Devices</li> <li>Instructional videos</li> <li>Virtual Laboratory</li> </ul>	Assignment 3: Individual work on a mini-project	7

## Course Information

Course Code:	CST807
Course Title:	Secure Software Engineering
Credit Unit:	2
Course Status:	Elective
Course Description/Blurb:	This introduces to the learners to Security requirements; Specification of security requirements; Software development lifecycle and Security development lifecycle; Programming languages and type-safe languages; Best security programming practices; Writing secure distributed programs; Secure software, risk analysis, threat modelling, deploying cryptographic algorithms, defensive coding, penetration testing, static analysis, and security assessment; Security for web and mobile applications.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

Assess Software Development Vulnerabilities

## Course Objectives

- To provide the student with a deep understanding of the intricacies of securing programming
- To enable students to assess vulnerabilities in programming languages.
- To introduce students to the various software analysis and models

## Modules and Units

Module 1: Fundamentals and requirement level analysis

Unit 1: Overview of secure software engineering

Unit 2: Software security life cycle

Unit 3: Software quality attributes

Unit 4: Security requirement gathering principles and guidelines

Module 2: Vulnerabilities during implementation, consequences, and prevention, consideration

Unit 1: Defensive coding practices

Unit 2: Code Inspections

Unit 3: Database security

Unit 4: Software Vulnerabilities and exploitation

Unit 5: Secure programming for preventing BOF, FSB, SQLI, XSS, session

Unit 6: Mobile application development security

Module 3: Design and testing for security, best practices

Unit 1: Secure software design principles

Unit 2: Static analysis techniques

Unit 3: Security testing

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1:Unit1  Overview of secure software engineering	Describe the steps in software engineering and why security should be embedded in software development	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course</li> </ul> </li> </ul>	Students work through the activities and participate in forum discussion	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> </ul>	Self-Assessment Exercise: Two multiple choice self assesment	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		material with in-text questions and self-assessment exercises		<ul style="list-style-type: none"> <li>Discussion Forum</li> </ul>	exercises with feedback	
Module1:Unit2 Software security life cycle	Describe the phases of a software development life cycle and how to build security in the SDLC	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students respond to study the material, listen to video and attempt the self-assessment exercise	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module1:Unit3 Software quality attributes	Describe the Attributes of a good software and to investigate the quality of a software	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)               <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students respond to study the material, listen to video and attempt the self-assessment exercise	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module1:Unit4 Security requirement	Perform security requirements gathering and analysis	<ul style="list-style-type: none"> <li>Problem Based Scenario</li> <li>Case Studies</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> </ul>	Assignment 1: Students should be given real life	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
gathering principles and guidelines				<ul style="list-style-type: none"> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	problem to respond to. Each student could use their context.	
Module 2: Unit 1: Defensive coding practices	Develop projects using techniques Defensive Programming	<ul style="list-style-type: none"> <li>Scenario Based Learning</li> <li>Case Studies</li> </ul>	Students respond to case studies and scenarios	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module2: Unit 2: Code Inspections	Evaluate software application to determine if it has met the coding standard.	<ul style="list-style-type: none"> <li>Scenario Based Learning</li> <li>Case Studies</li> </ul>	Students work through the content and listen to video	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module2: Unit 3: Database security	Use security control techniques to protect database and data	<ul style="list-style-type: none"> <li>Scenario Based Learning</li> <li>Case Studies</li> </ul>	Students respond to various activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module2: Unit 4: Software Vulnerabilities and Exploitation	Manage the various vulnerabilities that may occurs in software and how they can be exploited by malwares	<ul style="list-style-type: none"> <li>Scenario Based Learning</li> <li>Case Studies</li> </ul>	Students respond to various activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module2: Unit 5: Secure programming for preventing BOF, FSB, SQLI, XSS, session	<ul style="list-style-type: none"> <li>• Use BOF, FSB, SQLI, XSS, session threats to solve real life problems</li> <li>• Manage the techniques for preventing BOF, FSB, SQLI, XSS, session</li> </ul>	<ul style="list-style-type: none"> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to problems and case studies	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module2: Unit 6: Mobile application development security	Build security into mobile application development lifecycle	<ul style="list-style-type: none"> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students read and respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Assignment 2: Students to review five post on the forum that covers all the ILOs in Module 2	5
Module3: Unit 1: Secure software design principles	Apply the Software security design Principles to maintain confidentiality, integrity, and availability of a system, sub-system, and system data	<ul style="list-style-type: none"> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students read and respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module3: Unit 2: Static analysis techniques	Analyse and debug computer without executing it	<ul style="list-style-type: none"> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students work through the material and respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Two multiple choice self assesment excercises with feedback	5
Module3: Unit 3: Security testing	Perform Security Testing on software using black box and white box	<ul style="list-style-type: none"> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students work through the material and	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> </ul>	Assignment 3: Mini Project to cover	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
			respond to the activities	<ul style="list-style-type: none"> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	topics on the discussion forum	

## Course Information

Course Code:	CST809
Course Title:	Security Architecture and Design
Credit Unit:	2
Course Status:	Elective
Course Description/Blub:	This course discuss the fundamental components of security architecture. Topics treated include Components design; Principles of secure component design; Component identification; Security Design Principle; Principle of Secure Design; Principle of Software Security, Design Principle for Protection Mechanism; Trusted Computing Base and protection mechanism; formal security models and evaluation criteria; Project on modeling secure system.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- To develop overall architecture and is developed to provide guidance during the design of the product. It outlines the level of assurance that is required and potential impacts that this level of security could have during the development stages on the product overall.

## Course Objectives

- Explain the concept of security architecture analysis.
- Value addition points in security architecture and design
- Expatriate on the forms of security models, open and distributed systems.

## **Modules and Units**

Module 1: Fundamental component of Design Architecture

Unit 1: Architecture development and style

Unit 2: Technological Development

Unit 3: Performance Measure

Module 2: Instructional Set Architecture and Design

Unit 1: Memory Location and Operations

Unit 2: Addressing Modes

Unit 3: Instruction Types

Module 3: Secure Component Design

Unit 1: Processing Unit Design

Unit 2: Memory System Design

Unit 3: Input and Output Design

Module 4: Security Design Principle

Unit 1: Principle of Secure Design

Unit 2: Principle of Software Security

Unit 3: Design Principle for Protection Mechanism

Unit 4: Trusted Computing Base

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Fundamental component of Design Unit 1: Architecture development and style	Use different architectures and style in project development	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students have hands-on	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Forum Discussion</li> </ul>	Self-Assessment: Present case studies in architectures and style in project management for students to analyse	5
Unit 2: Technological Development	Design new technique for technological development	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students are to simulate designs	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Self-Assessment Exercise: Students to have hands-on exercise through simulation	5
Unit 3: Performance Measure	Demonstrate the use of performance measure in providing solutions to problem-based scenarios	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students analyse case studies and scenarios	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Self-Assessment Exercise: five multiple choice questions with feedback	5
Module 2: Instructional Set Architecture and Design Unit 1: Memory Location and Operations	Justify the use of memory location and operations in design	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students analyse cases that could justify the use of memory location and operation in design	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Forum Discussion</li> </ul>	Self-Assessment Exercise; five multiple choice questions with feedback	5
Unit 2: Addressing Modes	Perform programming tasks using addressing modes, present addressing modes and writing sample segment codes	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Student perform programming tasks through simulation	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Self-Assessment Exercise. Five multiple choice questions	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Unit 3: Instruction Types	<ul style="list-style-type: none"> <li>Interpret and modify instruction types of programming tasks.</li> <li>Evaluate instruction types of programming tasks.</li> </ul>	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students evaluate projects in the cases and scenarios presented	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Assignment 1: Mini Project	5
Module 3: Secure Component Design Unit 1: Processing Unit Design	Design a processing unit	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students watch simulated video on design process	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Self-Assessment Exercise	5
Unit 2: Memory System Design	Design memory system to solve specific problem	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Self-Assessment Exercise	5
Unit 3: Input and Output Design	Evaluate and input and output design	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Continuation of Mini Project	5
Module 4: Security Design Principle Unit 1: Principle of Secure Design	Design security from the start and able to structure the security relevant features	<ul style="list-style-type: none"> <li>Case studies</li> <li>Problem based learning</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>Generic Resources</li> <li>Simulated Scenarios</li> <li>Simulation resources</li> </ul>	Self-Assessment Exercise	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Unit 2: Principle of Software Security	Manage real life problems from security threats.	<ul style="list-style-type: none"> <li>• Case studies</li> <li>• Problem based learning</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>• Generic Resources</li> <li>• Simulated Scenarios</li> <li>• Simulation resources</li> </ul>	Self-Assessment Exercise	5
Unit 3: Design Principle for Protection Mechanism	Design principles to manage specific real-life scenarios	<ul style="list-style-type: none"> <li>• Case studies</li> <li>• Problem based learning</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>• Generic Resources</li> <li>• Simulated Scenarios</li> <li>• Simulation resources</li> </ul>	Self-Assessment Exercise	5
Unit 4: Trusted Computing Base	Evaluate available based trusted computing	<ul style="list-style-type: none"> <li>• Case studies</li> <li>• Problem based learning</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>• Generic Resources</li> <li>• Simulated Scenarios</li> <li>• Simulation resources</li> </ul>	Assignment 3: Completion of mini project and presentation	5

## Course Information

Course Code:	CST802
Course Title:	Malware and Digital Forensics
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blurb:	This course covers the principles and techniques for digital forensics investigation. Students will learn forensic investigation on both Linux and Windows systems, filesystems and network forensics.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- Perform Forensic Analysis of Data, Systems and Network.
- Perform Malware Analysis of Data, Systems and Network
- Protect System and Network Infrastructure

## Course Objectives

- To conduct forensic investigations on digital devices that conform to accepted professional standards and are based on the investigative process,
- To apply the tools and methodologies in performing static and dynamic analysis on unknown executables,
- To extract investigative leads from host and network-based indicators associated with a malicious program.

## **Modules and Units**

Module 1: Fundamentals Digital Forensics

Unit 1: Overview of digital forensics

Unit 2: Investigative methods and processes

Unit 3: Evidence Collection

Module 2: File system Forensics

Unit 1: Windows File system

Unit 2: Linux File system

Module 3: Operating Systems

Unit 1: Windows forensics

Unit 2: Linux forensics

Module 3: Network Forensics

Unit 1: Fundamentals of Network Forensics

Unit 2: Traffic Analysis

Module 4: Concepts of Malware Analysis

Unit 1: Static Analysis

Unit 2: Dynamic Analysis

Unit 3: Malware behavior

Unit 4: Anti-analysis

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 1 Overview of digital forensics	Apply the standards and policies in digital investigations	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop,</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course material and further reading</li> <li>• Discussion forum</li> </ul>	Self-Assessment Exercise	7
Module 1: Unit 2 Investigative methods and processes	Demonstrate various digital investigative methods	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop,</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Workbook with scenarios depicting different instances that require different investigative methods</li> <li>• Course materials and further reading</li> </ul>	Self-Assessment Exercise	7
Module 1: Unit 3 Evidence Collection	Evaluate different digital devices, live and dead systems	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop,</li> <li>• Internet,</li> <li>• Mobile devices</li> <li>• Instructional video on evidence collection</li> <li>• Virtual Machine</li> <li>• Imager</li> <li>• Hex Editor</li> <li>• Course materials and further reading</li> <li>• Forum Discussion</li> </ul>	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 2: Unit 1 Windows File system	Demonstrate the differences on the structures of FAT16, FAT32 and NTFS	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop,</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Animation on the structure of the filesystems</li> <li>• Workbook on the structures of FAT16, FAT32 and NTFS</li> <li>• Imager</li> <li>• Hex editor</li> <li>• Course materials and further reading</li> </ul>	Self-Assessment Exercise	7
Module 2: Unit 2 Linux File system	Demonstrate the differences on the structures of ext3 and ext4	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop,</li> <li>• Internet,</li> <li>• Mobile devices</li> <li>• Animation on the structure of the filesystems</li> <li>• Workbook on the structures of ext3 and ext4</li> <li>• Hex Editor</li> <li>• Course materials and further reading</li> </ul>	Assignment 1: Create a task that will require the responses in the Discussion forums	7
Module 3: Unit 1 Windows Forensics	<ul style="list-style-type: none"> <li>• Analyse evidence from a Windows system</li> <li>• Write investigative notes which when repeated by a third party will produce the same results</li> </ul>	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop,</li> <li>• Internet,</li> <li>• Mobile devices</li> <li>• Instructional videos on examining Windows system</li> <li>• Virtual Machine</li> <li>• Imager</li> <li>• Hex Editor</li> </ul>	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
				Course materials and further reading		
Module 3: Unit 2 Linux Forensics	<ul style="list-style-type: none"> <li>Evaluate a Linux system</li> <li>Use Linux forensic workstation to acquire and analyse evidence</li> <li>Build Linux forensic workstation that can be use to analyse evidence</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Based Learning</li> <li>Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Instructional videos on examining Linux system</li> <li>Instructional videos on using Linux as a forensic workstation</li> <li>Virtual Machine</li> </ul> Course materials and further reading	Assignment 2: An evaluation of a forensic project	7
Module 4: Unit 1 Fundamentals of Network Forensics	Manage evidence from network devices using forensically sound methodologies and tools	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Based Learning</li> <li>Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Instructional videos of investigating network devices</li> <li>Virtual machine</li> </ul> Course materials and further reading	Self-Assessment Exercise	7
Module 4: Unit 2 Traffic Analysis	Capture and analyse data packets	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Based Learning</li> <li>Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Instructional videos on capturing and analysing network traffic</li> <li>Virtual machine</li> </ul> Course materials and further reading	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 5: Unit 1 Static Analysis	Examine an executable file without viewing the instructions	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Internet</li> <li>• Instructional videos static analysis techniques</li> <li>• Virtual Machine</li> </ul> Course materials and further reading	Self-Assessment Exercise	7
Module 5: Unit 2 Dynamic Analysis	Examine an executable file in a controlled environment	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos on dynamic analysis techniques</li> <li>• Virtual Machine</li> </ul> Course materials and further reading	Self-Assessment Exercise	7
Module 5: Unit 3 Malware Behaviour	Detect and identify malware	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Virtual Machine</li> <li>• Course materials and further reading</li> </ul> Discussion forum	Self-Assessment Exercise	7
Module 5: Unit 4 Anti-analysis	Demonstrate anti-disassembly analysis and anti-debugging techniques	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Problem Based Learning</li> <li>• Case Studies</li> </ul>	Students respond to activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Virtual machine</li> </ul> Course materials and further reading	Assignment 3: mini project	7

## Course Information

Course Code:	CST804
Course Title:	Ethical Hacking and Penetration Testing
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blurb:	Focuses on penetration testing and vulnerability analysis. Introduces methodologies, techniques and tools to analyze and identify vulnerabilities in stand-alone and networked applications. An in-depth understanding of penetration (pen) testing and "ethical hacking", including requirements and reporting. Students will examine the business impact of testing and will conduct security testing (including network and web application penetration testing) in the lab environment that includes: intelligence gathering, identifying and exploiting vulnerabilities, conducting post-exploitation exercises, and reporting results. Students will be required to create a comprehensive report summarizing the findings including recommendations to mitigate the risks identified. Topics will include social engineering, web application testing, managing a security test, and tools of attack.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- Protecting Data at Rest and During Transmission
- Protecting System and Network Infrastructure
- Assessing Software Development Vulnerabilities

## Course Objectives

- To provide practical knowledge and skills for vulnerability assessment and penetration testing in order to discover weaknesses in applications and infrastructure
- To provide a solid knowledge of the main issues related to security in modern networked computer systems and IT infrastructure

## Modules and Units

### Module 1: Overview of Hacking

Unit 1: Foot printing

Unit 2: Target Scanning

Unit 3: Covering of tracks

### Module 2: Targeted attacks

Unit 1: Windows System

Unit 2: Linux System

Unit 3: Web Server & Web Applications

### Module 3: Types of attacks

Unit 1: Trojans and Viruses

Unit 2: Social Engineering & Distributed Denial of Service

Unit 3: Spyware

### Module 4: Penetration Testing

Unit 1: Security Audit

Unit 2: Vulnerability Assessment

Unit 3: Penetration Testing Roadmap

Unit 4: Penetration Test Plan

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 1 Foot printing	Use footprintng to gather information about a targetted system	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>• Assign texts to students</li> <li>• Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>• Scenario-based Simulations on how to use both passive and active footprinting to gather information on a target</li> </ul>	Lab exercises on the passive footprinting techniques	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos on passive and active footprinting and countermeasures</li> <li>• Course materials and further reading</li> </ul>	Self-Assessment Exercise: <ul style="list-style-type: none"> <li>• Lab exercises where students will use active footprinting techniques to get information about a target organisation</li> <li>• Develop one open ended question without providing answer from the video</li> </ul>	7
Module 1: Unit 2 Port scanning	Assess the security of a system by identifying open ports	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>• Assign texts to students</li> <li>• Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>• Scenario-based Simulations on how port scanning can be used to assess the security of a system</li> </ul>	Lab exercises on the various part scanning techniques	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos the use of port scanning and its techniques</li> <li>• Course materials and further reading</li> </ul>	Self-Assessment Exercise: <ul style="list-style-type: none"> <li>• Lab exercises on identifying open TCP ports on a target network</li> <li>• Develop one open ended question without providing answer from the video</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 3 Covering of tracks	Demonstrate techniques that can be used to cover tracks and erase evidence after hacking	<ul style="list-style-type: none"> <li>POGIL               <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning               <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> </ul>	Group work using a case study to highlight methods of erasing evidence	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Instructional videos the use of port scanning and its techniques</li> <li>Course materials and further reading</li> <li>Group Discussion</li> </ul>	Assignment 1: Exercise that involves practical	7
Module 2: Unit 1 Windows System	Gain access into windows system using system vulnerabilities	<ul style="list-style-type: none"> <li>POGIL               <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Scenario-based Simulations on the use of vulnerabilities to gain access into a Windows system</li> </ul>	Lab exercises on method of gaining access into a Windows system	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Instructional videos OS attacks, application level attacks and misconfiguration attacks</li> <li>Virtual Machine</li> <li>Course materials and further reading</li> </ul>	Self-Assessment Exercise: <ul style="list-style-type: none"> <li>Lab exercises where students will attempt to crack the password of a Windows system</li> <li>Develop one open ended question without providing answer from the video</li> </ul>	7
Module 2: Unit 2 Linux System	Evaluate security vulnerabilities and use it to attack a Linux server	<ul style="list-style-type: none"> <li>POGIL               <ul style="list-style-type: none"> <li>Assign texts to students</li> </ul> </li> </ul>	Lab exercises on infecting a Linux server with a virus	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> </ul>	Self-Assessment Exercise: <ul style="list-style-type: none"> <li>Lab exercises where students</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> <li>Scenario-based Simulations on exploiting system vulnerabilities to attack a Linux server</li> </ul>		<ul style="list-style-type: none"> <li>Instructional videos on exploiting vulnerabilities on Linux systems to attack and compromise (Kali and Unity)</li> <li>Virtual Machine Course materials and further reading</li> </ul>	<p>will hack a Linux system</p> <ul style="list-style-type: none"> <li>Develop one open ended question without providing answer from the video</li> </ul>	
Module 2: Unit 3 Web Server & Web Applications	Evaluate vulnerabilities of web servers and web application	<ul style="list-style-type: none"> <li>POGIL</li> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> <li>Scenario-based Simulations to demonstrate how attacks on web servers and web applications are perpetrated</li> </ul>	Lab exercises on types of attacks on web servers and web applications	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Instructional videos webserver and web application attacks, attack methodology</li> <li>Virtual Machine</li> <li>Scenario based simulation</li> </ul>	Lab exercises in which students will attack a web application	7
Module 3: Unit 1	Examine various virus and trojans and use them to infect systems	Scenario-based Simulations on how trojans and viruses work	Students will watch the video using guidelines	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> </ul>	Self-Assessment Exercise: Develop one open ended question without	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Trojans & Viruses				<ul style="list-style-type: none"> <li>• Instructional videos on the use of trojans and viruses to attack a system and their countermeasures</li> <li>• Scenario based simulations</li> </ul>	providing answer from the video	
Module 3: Unit 2 Social Engineering & D(D)oS	Employ social engineering techniques to steal identities and execute D(D)oS attacks	Scenario-based Simulations on the use of social engineering techniques to perpetrate attacks and how botnets are used in DDoS a	Students will watch the video using guidelines	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos on social engineering, identity theft, D(D)oS, botnets and their countermeasures</li> <li>• Scenario based simulations</li> </ul>	Self-Assessment Exercise: Develop one open ended question without providing answer from the video	7
Module 3: Unit 3 Spyware	Deploy spyware on a target system to gather sensitive information	<ul style="list-style-type: none"> <li>• Scenario-based Simulations on how spyware can be used to gain access to sensitive information on a system</li> <li>• Learning Ask questions that require group discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Group work using a case studies on the use of spyware in corporations</li> </ul> Group discussion	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Instructional videos on spyware and keyloggers</li> <li>• Discussion forum</li> </ul>	Assignment 2: Assessment that will make the students take a real life survey and make post poster.	7
Module 4: Unit 1 Vulnerability Assessment	Assess the security of systems, applications and	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>• Assign texts to students</li> </ul> </li> </ul>	Group discussion on	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> </ul>	Self-Assessment Exercise: 2 multiple choice self with feedback	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	infrastructure and identify ways to mitigate the risk of attacks	<ul style="list-style-type: none"> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> <li>Cooperative Learning Ask questions that require group discussions</li> </ul>		<ul style="list-style-type: none"> <li>Discussion forum</li> <li>Course materials and further reading</li> </ul>		
Module 4: Unit 2 Security Audit	Examine the security of an organisation to identify its strength and potential weaknesses	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning Ask questions that require group discussions</li> </ul>	Group discussion on the processes of security audits	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> <li>Course materials and further reading</li> </ul>	Self-Assessment Exercise: Develop one open ended question without providing answer from the text	7
Module 4: Unit 3 Penetration Testing Roadmap	Develop penetration testing roadmap	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Group discussion</li> </ul> Group project to present a penetration testing roadmap for an organisation	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul>	Self-Assessment Exercise: Develop one open ended question without providing answer from the text	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Project Based Learning</li> </ul> <p>Students will be given a project to develop a penetrating testing roadmap for an organisation</p>				
Module 4: Unit 4 Penetration Test Plan	Develop a plan for conducting penetration testing in order to identify vulnerabilities	Problem Solving Scenarios	Students work through the activities	Instructional video	Assignment 3: Mini project	7

## Course Information

Course Code:	CST806
Course Title:	Cyber War and Cyber Deterrence
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blub:	The focus of this course is on: definition of cyberwar, motivation, attackers, threats, fifth domain on warfare, differences between cyber warrior and traditional warrior; Analysis of Cyber Attacks; Cyber Weapons; Cyber Warfare Attacks and Tactics; Cyber Defense Tactics; Cyber Warfare Doctrine and Strategy; Cyber Warfare Capabilities by Nation; Legal Status and Ethics of Cyber Warfare; Emerging trends in Cyber Warfare.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Protecting system and network infrastructure
- Regulatory compliance and auditing

## Course Objectives

- To describes the tools and tactics used in cyber warfare.
- Describes both offensive and defensive tactics from an insider's point of view.
- Presents doctrine and hands-on techniques to understand as cyber warfare evolves with technology.

## **Modules and Units**

### **Module 1: Cyber warfare**

Unit 1: Cyber Warfare fundamentals

Unit 2: Cyber Threats landscape and the Cyberspace Battlefield

Unit 3: Cyber Doctrine

Unit 4: Cyber Warriors

### **Module 2: Cyber weapons**

Unit 1: Logical Weapons

Unit 2: Physical Weapons

Unit 3: Psychological Weapons

### **Module 3: Cyber warfare tactics**

Unit 1: Offensive Tactics and Procedures

Unit 2: Defensive Tactics and Procedures

### **Module 4: Legal Status and Ethics of Cyber Warfare**

Unit 1: Legal System Impacts

Unit 2: Ethics

### **Module 5: Challenges and Future of Technology and Their Impacts on Cyber Warfare**

Unit 1: Cyberspace Challenges and The Future of Cyber Warfare

Unit 2: Cyber deterrence measures

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1:Unit1 Cyber Warfare Fundamentals	Explain what cyberwarfare is and the ways in which cyberwarfare can be waged	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module1:Unit2 Cyber Threats landscape and The Cyberspace Battlefield	Determine the boundaries of cyber warfare and the perspectives used to define it	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module1:Unit3 Cyber Doctrine	Evaluate the state of cyber warfare doctrines and examines some of the traditional tactics and products that the military must adapt to the cyberspace environment	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions</li> </ul> </li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment –Two multiple choice self assesment excercises with feedback</li> </ul>	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>and self-assessment exercises</li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>				
Module1:Unit4 Cyber Warriors	Analyse the training and experiences of those working in the cyber fields as well as how traditional armed forces differ from cyber warriors in age, attitude, physical condition, and credentials.	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Assignment 1: Should be practical oriented	5
Module 2: Unit 1: Logical Weapons	Use the variety of tools available in cyber warfare, penetration testing, and security in general to defend against an attacker	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment –Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module2: Unit 2:	Examine the intersect between logical and physical systems	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL)</li> </ul>	Students respond to case studies	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment –Two multiple</li> </ul>	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Physical Weapons	as well as the use of physical weapons in cyber warfare	<ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	and problem-solving scenarios	<ul style="list-style-type: none"> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	choice self assesment excercises with feedback	
Module2: Unit 3: Psychological Weapons	<ul style="list-style-type: none"> <li>• Explain the techniques used in social engineering</li> <li>• Evaluate techniques needed to tackle social engineering threat</li> </ul>	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module3: Unit 1: Offensive Tactics and Procedures	Investigate the different phases of the attack process, from reconnaissance, scanning, accessing systems, and escalating privileges, to exfiltration data, assaulting the system, sustaining access, and obfuscating any traces that might be left behind	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Case Studies</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		Problem Solving Scenarios				
Module3: Unit 2: Defensive Tactics and Procedures	Discuss security awareness and strategies for defending against attacks. Describe the key principles of security	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	Assignment 2:	5
Module4: Unit 1: Legal System Impacts	Discuss the legal aspects of cyber warfare and current laws that impact how cyber warfare is conducted	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module4: Unit 2: Ethics	Appraise the ethics surrounding cyber warfare	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions</li> </ul> </li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet,</li> <li>Course materials/ other readings</li> <li>Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>and self-assessment exercises</li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>				
Module5: Unit 1: Cyberspace Challenges and The Future of Cyber Warfare	<ul style="list-style-type: none"> <li>• Manage principal cyber challenges faced by nations and resources needed for these challenges</li> <li>• Identify some near-term trends in cybersecurity and courses of action as well discuss inherent problems associated with recent development in technology</li> </ul>	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise –Two multiple choice self assesment excercises with feedback</li> </ul>	5
Module5: Unit 2: Cyber deterrence measures	Interprets cyberwarfare treaties and measures	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students respond to case studies and problem-solving scenarios	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet,</li> <li>• Course materials/ other readings</li> <li>• Discussion Forum</li> </ul>	Assignment 3: Mini Project	5

- Laptop/moile phone and internet access is required for all.

## Course Information

Course Code:	CST808
Course Title:	Incidence Management and Disaster Recovery
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blub:	This course covers: An Overview of Information Security and Risk Management: Overview of Risk Management, Contingency Planning and Its Components, Role of Information Security Policy in Developing Contingency Plans. Planning for Organizational Readiness; Disaster Recovery Philosophy, Principles and Planning, Contingency Plan Components, Agency response procedures and Continuity of Operations, Planning Processes, Continuity and Recovery Function, Steps of Disaster Recovery Planning Elements Required to Begin Contingency Planning, Contingency Planning Policy, Business Impact Analysis, BIA Data Collection, Budgeting for Contingency Operations. Contingency Strategies for IR/DR/BC; Data and Application Resumption, Site Resumption Strategies. Incident Response: Planning, Detection, Decision Making, Strategies, Recovery and Maintenance. Business Continuity Planning, Crisis Management and International Standards in IR/DR/BC
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- To Protect and manage system and network infrastructure from risk management, disaster recovery and international standards

## Course Objectives

- To promote the management of the basic infrastructure from risk and disaster through proper administration
- Adopt international standards for effective management of systems and network infrastructure

## Modules and Units

Module 1: An overview of Information Security and Risk Management

Unit 1: Concept of Information Security

Unit 2: Concept of Risk Management

Unit 3: Planning for organization readiness

Module 2: Contingency Strategy for IR/DR/BC

Unit 1: Contingency Planning

Unit 2: Incidence Response

Unit 3: Disaster Recovery

Unit 4: Business Continuity

Module 3: Incidence Response Organizing and Preparing the CSIRT

Unit 1: CSIRT Actions

Unit 2: CSIRT Design

Unit 3: CSIRT Development

Module 4: Crisis Management and International Standards for IR/DR/BC

Unit 1: Role of Crisis Management

Unit 2: Element of Plan to prepare for Crisis Response

Unit 3: International Standards for IR/DR/BC

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1: Unit 1 Concept of Information Security	Describe the concept of information security	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module1: Unit 2 Concept of Risk Management	Measure the concept of risk and its implication	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module1: Unit 3 Planning for organization readiness	Manage risks in an organisation	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Assignment 1: Focused on Module 1 and must give opportunity for thinking and application	5
Module2: Unit 1 Contingency Planning	Establish relationship in contingency planing and explain the techniques used for data and application backup and recovery	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module2: Unit 2 Incidence Response	Plan incidence response that will solve real life problem	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module2: Unit 3 Disaster Recovery	Create techniques for disaster recovery	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module2: Unit 4 Business Continuity	Derive strategies for business sustainability	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module3: Unit 1 CSIRT Actions	Analyse CSIRT actions	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module3: Unit 2 CSIRT Design	Design CSIRT that can be develop	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module3: Unit 3 CSIRT Development	Develop CSIRT that can be deployed for use	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Assignment 2: Focused on Modules 2 and 3 and must give opportunity for thinking and application	5
Module4: Unit 1	Manage crises	<ul style="list-style-type: none"> <li>Case Studies</li> </ul>	Students respond to	Generic Resources	Self-Assessment Exercise	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Role of Crisis Management		<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> </ul>	case studies and scenarios			
Module4: Unit 2 Element of Plan to prepare for Crisis Response	Plan response strategies as a means for crises management	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Self-Assessment Exercise	5
Module4: Unit 3 International Standards for IR/DR/BC	Use tools and techniques to examine an executable file in a controlled environment	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students respond to case studies and scenarios	Generic Resources	Assignment 3: Focus on the entire modules.	5

## Course Information

Course Code:	CST810
Course Title:	Web Security
Credit Unit:	2
Course Status:	Elective
Course Description/Blurb:	Security Fundamentals, creating web pages and running web servers, JavaScript: the language, and the browser runtime, Client-side attacks and defenses, Single Page Applications, Web application back ends, Web application backing stores, Advanced side channel attacks, Web privacy, Human factors / Usable web security, Scaling and securing web applications.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Protecting Data at rest and during transmission
- Assessing software development vulnerabilities

## Course Objectives

- Learn the basic techniques for developing websites.
- Explore security-related issues in Web-based systems and applications.
- Explore the fundamental mechanisms of securing a Web-based system.
- To evaluate a Web-based system with respect to its security requirements.
- To implement security mechanisms to secure a Web-based application.

## Modules and Units

Module 1: fundamental concepts of web programming

Unit 1: Introduction of Internet, WWW and N-tier web applications

Unit 2: Web Basics: HTML, CSS, JS, URLs

Unit 3: Web Basics: DOM, Frames, HTTP, Navigation, X-Domain communication

Module 2: Web application flaws

Unit 1: Injection Flaws

Unit 2: Authentication Flaws

Unit 3: Request Authorization Flaws

Unit 4: Cookie Flaws

Unit 5: HTTP request flows

Unit 6: User Privacy flows

Module 3: web vulnerability exploitation and web security measures

Unit 1: Network Attacks, HTTPS and its Limitations of HTTPS

Unit 2: Same Origin Policy

Unit 3: Attacks on User Interfaces

Unit 4: Web security measures

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	<ul style="list-style-type: none"> <li>Teaching Technique</li> </ul>	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1:Unit1 Introduction of Internet, WWW and N-tier web applications	Distinguish internet, www and N-tier web applications	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise.	5
Module1:Unit2 Web Basics: HTML, CSS, JS, URLs	Use the basic technologies for creating web pages	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Self-Assessment Exercise.	5
Module1:Unit3 Web Basics: DOM, Frames, HTTP, Navigation, X-Domain communication	Design web pages using the basic tools – DOM, Frames, HTTP, Navigation, X-Domain communication	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Assignment 1:	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	<ul style="list-style-type: none"> <li>Teaching Technique</li> </ul>	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> </ul>				
Module2: Unit 1: Injection Flaws	Demonstrate the techniques for attacking Web application through injection of malicious code such as SQL injection	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Self-Assessment Exercise.	5
Module2: Unit 2: Authentication and authorization Flaws	<ul style="list-style-type: none"> <li>Demonstrate authentication flows in web applications</li> <li>Prevent weaknesses that allow attackers to capture or bypass authentication in web applications</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise.	5
Module 2: Unit 3: Cookie Flaws	Explains security issues in cookies such as cookie hijacking and techniques for analyzing cookies data	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-</li> </ul> </li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Self-Assessment Exercise.	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	<ul style="list-style-type: none"> <li>Teaching Technique</li> </ul>	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>assessment exercises</li> <li>Problem Solving Scenarios</li> </ul>				
Module 2: Unit 4: Request Authorisation		<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, Scenario	Self-Assessment Exercise.	
Module 2: Unit 5: HTTP request attacks	<ul style="list-style-type: none"> <li>Perform HTTP request attacks including Pollution and Parameter tampering</li> <li>Protect web applications against such attacks</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Self-Assessment Exercise.	5
Module2: Unit 6: User Privacy flows	Identify techniques that allow websites to track users including Device Fingerprinting and Browser Caching	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions</li> </ul> </li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Assignment 2	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	<ul style="list-style-type: none"> <li>Teaching Technique</li> </ul>	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>and self-assessment exercises</li> <li>Problem Solving Scenarios</li> </ul>				
Module3:Unit1 Network Attacks, HTTPS and its Limitations	<ul style="list-style-type: none"> <li>Classify the type of attacks in network</li> <li>Use HTTPS to secure transition on the network</li> <li>Demonstrate the limits to the benefits HTTPS in securing browsing as well as tricks for Defeating SSL</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Self-Assessment Exercise.	5
Module3:Unit2 Same Origin Policy	Use SOP to prevents a malicious script on one page from obtaining access to sensitive data on another web page	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Self-Assessment Exercise.	5
Module 3: Unit 3: Attacks on User Interfaces	Explains common vulnerabilities found in User Interface. Explain Techniques for attacking Web User Interfaces	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-</li> </ul> </li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Self-Assessment Exercise.	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	<ul style="list-style-type: none"> <li>Teaching Technique</li> </ul>	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>text questions and self-assessment exercises</li> <li>Problem Solving Scenarios</li> </ul>				
Module3: Unit 4: web security measures	Describe the techniques for securing web applications	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Solving Scenarios</li> </ul>	Students respond read, watch video and respond to the activities	Generic Resources, software and simulation	Assignment 3: Mini project	5

## Course Information

Course Code:	CST812
Course Title:	Cyber Law and Ethics
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blub:	In this course you will learn about Legal and policy challenges of evolving cybersecurity threats at national and international level, legal frameworks; Cyber regulation, Standards, law and technology; National and International governing authorities; Security governance and policy; Privacy law; Security policy development cycle; Property-rights legislation; Virtue ethics; Utilitarian ethics and deontological ethics.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

To introduce students to the laws guiding the use of cyberspace

## Course Objectives

- To analyze statutory, regulatory, constitutional, and organizational laws as it is applied to cybersecurity
- To explore the laws of other countries in relation to cyberspace
- To be conversant on the ethical issues surrounding the use of the internet

## **Modules and Units**

### **Module 1: The Internet**

Unit 1: Legal Framework of cyberspace

Unit 2: Privacy and Censorship

Unit 3: Net Neutrality

### **Module 2: Cyber law in Nigeria**

Unit 1: Advance Fee Fraud and Other Fraud Related Offences (Amendment) Act

Unit 2: Cybercrime Act

Unit 3: Evidence Act

Unit 4: Nigeria Data Protection Regulation, cybercrime policy and strategy documents

### **Module 3: Cyber law: International Perspective**

Unit 1: UN & International Telecommunication Union (ITU) Initiatives

Unit 2: Council of Europe - Budapest Convention on Cybercrime

### **Module 4: Dispute in Cyberspace**

Unit 1: Intellectual Property Issues

Unit 2: Jurisdiction and International Law

### **Module 5: Cyber Ethics and emerging trends**

Unit 1: Ethical Concepts and Professionalism

Unit 2: emerging trends in cyber laws and ethics

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1: Unit 1 Legal Framework of the cyberspace	Develop guidelines on rights and responsibilities of using the Internet and Internet-related technologies	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>○ Assign texts to students</li> <li>○ Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>• Cooperative Learning <ul style="list-style-type: none"> <li>○ Ask questions that require group discussions</li> </ul> </li> <li>• Problem Solving Scenarios</li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Discussion forum</li> </ul>	Self-Assessment Exercise	5
Module1: Unit 2 Privacy and Censorship	Manage organisations from security breaches by the use of proper privacy and censorship policies	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>○ Assign texts to students</li> <li>○ Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>• Cooperative Learning <ul style="list-style-type: none"> <li>○ Ask questions that require group discussions</li> </ul> </li> <li>• Case Study Method</li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Discussion forum</li> </ul>	Self-Assessment Exercise: Develop one open ended question without providing answer from the text	5
Module1: Unit 3	Examine policies of ISPs to ensure that	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>○ Assign texts to students</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> </ul>	Self-Assessment Exercise: 2 open ended questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Net Neutrality	all users are treated equally	<ul style="list-style-type: none"> <li>○ Ask questions that require the text for answer but not such that it requires memorisation</li> <li>• Cooperative Learning <ul style="list-style-type: none"> <li>○ Ask questions that require group discussions</li> </ul> </li> <li>• Case Study Method</li> </ul>		<ul style="list-style-type: none"> <li>• Internet</li> <li>• Discussion forum</li> </ul> Course materials and further reading		
Module2: Unit 1 Advance Fee Fraud and Other Fraud Related Offences (Amendment) Act	Demonstrate the evolution of the Advance Fee Fraud and how it relates to cybercrime	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>○ Assign texts to students</li> <li>○ Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>• Cooperative Learning <ul style="list-style-type: none"> <li>○ Ask questions that require group discussions</li> </ul> </li> <li>• Case Study Method</li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Discussion forum</li> </ul> Course materials and further reading	2 Self-Assessment Exercise: multiple choice self assessment exercises with feedback	5
Module2: Unit 2 Cybercrime Act	Evaluate cybercrime art for adequate deployment and protection	<ul style="list-style-type: none"> <li>• POGIL <ul style="list-style-type: none"> <li>○ Assign texts to students</li> <li>○ Ask questions that require the text for answer but not such that</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>• Laptop</li> <li>• Mobile devices</li> <li>• Internet</li> <li>• Discussion forum</li> </ul> Course materials and further reading	Group project on critical analysis of the Cybercrime Act 2015	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		it requires memorisation <ul style="list-style-type: none"> <li>Cooperative Learning               <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> <li>Case Study Method</li> <li>Problem Solving Scenarios</li> </ul>				
Module2: Unit 3 Evidence Act	Manage the admissability of electronic evidence in investigations	<ul style="list-style-type: none"> <li>POGIL               <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning               <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul> Course materials and further reading	Self-Assessment Exercise: 3 in-text multiple choice questions with four options. Each option must have an explanation of why it is right or wrong. The answers should be eletronically generated with a click of a button	5
Module2: Unit 4 Nigeria Data Protection Regulation, cybercrime policy and strategy	Apply the regulations to protect personal data of individuals and organisations	<ul style="list-style-type: none"> <li>POGIL               <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning               <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul> Course materials and further reading	Assignment 1: <ul style="list-style-type: none"> <li>Presentation of the group project in module 2 Unit 2 through video conferencing or on dicussion forum using</li> </ul>	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
					narrated PowerPoint <ul style="list-style-type: none"> <li>Students comment on other group presentations</li> </ul>	
Module3: Unit 1 UN & International Telecommunication Union (ITU) Initiatives	Use different initiatives to combat cybercrime	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul> Course materials and further reading	Self-Assessment Exercise: 2 open ended questions	5
Module3: Unit 2 Council of Europe - Budapest Convention on Cybercrime	Use specific treaty when investigating cross-border crimes	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul> Course materials and further reading	Self-Assessment Exercise: Develop one open ended question without providing answer from the text	5
Module4: Unit 1 Intellectual Property Issues	Investigate cybercrimes related to copyright, trademark, patents etc	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Assign texts to students</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul>	Self-Assessment Exercise: 3 in-text multiple choice questions with four options. Each	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> <li>Cooperative Learning Ask questions that require group discussions</li> </ul>		Course materials and further reading	option must have an explanation of why it is right or wrong. The answers should be electronically generated with a click of a button	
Module4: Unit 2 Jurisdiction and International Law	Investigate cross-border crime	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul> Course materials and further reading	Assignment 2: Group project on cross-border cybercrime	5
Module5: Unit 1 Ethical Concepts and Professionalism	Demonstrate ethical concepts and professionalism in	<ul style="list-style-type: none"> <li>POGIL <ul style="list-style-type: none"> <li>Assign texts to students</li> <li>Ask questions that require the text for answer but not such that it requires memorisation</li> </ul> </li> <li>Cooperative Learning <ul style="list-style-type: none"> <li>Ask questions that require group discussions</li> </ul> </li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> <li>Internet</li> <li>Discussion forum</li> </ul> Course materials and further reading	Self-Assessment Exercise: One Tutor marked assignment with 2 open ended questions	5
Module5: Unit 2	Review the current trends in cyber laws and ethics	<ul style="list-style-type: none"> <li>POGIL</li> </ul>	Students respond to the activities	<ul style="list-style-type: none"> <li>Laptop</li> <li>Mobile devices</li> </ul>	Assignment 3: Mini project	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
emerging trends in cyber laws and ethics		<ul style="list-style-type: none"> <li>• Assign texts to students</li> <li>• Ask questions that require the text for answer but not such that it requires memorisation</li> <li>• Cooperative Learning <ul style="list-style-type: none"> <li>○ Ask questions that require group discussions</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>• Internet</li> <li>• Discussion forum</li> </ul> Course materials and further reading		

**Ph.D. Cyber Security**

## Programme Competencies

- Performing Forensic Analysis of Data, Systems and Network.
- Performing Malware Analysis of Data, Systems and Network
- Protecting Data at Rest and During Transmission
- Protecting System and Network Infrastructure
- Assessing Software Development Vulnerabilities
- Regulatory Compliance and Auditing

## Courses

CST901: Advanced Computer and Network Security  
 CST903: Advanced Cryptography  
 CST905: Malware Analysis  
 CST902: Digital Forensics and Incident Response  
 CST904: Monitoring, Auditing, and Penetration Testing  
 CST908: Cyber Threat Intelligence

Table 1: Programme Competences and Courses

Competences	CST90 1	CST90 3	CST90 5	CST90 2	CST90 4	CST90 8
Performing Forensic Analysis of Data, Systems and Network.				X		
Performing Malware Analysis of Data, Systems and Network			X			
Protecting Data at Rest and During Transmission	X	X	X		X	X
Protecting System and Network Infrastructure	X		X		X	X
Assessing Software Development Vulnerabilities	X				X	X
Regulatory Compliance and Auditing				X	X	

## Course Information

Course Code:	CST901
Course Title:	Advanced Computer Security
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blub:	This course is an advanced study of computer security which will cover threat and security policy models, authentication mechanisms, authorization techniques, security models, trusted computing, network architecture security and security protocols, operating system security, database security, physical security, Internet security
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- Protecting Data at Rest and During Transmission
- Protecting System and Network Infrastructure
- Assessing Software Development Vulnerabilities

## Course Objectives

- Explain the fundamentals concepts of computer security apply to different components of computing systems.
- Identify the basic cryptographic techniques using existing software in maintain information security.
- Describe how malicious attacks, threats, and protocols for security vulnerabilities impact a systems infrastructure.
- Explain and compare security mechanisms for conventional operating systems.
- Describe security requirements for database security

- Describe threats to networks, and explain techniques for ensuring network security

## **Modules and Units**

### Module 1: Computer security technology and principles

Unit 1: Security fundamentals

Unit 2: User authentication

Unit 3: Cryptographic tools

Unit 4: Access control

Unit 5: Malicious software

Unit 6: Database and cloud security

Unit 7: Intrusion detection

Unit 8: Firewall and intrusion prevention systems

### Module 2: Software security and trusted Systems

Unit 1: Software security

Unit 2: Operating system security

### Module 3: Network security

Unit 1: Internet security protocols and standards

Unit 2: Wireless Network Security

Unit 3: Cellular network security

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1:Unit1: Security fundamentals	Describe the key security requirements of confidentiality, integrity, and availability. Discuss the types of security threats and attacks that must be dealt with	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: Create real life situation for students to respond to</li> </ul>	7
Module1:Unit2: User authentication	Use the techniques and mechanisms of authenticating a user	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7
Module1:Unit3 Cryptographic tools	Manage the operation of selected encryption algorithms	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Problem Based Scenario</li> </ul>				
Module1: Unit 4 Access control	Manage access control towards goal achievement	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7
Module1: Unit 5 Malicious software	<ul style="list-style-type: none"> <li>Describe the different threats posed malware Describe the mechanisms malware uses to propagate.</li> <li>Describe some malware countermeasure elements</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7
Module1:Unit6 Database and cloud security	<ul style="list-style-type: none"> <li>Categorise approaches to database access control</li> <li>Explain the security threat in database systems.</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-</li> </ul> </li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Manage the security issues related to cloud computing</li> </ul>	<ul style="list-style-type: none"> <li>assessment exercises</li> <li>Problem Based Scenario</li> </ul>				
Module1: Unit7: Intrusion detection	<ul style="list-style-type: none"> <li>Distinguish among various types of intruder behaviour patterns.</li> <li>Explain the principles of and requirements for intrusion detection</li> </ul> <p>Discuss the key features network-based and host-based intrusion detection.</p>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7
Module1: Unit 8: Firewall and intrusion prevention systems	<ul style="list-style-type: none"> <li>Explain the role of firewalls as part of a computer and network security strategy.</li> <li>Discuss the various basing options for firewalls.</li> <li>Distinguish between firewalls and intrusion prevention systems.</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Assignment 1: Present a Problem-Solving Scenario for the students to solve	7
Module2: Unit 1: Software security	Manage different security software towards organization protection	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions</li> </ul> </li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>and self-assessment exercises</li> <li>• Problem Based Scenario</li> </ul>				
Module2: Unit 2: Operating system security	Evaluate operating system security in planning and usage	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Assignment: 2: Students to present poster on the innovative idea they have created from what they have learned in Units 1 and 2.	7
Module3: Unit 1: Internet security protocols and standards	<ul style="list-style-type: none"> <li>• Explain the functionality of S/MIME</li> <li>• Explain the key components of SSL.</li> <li>• Discuss the use of HTTPS.</li> </ul>	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>• Problem Based Scenario</li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7
Module3: Unit 2: Wireless Network Security	Analyse security threats and countermeasures for wireless networks.	<ul style="list-style-type: none"> <li>• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-</li> </ul> </li> </ul>	Students go through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: Create real life situation for students to respond to	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		text questions and self-assessment exercises • Problem Based Scenario				
Module3: Unit 3: Cellular network security	Analyse security threats and countermeasures for cellular networks.	• Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>○ Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> • Problem Based Scenario	Students go through the materials and respond to the activities	Generic Resources	Assignment 3: Mini project	7

Laptop/mobile phone and internet access is required for all.

## Course Information

Course Code:	CST903
Course Title:	Advanced Cryptography
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blub:	This covers symmetric and asymmetric cryptography including the history of cryptography and cryptanalysis, algorithms for modern ciphers such as AES, DES, RSA, and RC4, key exchange and management, digital signatures, secure hashes, as well as steganography.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- To introduce students on the various research in the design and implementation of security and its applications.

## Course Objectives

- Protecting data at rest and during transmission in systems and network

## Modules and Units

### Module 1: Symmetric Cryptography

Unit 1: Symmetric Encryption Scheme

Unit 2: Indistinguishability Under Chosen Plaintext Attack

Unit 3: Indistinguishability Under Chosen Cipher Text Attack

### Module 2: Asymmetric Cryptography

Unit 1: Asymmetric Encryption Scheme

Unit 2: Problem with Deterministic Encryption

Unit 3: RSA Cryptosystem

Unit 4: Probabilistic Public Key Encryption

### Module 3: Algorithms of Modern Cipher

Unit 1: AES, DES and RSA

Unit 2: RC4 and Key Exchange Management

### Module 4: Signature Scheme

Unit 1: Security Requirement for Signature Scheme

Unit 2: Digital Signature Algorithm

Unit 3: Secure Hash

Unit 4: Steganography

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1: Symmetric Cryptography Unit 1: Symmetric Encryption Scheme	Identify communication data with the various security attributes. Understand privacy and authenticity of the communicated data.	Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text.	Students participate in forum discussions and respond to the activities	Laptop mobile devices and internet Course materials and further reading	Formative – 2 multiple choice self assessment exercises with feedback Group work,	7
Module 1: Unit 2  Indistinguishability Under Chosen Plaintext Attack	Process plaintext using the key	Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text	Students participate in forum discussions and respond to the activities	Laptop, Internet Workbook	Short answer questions Lab Exercise	7
Module 1: Unit 3: Indistinguishability Under Chosen Ciphertext Attack	Process plaintext using the key, thereby providing ciphertext	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text  2. Problem solving scenario	Students participate in forum discussions and respond to the activities	Laptop mobile devices and internet Course materials and further reading	Formative – 2 multiple choice self assessment exercises with feedback Group work,	7
Module 2: Unit 1 Asymmetric Encryption Scheme	Analyze a public-key cryptosystem, such as the <i>ElGamal Cryptosystem</i> , that are based on the Discrete Logarithm problem	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text	Students participate in group project to present the concept of perfect secrecy and entropy	Laptop Mobile devices Internet Course materials and further reading,	Assignment 1: Group Project	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 2: Unit 2: Problem with Deterministic Encryption	Analyze problem with deterministic encryption	<ul style="list-style-type: none"> <li>Problem solving scenario</li> <li>Experimental Method on cryptosystem</li> </ul>	Lab Exercise on the use of information theory in cryptography Group work	Laptop Mobile devices Internet Instructional videos that demonstrate the use of information theory  Course materials and further reading	<ul style="list-style-type: none"> <li>Lab exercises with the use of cryptanalysis tool</li> <li>Short answer questions as self assessment exercise</li> </ul>	7
Module 2: Unit3 RSA Cryptosystem	Describe the Rivest, Shamir, and Adelman cryptosystem	Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text	Lab Exercise on the use of information theory in cryptograp Group work	Laptop Mobile devices Internet Instructional videos on modern block cipher design and analysis Course materials and further reading Discussion Forum	<ul style="list-style-type: none"> <li>Lab exercise</li> <li>Self-Assessment Exercise – 2 multiple choice self assessment exercises with feedback</li> <li>Group work,</li> </ul>	7
Module2: Unit 4 Probabilistic Public Key Encryption	Demonstrate the use of substitution-permutation model to introduce many of the concept of modern block cipher design	Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text	Lab Exercise on the use of information theory in cryptograp Group work	Laptop Mobile devices Internet Instructional videos on modern block cipher design and analysis Course materials and further reading Discussion Forum	Assignment 2: Students to carry out specific experiment and present poster	7
Module 3: Unit 1 AES, DES and RSA	Describe and analyze the advance encryption standard, Data Encryption Scheme and the Rivest Shamir and Adelman	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text	Lab Exercise on the use of information theory in cryptography Group work	Laptop Mobile devices Internet Course materials and further reading Discussion Forum	Self-Assessment Exercise – <ul style="list-style-type: none"> <li>2 multiple choice self assessment exercises with feedback</li> <li>Discussion forum</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		2. Problem solving scenario			End of mDataodule examination	
Module 3: Unit 2 RC4, Key Exchange and Management	<ul style="list-style-type: none"> <li>Manage the Principle and process of block cipher and keys.</li> <li>Manage the key exchange in providing solution</li> </ul>	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text  2. Problem solving scenario	<ul style="list-style-type: none"> <li>Lab Exercise on cryptanalysis</li> <li>Forum discussion on the basic discrete logarithm problem.</li> <li>Interactive quiz on which gives feedback on the answers</li> </ul>	Laptop Mobile devices Internet Course materials and further reading Cryptanalysis tools	Self-Assessment Exercise – 2 multiple choice self assessment exercises with feedback Group work,	7
Module 4: Unit 1 Security Requirement for Signature Scheme	Process the treatment of special types of signature schemes such as undeniable and fail-stop signature schemes	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text  2. Problem solving scenario	<ul style="list-style-type: none"> <li>Lab exercises on discrete algorithm problem.</li> </ul>	Laptop Mobile devices Internet Course materials and further reading	Self-Assessment Exercise– 2 multiple choice self assessment exercises with feedback Group work,	7
Module 4: Unit 2 Digital Signature Algorithm	manage special types of signature schemes and its signature algorithm such as undeniable and fail-stop signature schemes	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text  2. Problem solving scenario	Forum discussion on discrete logarithm Interactive quiz on which gives feedback on the answers	Laptop Mobile devices Internet Course materials and further reading	Self-Assessment Exercise – 2 multiple choice self assessment exercises with feedback Group work End of module examination	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 4: Unit 3 Secure Hash	Apply simple strange functions from string of almost arbitrary length to .strings of 160 bit	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text  2. Problem solving scenario	Lab Exercise on symmetric encryption scheme Classroom discussion Interactive quiz on which gives feedback on the answers	Laptop Mobile devices Internet Course materials and further reading	Self-Assessment Exercise – 2 multiple choice self assessment exercises with feedback Group work Lab Exercise on symmetric encryption scheme	7
Module 4: Unit 4 Steganography	Demonstrate how to conceal a file, image, message and video within another file, message, image and video	1.Process Oriented Guided Inquiry Lesson (POGIL)- Assign text and followup with questions that will require the text  2. Problem solving scenario	Lab Exercise on symmetric encryption scheme Classroom discussion Interactive quiz on which gives feedback on the answers	Laptop Mobile devices Internet Course materials and further reading	Assignment 3: Lab Exercise on problem solving in privacy	7

## Course Information

Course Code:	CST905
Course Title:	Malware Analysis
Credit Unit:	2
Course Status:	Compulsoy
Course Description/Blub:	This course covers behavioral and code analysis of malware, tools and techniques for malware analysis, dynamic and static analysis, network monitoring, cybersecurity defences and developing policies for malware handling.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Perform Malware Analysis of Data, Systems and Network
- Protect Data at Rest and During Transmission
- Protect System and Network Infrastructure

## Course Objectives

- To apply the tools and methodologies in performing static and dynamic analysis on unknown executables,
- To perform behavioural analysis on malware
- To extract investigative leads from host and network-based indicators associated with a malicious program.

## **Modules and Units**

### **Module 1: Malware Concepts**

Unit 1: Malware Taxonomy and Terminology

Unit 2: Types of Malware

Unit 3: Malware Detection

Unit 4: Malware Analysis Concepts

Unit 5: Malware Eradication

### **Module 2: Malware Analysis**

Unit 1: Basic Analysis

Unit 2: Static Analysis

Unit 3: Dynamic Analysis

Unit 4: Behaviour Analysis

### **Module 3: Advanced Analysis**

Unit 1: Advanced Static Analysis

Unit 2: Advanced Dynamic Analysis

### **Module 4: Anti Analysis**

Unit 1: Anti-disassembly

Unit 2: Anti-debugging

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 1 Malware Taxonomy and Terminology	Communicate the concept and terminology of malware	POGIL ( Process Oriented Guided Inquiry Lessons) and Problem Solving Scenario	Group discussions.	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading Discussion forum	Self-Assessment Exercise-Create two self-asesment exercises.	5
Module 1: Unit 2 Types of Malware	Recognise the different types of malware	POGIL ( Process Oriented Guided Inquiry Lessons)	Group discussion	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading Discussion Forum	Self-Assessment Exercise -Create two self-asesment exercises.	5
Module 1: Unit 3 Malware Detection	Apply detection techniques on infected systems to identify malware	POGIL ( Process Oriented Guided Inquiry Lessons) Project based learning	Lab Exercise and Group Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Self-Assessment Exercise: Lab exercise	5
Module 1: Unit 4 Malware Analysis	Conduct basic analysis of malware to ease its removal	POGIL ( Process Oriented Guided Inquiry Lessons) Project based learning	Lab Exercise Individual Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Self-Assessment Exercise - Lab exercise Short answer questions	5
Module 1: Unit 5 Malware Eradication	Examine and select the required technique(s) to	POGIL ( Process Oriented Guided Inquiry Lessons)	Lab Exercise	Laptop, Internet, Mobile devices Instructional videos	Assignment 1 - Create a problem solving scenario	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	remove detected malware			Virtual Machine Course materials and further reading	that will require Lab exercise Short answer questions	
Module 2: Unit 1 Basic Analysis	Execute a malware in a controlled environment Identify and remove malware	POGIL ( Process Oriented Guided Inquiry Lessons) and Problem Solving Scenario	Lab Exercises	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Lab exercise Short answer questions	5
Module 2: Unit 2 Static Analysis	Examine a malware and apply static binary code analysis techniques	POGIL ( Process Oriented Guided Inquiry Lessons)	Lab Exercises	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Lab exercise Short answer questions	5
Module 2: Unit 3 Dynamic Analysis	Analyse malware with dynamic program tracing techniques	POGIL ( Process Oriented Guided Inquiry Lessons)	Lab Exercises	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Lab exercises Formative –Two multiple choice self assesment excercises with feedback.	5
Module 2: Unit 4 Behaviour Analysis	Determine the type of malware based on its characteristics and behaviour	POGIL (Process Oriented Guided Inquiry) Project based learning	Lab exercises Group Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Case study Formative (in-text questions, self-assessment exercises) Lab Exercises	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 3: Unit 1 Advanced Static Analysis	Perform pointer analysis on a malware	POGIL ( Process Oriented Guided Inquiry Lessons) Project based learning	Lab Exercises Group Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Formative (in-text questions, self-assessment exercises) Lab exercises	5
Module 3: Unit 2 Advanced Dynamic Analysis	Analyse malware with data flow tracking technique	POGIL ( Process Oriented Guided Inquiry Lessons) Project based learning	Lab Exercises Group Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Assignment 2: Present a problem solving scenario that will require Lab	5
Module 4: Unit 1 Anti-disassembly	Identify and overcome common anti-disassembly techniques	Problem Solving Scenarios, Project Based Learning (PBL)	Group Project	Laptops Internet Mobile Devices Instructional videos Virtual Machine Course materials and further reading Discussion forum	Lab exercise Short answer questions	5
Module 4: Unit 2 Anti-debugging	Identify and overcome common anti-debugging techniques	Problem Solving Scenarios, Project Based Learning (PBL) Reality of Pedagogy	Group Project	Laptops Internet Mobile Devices Instructional videos Virtual Machine Course materials and further reading Discussion forum	Assignment 3: This should be problem solving to cover the module	5

## Course Information

Course Code:	CST902
Course Title:	Digital Forensics and Incident Response
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blurb:	This course presents the evolution of digital forensics with emphasis on investigative methods and models, peculiarities of Windows, Linux and Mac OS, guidelines and standards of digital forensics, cloud computing forensics, open source intelligence techniques for digital forensics, and digital forensics of emerging technologies such smart devices, virtual reality and social media.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- Perform Forensic Analysis of Data, Systems and Network

## Course Objectives

- To conduct forensic investigations on digital devices that conform to accepted professional standards and are based on the investigative process.

## **Modules and Units**

Module 1: Fundamentals Digital Forensics

Unit 1: Overview of Digital Forensics

Unit 2: Investigative Methods and Processes

Module 2: Operating Systems

Unit 1: Windows Forensics

Unit 2: Linux Forensics

Unit 3: Mac Forensics

Module 3: Advanced Forensics

Unit 1: File system Forensics

Unit 2: Network Forensics

Unit 3: Cloud Forensics

Unit 4: Web browser Forensics

Unit 5: Mobile Forensics

Unit 6: Social Media Forensics

Module 4: Incidence Management

Unit 1: Incidence Handling

Unit 2: Incidence Response

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 1 Overview of Digital Forensics	Evaluate the concept of digital forensics and apply it to an investigation	<ul style="list-style-type: none"> <li>• POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>• Problem Solving Scenario</li> <li>• Case Studies</li> </ul>	Group discussions.	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading Discussion forum	Self-Assessment - Create two	7
Module 1: Unit 2 Investigative methods and processes	Demonstrate various digital investigative methods for live and dead systems	<ul style="list-style-type: none"> <li>• POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>• Problem Solving Scenario</li> <li>• Case Studies</li> </ul>	Lab Exercise	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Course materials and further reading	Self-Assessment	7
Module 2: Unit 1 Windows Forensics	Investigate Windows system to identify, acquire and analyse evidence that can be used in the court of law	<ul style="list-style-type: none"> <li>• POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>• Project based learning</li> </ul>	<ul style="list-style-type: none"> <li>• Lab Exercise</li> <li>• Group Project</li> </ul>	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Digital forensics tools Course materials and further reading	Lab exercise and Short answer questions	7
Module 2: Unit Linux Forensics	<ul style="list-style-type: none"> <li>• Investigate a Linux system to identify, acquire and analyse evidence that can be used in the court of law.</li> <li>• Create a Linux forensic workstation</li> </ul>	<ul style="list-style-type: none"> <li>• POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>• Project based learning</li> </ul>	Lab Exercise Individual Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Digital forensic tools Course materials and further reading	Lab exercise Short answer questions	7
Module 2: Unit 3	<ul style="list-style-type: none"> <li>• Investigate a Linux system to identify, acquire and analyse</li> </ul>	<ul style="list-style-type: none"> <li>• POGIL ( Process Oriented Guided Inquiry Lessons)</li> </ul>	Lab Exercise	Laptop, Internet, Mobile devices	Assignment 1: will involve Lab work followed	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Mac Forensics	evidence that can be used in the court of law.	<ul style="list-style-type: none"> <li>Problem Solving Scenario</li> </ul>		Instructional videos Virtual Machine Digital forensic tools Course materials and further reading	with questions. It will be such that will solve a real life problem	
Module 3: Unit 1 File system Forensics	<ul style="list-style-type: none"> <li>Identify common filesystems used by Windows, Linux and Mac using file signatures</li> <li>Demonstrate the structures of the common filesystems</li> </ul>	<ul style="list-style-type: none"> <li>POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>Problem Solving Scenario</li> </ul>	Lab Exercises	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Digital forensic tools Course materials and further reading	Lab exercise and Short answer questions	7
Module 3: Unit 2 Network Forensics	<ul style="list-style-type: none"> <li>Acquire and analyse data from network devices</li> <li>Analyse data packets</li> </ul>	<ul style="list-style-type: none"> <li>POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>Problem Solving Scenario</li> </ul>	Lab Exercises	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Digital forensic tools Course materials and further reading	Lab exercise and Short answer questions	7
Module 3: Unit 3 Cloud Forensics	<ul style="list-style-type: none"> <li>Apply investigative techniques to acquire and analyse evidence from the cloud</li> <li>Write investigative note which can be used by a third party to obtain the same results</li> </ul>	<ul style="list-style-type: none"> <li>POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>Problem Solving Scenario</li> </ul>	Lab Exercises	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Digital forensic tools Course materials and further reading	Lab exercises Formative – Two multiple choice self assesment excercises with feedback.	7
Module 3: Unit 4 Web Browser Forensics	<ul style="list-style-type: none"> <li>Examine common web browsers (Edge, Chrome, Safari and Firefox)</li> </ul>	<ul style="list-style-type: none"> <li>POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>Project Based Learning</li> </ul>	Lab Exercises Group Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine	in-text questions, self-assessment exercises, Lab exercises	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>State the types of evidence that can be acquired from these web browsers</li> </ul>			Digital forensic tools Course materials and further reading		
Module 3: Unit 5 Mobile Forensics	<ul style="list-style-type: none"> <li>Create an image of a mobile device (Android, Windows and Apple)</li> <li>Plan the procedure of acquiring evidence from these devices</li> </ul>	<ul style="list-style-type: none"> <li>POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>Project Based Learning</li> </ul>	Lab Exercises Group Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Digital forensic tools Course materials and further reading	Self-Assessment - (in-text questions, self-assessment exercises) Lab Exercises	7
Module 3: Unit 6 Social Media Forensics	<ul style="list-style-type: none"> <li>Identify the types of evidence that can be acquired from social media applications</li> <li>Analyse evidence from social media applications</li> </ul>	<ul style="list-style-type: none"> <li>POGIL ( Process Oriented Guided Inquiry Lessons)</li> <li>Project Based Learning</li> </ul>	Lab exercises Group Project	Laptop, Internet, Mobile devices Instructional videos Virtual Machine Digital forensic tools Course materials and further reading	Assignment 2: Case study and Lab Exercises	7
Module 4: Unit 1 Incidence Handling	Develop incidence handling action plan to counteract attacks	<ul style="list-style-type: none"> <li>Problem Solving Scenarios,</li> <li>Project Based Learning (PBL),</li> </ul>	Individual Project	Laptops Internet Mobile Devices Instructional videos Discussion forum	Self-Assessment Exercise: Case study with real data from industry	7
Module 4: Unit 2 Incidence Response	Develop incidence response policies based on best practices	<ul style="list-style-type: none"> <li>Problem Solving Scenarios,</li> <li>Project Based Learning (PBL),</li> <li>Reality of Pedagogy.</li> </ul>	Group Project	Laptops Internet Mobile Devices Instructional videos Discussion forum	Assignment 3: Mini Project	7

## Course Information

Course Code:	CST904
Course Title:	Monitoring, Auditing, and Penetration Testing
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blub:	This course examines industry best practices for identifying system vulnerabilities, threats and preventing attacks on organisational level. It includes risk assessment, security assessment, network and perimeter auditing, web application, auditing reporting and penetration testing
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

- To equip students with the skills to expose vulnerabilities in systems and software

## Course Objectives

- To provide practical knowledge and skills for vulnerability assessment and monitoring in order to discover weaknesses in applications and infrastructure
- To provide a solid knowledge of the main issues related to security in modern networked computer systems and IT infrastructure

## **Modules and Units**

### **Module 1: Preparing the Vulnerability Assessment**

- Unit 1: Understanding the Concept of Vulnerability Assessment
- Unit 2: Identify the Objective and Expected Outcome
- Unit 3: Determine the Scope of Vulnerability Assessment
- Unit 4: Prepare an Implementation Plan

### **Module 2: Security and Risk Assessment**

- Unit 1: Developing Impact Chain
- Unit 2: Identify and Selecting Indicators
- Unit 3: Data Acquisition and Management
- Unit 4: Normalization of Indicator Data

### **Module 3: Reporting Vulnerability Assessment**

- Unit 1: Presenting the Outcomes of Vulnerability Assessment
- Unit 2: Applying Vulnerability Assessment for Monitoring

### **Module 4: Auditing and Monitoring**

- Unit 1: Continuous Auditing, Assurance, Monitoring
- Unit 2: Application of Continuous Auditing
- Unit 3: Implementing Continuous Auditing

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module 1: Unit 1 Understanding the Concept of Vulnerability Assessment	Analyse the concept of vulnerability assessment	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise	7
Module 1: Unit 2 Identify the Objective and Expected Outcome	Evaluate objectives and expected outcomes of projects	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise	7
Module 1: Unit 3 Determine the Scope of Vulnerability Assessment	Assess the scope of vulnerability	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise	7
Module 1: Unit 4 Prepare an Implementation Plan	Design and implementation plan	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Assignment 1: Students are to evaluate the content in module 1 in their context	7
Module2: Unit1: Developing Impact Chain	Develop an impact chain for implementation	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise:	7
Module2: Unit 2: Identify and Selecting Indicators	Select indicator for exposure, sensitivity, adaptive capacity and check if indicator is specific enough	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise:	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module2: Unit 3: Data Acquisition and Management	Collect and manage data	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise	7
Module2: Unit4: Normalization of Indicator Data	Determine the scale of measurement and normalize the indicator value, weighting and aggregating of indicator	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise	7
Module3: Unit 1: Presenting the Outcomes of Vulnerability Assessment	Manage vulnerability outcomes presentations	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Students will read, watch video and respond to the activities</li> <li>Forum Discussion</li> </ul>	Generic Resources	Self-Assessment Exercise: Forum Discussion	7
Module3: Unit 2: Applying Vulnerability Assessment for Monitoring	Evaluate the changes in the level of vulnerability overtime	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Assignment 2: Students to comment on five posts on the forum page in Module 3. Give guide on the area of focus for the comment.	7
Module4: Unit 1: Continuous Auditing, Assurance, Monitoring	Apply continuous auditing, assurance and monitoring for effectiveness of risk management and control system	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module4: Unit2: Application of Continuous Auditing	Apply continuous auditing, for effectiveness of risk management and control system	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise	7
Module4: Unit3: Implementing Continuous Auditing	Manage the implementation of continuous auditing	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Based Scenarios</li> </ul>	Students will read, watch video and respond to the activities	Generic Resources	Assignment 3: To evaluate a real-life problem	7

## Course Information

Course Code:	CST906
Course Title:	Cyber Threat Intelligence
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blurb:	This covers intelligence foundation, lifecycle, attack, defense and tools; cyber threat intelligence landscape including tactical, operational and strategic dimensions and threat intelligence maturity model. It includes techniques gathering intelligence, counter intelligence methods and attribution.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Protecting Data at Rest and During Transmission
- Protecting System and Network Infrastructure
- Assessing Software Development Vulnerabilities

## Course Objectives

- Define and explain how Intelligence is used as part of Incident Response
- Describe the elements of cyber threat intelligence and discuss how it is collected, analysed, and used by a variety of consumers.
- Identify and describe the basics of the Intelligence cycle
- Explain the techniques for targeting adversaries

- Examine how intelligence can improve cybersecurity at tactical, operational, and strategic levels, and how it can help stop attacks sooner

## **Modules and Units**

### Module 1: Cyber Threat Intelligence and Requirements

Unit 1: Cyber threat intelligence fundamentals, characteristics and needs

Unit 2: Cyber Threat Intelligence lifecycle

Unit 3: Threat Intelligence Consumers

Unit 4: Cyber Threat Intelligence Requirements

### Module 2: Collecting Cyber Threat Information

Unit 1: Threat Indicators

Unit 2: Threat Data Feeds

Unit 3: Strategic Cyber Threat Intelligence

### Module 3: Analysis and Dissemination of Intelligence

Unit 1: Validation and Prioritization

Unit 2: Interpretation and Analysis

Unit 3: Dissemination of Cyber Threat Intelligence

Unit 4: Using Cyber Threat Intelligence

### Module 4: Implementing an Intelligence Program

Unit 1: Steps for implementing an intelligence program

Unit 2: Cyber Threat Intelligence Partners

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/ Learning Devices	Assessments	Required Hours for Study
Module1:Unit1: Cyber threat intelligence fundamentals, characteristics and needs	Evaluate cyber threat intelligence in areas of needs	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios; and participate in forum discussions	Generic Resources	Self-Assessment exercise and forum	5
Module1:Unit2 Cyber Threat Intelligence lifecycle	Evaluate the lifecycle of cyber threat intelligence	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Self-Assessment exercise	5
Module1:Unit3 Threat Intelligence Consumers	Identify the people and systems using the intelligence and define their needs	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios; and participate in forum discussions	Generic Resources	Self-Assessment exercise and forum	5
Module1:Unit4 Cyber Threat Intelligence Requirements	Describe the information assets that must be protected Examine the value of identifying adversaries	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Assignment 1: Should be problem-based assignment	5
Module2:Unit1 Threat Indicators	Identify entity that indicates the possibility of an attack	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios; and participate in forum discussions	Generic Resources	Self-Assessment exercise and forum	5
Module2: Unit2 Threat Data Feeds	Interpret threat indicators including Cyber threat statistics, reports, and surveys. Identify patterns associated with attacks	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Self-Assessment exercise	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/ Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module2: Unit3: Strategic Cyber Threat Intelligence	Describes the specification of adversaries that may target a given enterprise and the consequence of their attacks	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Self-Assessment exercise	5
Module3: Unit 1: Validation and Prioritization	Examine methods to validate and prioritize threat information	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Self-Assessment exercise	5
Module3: Unit 2: Interpretation and Analysis	Analyse and convert threat information into actionable cyber threat intelligence	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Self-Assessment exercise	5
Module3: Unit 3: Dissemination of Cyber Threat Intelligence	Review the steps involved in preparing intelligence for different stakeholders	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Self-Assessment exercise	5
Module3: Unit4: Using Cyber Threat Intelligence	Explain how intelligence can be used at the tactical, operational, and strategic levels to identify attacks and improve defence	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Assignment 2:	5
Module4: Unit 1: Steps for implementing an intelligence program	Evaluate the steps for intelligence program implementation	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Self-Assessment exercise	5
Module4: Unit 2: Cyber Threat Intelligence Partners	Investigate cyber threat intelligence providers	<ul style="list-style-type: none"> <li>• Problem Solving Scenarios</li> <li>• Case Studies</li> </ul>	Students respond to cases and scenarios	Generic Resources	Assignment 3: Mini Project	5

# Part 3

## Management Information System (MIS) Programmes

## **M.Sc. Management Information System**

**Programme:** M.Sc. Management Information Systems

**Program Competencies:**

1. Demonstrate skills in IT architecture, design and implementation
2. Develop and deploy software that meets the needs of stakeholders
3. Integrate business strategy and technology for an organization
4. Manage the information systems resources for organizations
5. Demonstrate project management and collaboration skills
6. Demonstrate research and knowledge sharing ability in key areas of MIS

**Courses:**

1. MIS801: IT Infrastructure (3 Credit Units)
2. MIS802: Business Continuity and Information Security (3 Credit Units)
3. MIS803 : Enterprise Data Management (3 Credit Units)
4. MIS804 : Data Warehouse and Analytics (2 Credit Units)
5. MIS805 : Enterprise Systems (3 Credit Units)
6. MIS806 : Business Process Analysis and Engineering (2 Credit Units)
7. MIS807 : Innovation Management and Organizational Change (2 Credit Units)
8. MIS808 : Ethics and Society (2 Credit Units)
9. MIS809: IS Strategy Planning and Governance (2 Credit Units)
10. MIS810: Information Systems Management and Operations (2 Credit Units)
11. MIS811: Information Systems Requirements Engineering (2 Credit Units)
12. MIS812 : Systems Development and Deployment (2 Credit Units)

Table 1: Programme Competences (Updated)

Competences	MIS 801	MIS 802	MIS 803	MIS 804	MIS 805	MIS 806	MIS 807	MIS 808	MIS 809	MIS 810	MIS 811	MIS 812	MIS 899
Demonstrate skills in IT architecture, design and implementation	x				x	x							
Develop and deploy software that meets the needs of stakeholders			x	x						x	x	x	
Integrate business strategy and technology for an organization		x					x		x				
Manage the information systems resources for organizations	x		x	x				x		x			
Demonstrate project management and collaboration skills					x		x	x					
Demonstrate research and knowledge sharing ability in key areas of MIS									x				x

## Course Information

Course Code:	MIS801
Course Title:	IT INFRASTRUCTURE
Credit Unit:	3
Course Status:	Core
Course Description/Blub:	This course addresses IT network infrastructure to serve different organizational needs in a rapidly changing competitive and technological environment. Areas to be covered include: designing data communication networks and data centre server solutions, designing infrastructure solutions using external service provider(s) (cloud computing), managing and negotiating infrastructure contracts/SLAs with vendors, selecting appropriate client devices to support the needs of an application area, developing and responding to requests for proposals (RFPs) for infrastructure solutions.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

Development of IT Infrastructure Solutions

## Course Objectives

By the end of this course you will be able to:

- Design integrated communication network for small and medium size organizations including Local Area Networks (LAN) and the use of Wide Area Networks (WAN) technologies to connect the local networks.
- Specify requirement for large scale network solutions

- Design implementation architecture for organizational data processing and systems solutions, using both internal hardware resources and external services solutions.
- Negotiate and enforce contracts/SLAs with providers of IT infrastructure.

## **Modules and Units**

### **Module 1,** Data communication networks

- UNIT1: Fundamentals of Communication Network
- UNIT2: Organization of Data Centre and Server Solution
- UNIT3: Management and Protection Devices and Media
- UNIT4: Network set-up, configuration and Troubleshooting

### **Module 2:** Data Processing Systems

- UNIT1: Data Architecture
- UNIT2: Cloud Computing
- UNIT3: Data storage and retrieval
- UNIT4: Data Engineering

### **Module 3:** Contract Management

- UNIT1: IT Contract
- UNIT2: Managing Infrastructural Risk
- UNIT3: Service Contract Management
- UNIT4: Services Level Agreements and Request for Proposals
- UNIT5: Monitoring and Optimizing Infrastructure Utilization

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1. UNIT1 Fundamentals of Communication Network	<ul style="list-style-type: none"> <li>Demonstrate the knowledge of the components of networks to guide informed decisions</li> <li>Implement a functional firewall.</li> <li>Design different layers of Network Architecture for resource sharing</li> <li>Design and implement the different types of network communications</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> <li>Student respond to promptings that test their ability to identify</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	<ul style="list-style-type: none"> <li>Develop open ended questions from videos</li> </ul> <p>Using Virtual Lab to configure devices</p>	7
Module1 UNIT2 Organization of Data Centre and Server Solution	<ul style="list-style-type: none"> <li>Demonstrate techniques in Data Processing</li> <li>Develop basic Server Application</li> </ul>	<ul style="list-style-type: none"> <li>Student explore real-world problems and challenges on Data processing</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> <li>Student watch videos on Server Preparation</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	<ul style="list-style-type: none"> <li>Develop open ended questions from videos</li> </ul> <p>Using Virtual Lab to configure devices</p>	<ul style="list-style-type: none"> <li>7</li> </ul>
Module1 UNIT3 Management and Protection of Devices and Media	<ul style="list-style-type: none"> <li>Analyse the choice of devices</li> <li>Terminate all forms of media</li> <li>Install and secure Different media types</li> <li>Implement Security on devices</li> </ul>	<ul style="list-style-type: none"> <li>Student will be given a role in class</li> <li>Assign text to student</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> <li>Student watch videos on Server Preparation</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	<ul style="list-style-type: none"> <li>Use Animation to map out Devices to the type of media</li> </ul> <p>Using Virtual Lab to implement security on devices</p>	<ul style="list-style-type: none"> <li>7</li> </ul>

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module1: UNIT4: Network set-up, configuration and Trouble-Shooting	<ul style="list-style-type: none"> <li>Identify and choose appropriate network devices to create solutions</li> <li>Terminate different media types</li> <li>Configure devices and establish connectivity among them</li> <li>Correct errors during configuration</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> <li>Student watch videos on network set-up</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	Assignment 1: Students are given guideline to review three forum posts	<ul style="list-style-type: none"> <li>7</li> </ul>
Module 2: UNIT 1 Data Architecture	<ul style="list-style-type: none"> <li>Build a simple database solution for small enterprises</li> <li>Create a blueprint for managing a small database</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	Student watch video on database development	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	<ul style="list-style-type: none"> <li>Student participates in forum</li> <li>Student reviews commands</li> </ul>	<ul style="list-style-type: none"> <li>7</li> </ul>
Module 2 UNIT2: Cloud Computing	Develop and deploy propriety network to supply hosted services	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	Student watch video on cloud development	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	Self-Assessment Exercise: 5 Multiple Choice	7
Module 2 Unit3: Data storage and retrieval	Select storage devices for deployment	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	Self-Assessment Exercise: 5 Multiple Choice	7
Module 2 Unit4: Data Engineering	<ul style="list-style-type: none"> <li>Demonstrate Data Modelling techniques</li> <li>Demonstrate Database clustering tools techniques</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> <li>Student respond to promptings</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	Assignment 2: should be problem solving	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Implement ETL design</li> </ul>		that test their ability to identify			
Module 3: Unit1: IT Contract	<ul style="list-style-type: none"> <li>Specify the requirement of a service contract</li> <li>Asses contract success</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> <li>Student respond to promptings that test their ability to identify</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	Self-Assessment Exercise: 5 Multiple Choice	7
Module 3 Unit2: Managing Infrastructural Risk	<ul style="list-style-type: none"> <li>Recognize threats on IT systems</li> <li>Asses threats on IT systems</li> <li>Mitigate threats on IT systems</li> <li>Develop response plan on threats identified</li> <li>Review risk procedure</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	<ul style="list-style-type: none"> <li>Student read through the text</li> <li>Student respond to promptings that test their ability to identify</li> </ul>	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	Self-Assessment Exercise: 5 Multiple Choice	7
Module 3 Unit3: Service Contract Management	<ul style="list-style-type: none"> <li>Develop a Service Contract Agreement</li> <li>Manage Contract Lifecycle</li> <li>Demonstrate basic contract risk assessment techniques</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	Students read the text, watch videos and respond to the activities	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> </ul>	Self-Assessment Exercise: 5 Multiple Choice	7
Module 3, Unit4: Services Level Agreements and Request for Proposals	<ul style="list-style-type: none"> <li>Write a basic Service Level Agreement</li> <li>Differentiate between KPI and SLA</li> <li>Explain the purpose of SLA</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	Students read the text, watch videos and respond to the activities	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops</li> <li>Tablets</li> <li>Online</li> </ul>	Self-Assessment Exercise: 5 Multiple Choice	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Write a Request for Proposal</li> <li>Differentiate between Request for Information RFI, Request for Proposal RFP and Request for Quotation RFQ</li> <li>Use RFP</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>		<ul style="list-style-type: none"> <li></li> </ul>		
Module3 Unit5: Monitoring and Optimizing Infrastructure Utilization	<ul style="list-style-type: none"> <li>Use resource monitoring applications effectively</li> <li>Interpret Data from monitoring</li> <li>Defend the state and functionality monitored resource.</li> </ul>	<ul style="list-style-type: none"> <li>Assign text to student</li> <li>Present Animations to Student</li> </ul>	Students read the text, watch videos and respond to the activities	<ul style="list-style-type: none"> <li>Online</li> <li>Instructional Videos</li> <li>Laptops Tablets</li> </ul>	Assignment 3: Mini Project	7

## Course Information

Course Code:	MIS802
Course Title:	Business Continuity & Information Security
Credit Unit:	3
Course Status:	
Course Description/Blub:	This course addresses the issues relating to Business Continuity planning, auditing and Information Security Management. Areas to be covered include network and software security management practices, managing systems risk and recovery, monitoring and protecting systems operations and IT assets, implementing and managing quality audit processes and assuring safety throughout system lifecycle.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	91

## Course Core Competencies

Business Continuity and Information Assurance

## Course Objectives

By the end of this course, you would have learnt how to:

- Create policies and standards for business continuity and information security
- Set information security roles and responsibilities throughout your organization.
- Implement an end-to-end business continuity plan for a system
- Analyse and manage your organizational risks
- Plan and implement procedures and technologies for managing risks, security and safety for business continuity and disaster recovery.
- Implement and classify protection practices for data and IT Assets

- Implement and manage audit processes for information assurance in an organization

## **Modules and Units**

Module 1: Network and Software security management practices

UNIT 1: Fundamental principles of information security

UNIT 2: Software security management planning, roles and responsibilities

UNIT 3: Security Policies, Standards, Guidelines, and Procedures

MODULE 2: Managing systems risk and recovery

UNIT 1: Risk Analysis and management

UNIT 2: Business Continuity planning and Disaster recovery planning

UNIT 3: Disaster Recovery principles, practices and business continuity management

MODULE 3: Monitoring and Protecting Systems Operations and IT Assets

UNIT 1: IT Asset Management (ITAM) processes and tools,

UNIT 2: IT Asset Management (ITAM) best practices and checklists for management and operation teams

UNIT 3: Classifying Assets for continuous system monitoring

MODULE 4: Implementing and Managing Quality Audit Processes

UNIT 1: Quality Audit Processes and Standards - ISO 9000

UNIT 2: Implementing Quality Management System (QMS) Audit

MODULE 5: System Lifecycle Assurance

UNIT 1: System assurance ecosystem, activities and processes

UNIT 2: System and Safety Requirements of a System

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE 1 UNIT 1 Fundamental Principles of Information Security	<ul style="list-style-type: none"> <li>Identify the principles of information security</li> <li>Use the different principles to create a managed security program</li> <li>Develop ideas on how to manage information security program</li> <li>Minimize organisational damage by using different recovery methods</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL) <ul style="list-style-type: none"> <li>Present the unit in the course material with in-text questions and self-assessment exercises</li> </ul> </li> <li>Scenario -based simulations</li> <li>Case Study method</li> </ul>	<ul style="list-style-type: none"> <li>Read the provided course materials and further readings</li> <li>Respond to the scenario and case study</li> </ul>	<ul style="list-style-type: none"> <li>Develop a scenario-based video that will demonstrate an organization working towards managing an information security program.</li> <li>Laptops, tablet, mobile device</li> </ul>	<ul style="list-style-type: none"> <li>In-test questions</li> <li>Use scenario and case study for self - assessment exercises followed with feedback</li> </ul>	7
MODULE I UNIT 2 Software Security Management Planning, Roles and Responsibilities	<ul style="list-style-type: none"> <li>Create awareness on how to prepare for creating information security policies</li> <li>Explain the active role managers take in setting and supporting the information security environment</li> <li>Manage organizational assets- including private and public</li> </ul>	<ul style="list-style-type: none"> <li>POGIL</li> <li>Scenario. Based simulation</li> <li>Case Study method</li> </ul>	<ul style="list-style-type: none"> <li>Read course materials</li> <li>Watch demonstration video</li> <li>Use POGIL for In-test questions</li> </ul>	<ul style="list-style-type: none"> <li>Develop a case study that requires the students to answer questions on how to set roles and responsibilities for and organisation.</li> <li>Develop a scenario-based video or slides will prepare them to create information security policies and protect organizational assets.</li> </ul> <p>Laptops, tablets, mobile devices</p>	<ul style="list-style-type: none"> <li>CBT</li> <li>Use scenario and case study for self-assessment exercises followed with feedback</li> </ul>	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	proprietary information <ul style="list-style-type: none"> <li>manage information security roles and responsibilities throughout your organization</li> </ul>					
MODULE 1 UNIT 3 Security Policies, Standards, Guidelines, and Procedures	<ul style="list-style-type: none"> <li>Develop security policies for an information security program</li> <li>Develop standards and guidelines that will be used throughout an organization to maintain security posture</li> <li>create procedures that transform and implement the policies into actionable tasks</li> </ul>	<ul style="list-style-type: none"> <li>Case study method</li> <li>Problem solving scenarios</li> <li>Cooperative Learning (Teamwork)</li> </ul>	<ul style="list-style-type: none"> <li>Collaboration and team work on deriving standards and guidelines</li> <li>Group work with consideration to time zone</li> <li>Read course materials</li> </ul>	<ul style="list-style-type: none"> <li>Forum page within the LMS to collaborate on group work for deriving standard and guidelines and setting policies.</li> <li>Given the problem-solving scenarios, make available Video conferencing for group members to participate in group meetings</li> <li>Develop a case study video or slides to allow the students create procedures that implement the policies.</li> </ul>	Assignment 1: - Group project to be presented on the forum page	7
MODULE 2 UNIT 1 Risk Analysis, Assessment and management	<ul style="list-style-type: none"> <li>Analyse organizational risks</li> <li>Classify different risks scenarios and their effect in an organisation</li> </ul>		Students read the material, watch the video and do the activities	Generic Resources	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	(business, financial, operational) <ul style="list-style-type: none"> <li>Design a risk management program for a business organization.</li> <li>Use qualitative and quantitative risk assessment methods;</li> </ul>					
MODULE 2 UNIT 2 Business Continuity planning and Disaster Recovery Planning	<ul style="list-style-type: none"> <li>Explain the process, principles and terminology of business continuity management (BCM).</li> <li>Use the business continuity planning process to develop a completed, customised business continuity plan</li> <li>Implement an end-to-end Business Continuity plan to prevent, prepare for, respond to, manage, and recover from the impacts of an</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>POGIL</li> <li>Scenario based</li> </ul>	Students read the material, watch the video and do the activities	Generic Resources	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	incident or disruptive event <ul style="list-style-type: none"> <li>Distinguish between how to develop a business continuity plan and a disaster recovery plan</li> <li>Develop a Recovery Framework and Plan for a specific case study.</li> </ul>					
MODULE 2 UNIT 3 Disaster Recovery Techniques, Principles and Practices	<ul style="list-style-type: none"> <li>Implement the techniques needed in carrying out a disaster recovery plan</li> <li>Describe and operationalise Recovery Guiding Principles.</li> <li>Apply concepts, standards, principles, and methods of recovery planning and operations to case studies</li> <li>Perform the data recovery plans for lost data after any type of disasters</li> </ul>	<ul style="list-style-type: none"> <li>POGIL – Inquiry or skills based with emphasis on analytical skills</li> <li>problem solving Scenario</li> <li>Case Study Analysis – Review of previous practice and guided analysis of specific aspects of a case</li> </ul>	<ul style="list-style-type: none"> <li>Demonstration Videos – Guided with a set of questions or an exercise that follows</li> <li>Seminars – Self-directed by students and guided and mentored by tutors               <ul style="list-style-type: none"> <li>Read course materials</li> </ul> </li> <li>Use POGIL for in-test questions</li> </ul>	Develop a case study or scenario document that demonstrates an organization who just encountered a disaster to allow them to practise the disaster recovery plan that was created.	Assignment 2: <ul style="list-style-type: none"> <li>Use Case study and problem-solving scenario for self-assessment</li> <li>Presentation Slides for assessment</li> </ul>	<ul style="list-style-type: none"> <li>7</li> </ul>

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE3: UNIT 1 IT Asset Management (ITAM) processes, tools, Best practices and checklists for management and operation teams	<ul style="list-style-type: none"> <li>Define the functions of IT Asset Management (ITAM) in supporting ITAsset life cycle management and strategic decision making for the IT environment.</li> <li>Use the right ITAM tools to automate manual process and monitor the real state of all technological resource (IT Asset) in an organisation.</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students read the material, watch the video and do the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 3 UNIT 2 IT Asset Management (ITAM) Best Practices and Checklists for Management and Operation Teams	<ul style="list-style-type: none"> <li>Implement the best practices that are already in place to perform an ITAM function in the organization</li> <li>Use the checklists for managing and auditing an IT Asset</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students read the material, watch the video and do the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 3 UNIT 3 Classifying Assets for continuous	<ul style="list-style-type: none"> <li>Explain concept of continuous security monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students read the material, watch the video and do the activities	Generic Resources	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
security monitoring	<ul style="list-style-type: none"> <li>Discuss continuous security monitoring of an Asset.</li> <li>Classify assets within the organisation</li> <li>Organise IT Assets requirements for continuous security monitoring</li> </ul>					
MODULE 4 UNIT 1 Quality Audit Processes and Standards - ISO 9000	<ul style="list-style-type: none"> <li>Identify ISO 9000 and other related standards</li> <li>Plan and conduct comprehensive and consistent audits,</li> <li>appraise processes in achieving business objectives</li> <li>Audit internal processes for effectiveness and efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Reality of Pedagogy</li> <li>POGIL</li> <li>Cooperative Learning (Team exercises)</li> <li>Case Study</li> </ul>	<ul style="list-style-type: none"> <li>Workshops</li> <li>Group work with consideration to time zone</li> <li>Read course materials</li> <li>Respond to case study on auditing internal processes.</li> <li>Watch video</li> </ul>	Develop audio-visual presentations using the ISO standards	<ul style="list-style-type: none"> <li>Quizzes- POGIL with multiple choice questions.</li> </ul> <p>Group projects or team-based assignments</p>	<ul style="list-style-type: none"> <li>7</li> </ul>
MODUL 4 UNIT 2 Implementing Quality Management	<ul style="list-style-type: none"> <li>Organise workstation using QMS</li> <li>identify the basics of performing</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Watch a demonstration video of how QMS works	Develop a video demonstrating how QMS works	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
System (QMS) Audit – ISO 9001	internal audits of a QMS <ul style="list-style-type: none"> <li>• Create and implement a QMS in the organisation</li> <li>• Wire and audit Report</li> </ul>					
MODULE 5 UNIT 1 System assurance Lifecycle, ecosystem, activities and processes	<ul style="list-style-type: none"> <li>• Use some concepts and approaches like CLASS in enhancement of system safety.</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students read the material, watch the video and do the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 5 UNIT 2 System and Safety Requirements of a System	<ul style="list-style-type: none"> <li>• Design and develop system safety requirements</li> <li>• Use the system safety requirements to design for safety in a system</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students read the material, watch the video and do the activities	Generic Resources	Assignment 3	7

## Course Information

Course Code:	MIS803
Course Title:	Enterprise Data Management
Credit Unit:	3
Course Status:	
Course Description/Blub:	This course addresses key data and information concepts. Areas to be covered include: Data and information management lifecycle, Conceptual modelling techniques for capturing and structuring data and information requirements, Logical level representation of data based on a conceptual model, implementing a database solution for multiple applications, and use of contemporary data manipulation, retrieval and management technologies. Other areas include use of appropriate techniques/technologies for securing data, protecting user privacy and organizational intellectual property.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	96

## Course Core Competencies

Data and Content Management

## Course Objectives

By the end of this course, the student will be able to:

1. Identify data and information management technology alternatives and manage flow of an information system's data throughout its life cycle.
2. Demonstrate how to use appropriate conceptual modelling techniques to capture and structure data and information requirements.

3. Design and implement relational database solutions that are used to manage multiple operational systems
4. Demonstrate the ability to use contemporary data manipulation, retrieval and management technologies
5. Demonstrate how to use appropriate techniques for securing data, protecting user privacy and organizational intellectual property

## **Modules and Units**

### **Module 1: Data and Information Lifecycle Management**

- UNIT 1: Data Lifecycle Management (DLM) Vs. Information Lifecycle Management (ILM)
- UNIT 2: Data Lifecycle stages and best practices
- UNIT 3: Managing data and information throughout its lifecycle

### **MODULE 2: Data Modelling**

- UNIT 1: Data modelling Concepts: types, roles and attributes
- UNIT 2: Conceptual, Logical and Physical modelling techniques
- UNIT 3: Creating a database model for business applications

### **MODULE 3: Database Design**

- UNIT 1: Database design concepts
- UNIT 2: Logical and Relational Database Design
- UNIT 3: Implementing Database solution for multiple operational systems

### **MODULE 4: Database Management Systems**

- UNIT 1: Principles and Fundamentals of database management systems
- UNIT 2: Data manipulation Language (DML)

### **MODULE 5: Data and User Protection Privacy**

- UNIT 1: Data Privacy vs Data Protection
- UNIT 2: Protecting User Privacy

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE 1 UNIT1 Data Lifecycle Management (DLM) Vs. Information Lifecycle Management (ILM)	<ul style="list-style-type: none"> <li>Explain the history of DLM and ILM</li> <li>Distinguish between DLM and ILM strategies</li> <li>Create a DLM strategy to manage and coordinate the different lifecycles in your information and data management infrastructure.</li> </ul>	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 1 UNIT 2 Data Lifecycle stages and best practices	<ul style="list-style-type: none"> <li>Explain the different data lifecycles and their stages.</li> <li>Identify the type of data lifecycle that fit best into the management of an organisation's data</li> <li>Manage the stages in data lifecycle</li> </ul>	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 1 UNIT 3 Managing data and information throughout its lifecycle	<ul style="list-style-type: none"> <li>Create an ILM solution that allows an organisation manage data through its lifecycle.</li> <li>Use strategies that Manage structured and unstructured data throughout its lifecycle.</li> </ul>	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Assignment 1: Contextual survey on information lifecycle and stages in data lifecycle	7
MODULE 2 UNIT 1 Data modelling Concepts: overview, workflow and tools	<ul style="list-style-type: none"> <li>Demonstrate the ability to gather business requirements by analysing the data needed by the business requirements and Identifying data relationships.</li> <li>Apply data model tools to simplify and speed up the</li> </ul>	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	creation of Database designs and to minimize human errors. • Apply the different types of data models in a project					
MODULE 2 UNIT 2 Data modelling types: Conceptual, Logical and Physical modelling techniques	• State the purpose for creating the different data model types. Design and develop the different levels of data models: conceptual models, logical and physical model before building a database.	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 2 UNIT 3 Creating a database model for business applications	Create a typical database model using case studies.	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 3 UNIT 1 Database design concepts	• Design a database. • Use CASE Tools for Database Design	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 3 UNIT 2 Database Design Phases: Logical and Relational Database Design	• Design logical database • Distinguish relational databases from other data base • Design a logical database using real examples • Use basic SQL and Use SQL to Implement a Relational Design	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 3 UNIT 3 Implementing Database solution	Implement a relational database design or solution for multiple applications.	Case Studies and Problem	Students read the text, watch videos and	Generic Resources	Assignment 2: To review two Case Studies	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
for multiple operational systems		Solving Scenario	respond to the activities			
MODULE 4 UNIT 1 Principles and Fundamentals of database management systems	<ul style="list-style-type: none"> <li>Manage data</li> <li>Use security measures for protecting the data within a database system.</li> </ul>	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 4 UNIT 2 Data manipulation Language (DML)	<ul style="list-style-type: none"> <li>Demonstrate the access, retrieval and manipulation of data using the data manipulation languages</li> <li>Use SQL DML commands to manipulate and query data in the database</li> </ul>	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 5 UNIT 1 Data Privacy vs Data Protection- Protecting user privacy	Solve problems relating to legal and ethical aspects of personal data protection.	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Self-Assessment Exercise	7
MODULE 5 UNIT 2 Data Privacy protection in Nigeria	Use Nigeria law on data privacy protection to project and secure data	Case Studies and Problem Solving Scenario	Students read the text, watch videos and respond to the activities	Generic Resources	Assignment 3: Mini project and presentation through video conferencing	7

## Course Information

Course Code:	MIS804
Course Title:	Data Warehousing and Analytics
Course Unit:	2 Credit Units
Course Status:	
Course Description/Blub:	This course addresses data warehousing and data analytics concepts. Areas to be covered include: contemporary architectures for designing and implementing data warehouses, enterprise data warehouse, creating information architecture for organizations, data collection and method selection for big data analytics, designing and implementing architectures for organizational content management systems.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration;	13 weeks
Required Hours of Study:	65

## Course Core Competencies:

Data and Content Management

## Course Objectives

By the end of this course, you will be able to:

- Identify data and information management technology alternatives.
- Manage appropriate IS from the identified alternatives based on the organizational information needs.
- Manage organizational policies and processes related to data and information management
- Analyze the needs of an organization and determine how those needs can best be addressed with different data, information, and content management solutions.

## **Modules and Units**

Module 1: Designing and implementing architectures for organizational content management systems.

UNIT 1: Architecture of modern Content Management Systems

UNIT 2: Information structures and navigational patterns

UNIT 3: Enterprise Content Management Systems

MODULE 2: Contemporary architectures for designing and implementing data warehouses

UNIT 1: Concepts of Data Warehousing

UNIT 2: Typical Data Warehouse Architecture

UNIT 3: Common Architectures of Data Warehouses and Information Flow

UNIT 4: Data Warehouse Modelling and Applications

MODULE 3: Enterprise Data Warehouse Systems

UNIT 1: Enterprise Data Warehouse

UNIT 2: OLAP, OLTP and other Data Warehouse Terminologies

MODULE 4: Data selection methodologies and Quality issues

UNIT 1: Challenges to Data Warehousing

UNIT 2: Ensuring Data Quality and Performance in Data Warehouse

MODULE 5: Multi-dimensional organizational policies, processes and requirements

UNIT 1: Legal and Regulatory requirements for management and use of data

UNIT 2: Ethical considerations and implications of technology decisions

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
MODULE 1 UNIT 1 Architecture of modern Content Management Systems (CMS)	<ul style="list-style-type: none"> <li>Describe various architectures of CMS</li> <li>Design system for quality assurance in CMS</li> <li>Select an appropriate CMS for organizational use based on underlying architecture</li> <li>Use the knowledge to knowledge for designing, planning, implementing and evaluating CMS.</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 1 UNIT 2 Information structures and navigational patterns	<ul style="list-style-type: none"> <li>Structure information with the use of navigational patterns.</li> <li>Develop ideas on how to manage connection between web systems and CMS</li> <li>Solve problems relating to CMS</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 1 UNIT 3 Enterprise Content Management Systems (ECMS)	Manage typical enterprise content management systems	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Assignment 1: Students to respond to real life scenario	5
MODULE 2 UNIT 1 Concepts of Data Warehousing	Justify the use of data warehousing in technology	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
MODULE 2 UNIT 2 Typical Data Warehouse Architecture	Manage architecture data warehouse	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 2 UNIT 3 Common Architectures of Data Warehouses and Information Flow	Manage the architectures of data warehouses and information flow	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 2 UNIT 4 Data Warehouse Modelling and Applications	Manage data warehouse across different sectors e.g. retail, finance, healthcare, government, etc.	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 3 UNIT 1 Enterprise Data Warehouse	<ul style="list-style-type: none"> <li>• Support enterprise-wide business needs of organizations</li> <li>• Evaluate an organization for data warehouse maturity and business architecture alignment</li> <li>• Perform operations on pivot tables to satisfy typical business analysis requests using prominent open source software</li> </ul>	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 3 UNIT 2 OLAP, OLTP and other Data	<ul style="list-style-type: none"> <li>• Categorise software tools which provide analysis of data for business decisions</li> </ul>	<ul style="list-style-type: none"> <li>• Scaffolding</li> <li>• Case Studies</li> </ul>	Students study the text, watch the video and	Generic Resources	Assignment 2: Students to	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Warehouse Terminologies	<ul style="list-style-type: none"> <li>Use the online transactional system, techniques and tools for managing any modification in a data warehouse.</li> <li>use data warehouse terminologies like data store, data mart, design schema, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> </ul>	respond to the activities		respond to two case studies	
MODULE 4 UNIT 1 Challenges to Data Warehousing	Manage challenges to data warehousing	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 4 UNIT 2 Ensuring Data Quality and Performance in Data Warehouse	Evaluate data warehouse to ensure quality and performance	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 5 UNIT 1 Legal and Regulatory requirements for management and use of data	Apply legal and regulatory procedure to manage and use of data	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple Choice Questions	5
MODULE 5 UNIT 2 Ethical considerations and implications of technology decisions	Justify the use of ethical considerations in technology decisions	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> </ul>	Students study the text, watch the video and respond to the activities	Generic Resources	Assignment 3: Mini project	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> </ul>				

## Course Information

Course Code: MIS805  
Course Title: Enterprise Systems  
Credit Unit: 3  
Course Status: Core  
Course Description/Blub: This course addresses the systematic understanding and knowledge of enterprise systems principles management. Areas to be covered include: Introduction to business functions, processes and data requirements within an enterprise, Enterprise wide IT systems, Managing Enterprise through ERP. ERP concepts, techniques, tools, selection and implementation issues. Other areas include SAP based hands-on case studies.

Basic Requirements:  
Academic Year: 2020  
Semester: First  
Course Duration: 13 weeks  
Required Hours for Study: 91

## Course Core Competencies

Enterprise Architecture

## Course Objectives

By the end of this course you will be able to:

1. Design enterprise architecture (EA)
2. Deploy and maintain an EA

## **Modules and Units**

### **MODULE I:** Enterprise IT Design

- UNIT1: Enterprise Lifecycle
- UNIT2: Enterprise Architecture development
- UNIT3: Multistage Process of Enterprise System
- UNIT4: Requirement Engineering

### **MODULE II:** Enterprise integrating

- UNIT1: Application Integration
- UNIT2: Business process integration
- UNIT3: Enterprise Modeling
  
- UNIT4: Integration and Process Improvement

### **MODULE III:** Enterprise Deployment

- UNIT1: Enterprise Software Deployment
- UNIT2: Software Platforms and Infrastructure as a service
- UNIT3: Cloud Computing
- UNIT4: Enterprise Systems Security
- UNIT5: Systems Maintenance

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE 1 UNIT1 Enterprise Life-Cycle	Evaluate the life cycle of enterprise systems	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> </ul>	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE 1 UNIT2: Enterprise Architecture development	<ul style="list-style-type: none"> <li>Identify the approach to Enterprise Systems development</li> <li>Apply a formal approach draw up an Architecture</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> </ul>	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE 1 UNIT3: Multistage Process of Enterprise System	<ul style="list-style-type: none"> <li>Incorporate Information in Enterprise Architecture Development</li> <li>Incorporate domain activity processes</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> </ul>	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE 1 UNIT4: Requirement Engineering	<ul style="list-style-type: none"> <li>Identify requirements in Systems Development Architecture</li> <li>Developing Requirement Specification</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> </ul>	Students study the content, watch the video and respond to the activities	Generic Resources	Assignment 1: Questions drawn from contextual issues	7
MODULE 2 UNIT1: Application Integration	<ul style="list-style-type: none"> <li>Evaluate the role of Integration Architecture</li> <li>Identify Middle ware framework</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> </ul>	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE 2 UNIT2:	<ul style="list-style-type: none"> <li>Evaluate and focus on efficient execution of processes.</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Case Studies</li> </ul>	Students study the content, watch the video	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Business process integration	<ul style="list-style-type: none"> <li>Empower Business process users</li> </ul>		and respond to the activities			
MODULE 2 UNIT3: Enterprise Modelling	<ul style="list-style-type: none"> <li>Represent and describe structures and processes</li> <li>Improve performance through creation and analysis of enterprise models</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenario</li> </ul>	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE 2 UNIT4: Integration and Process Improvement	<ul style="list-style-type: none"> <li>Eliminate waste as a sustainable data integration practice</li> <li>Design a model in enterprise architecture</li> </ul>	Problem Solving Scenario	Students study the content, watch the video and respond to the activities	Generic Resources	Assignment 2: Review of two Case studies. It could be grouped. This is followed with narrated PowerPoint presentation	7
MODULE 3 UNIT1: Enterprise Software Deployment	Evaluate all activities that takes place to make software application available to end user	Case Studies	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE3 UNIT2: Software Platforms and Infrastructure as a service	Develop, run, and manage applications without the complexity of building and maintaining the infrastructure	Problem Solving Scenario	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE 3 UNIT3: Cloud Computing	<ul style="list-style-type: none"> <li>Develop a cloud computing solution</li> <li>Demonstrate how cloud computing minimize IT infrastructure cost</li> </ul>	Problem solving Scenario	Students study the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7
MODULE 3 UNIT4:	<ul style="list-style-type: none"> <li>Evaluate Information security in a historic context</li> </ul>	Case Studies	Students study the content, watch the video	Generic Resources	Self-Assessment Exercise: 5 Multiple choice questions	7

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Enterprise Systems Security	<ul style="list-style-type: none"> <li>Demonstrate methods of assessing vulnerability and risk</li> </ul>		and respond to the activities			
MODULE 3 UNIT5: Systems Maintenance	<ul style="list-style-type: none"> <li>Evaluate whether Information System is effective and efficient</li> <li>Demonstrate the activities that make desired improvement on Enterprise systems</li> </ul>	Case Studies	Students study the content, watch the video and respond to the activities	Generic Resources	Assignment 3: Mini project	7

## Course Information

Course Code:	MIS806
Course Title:	Business Process Analysis and Engineering
Credit Unit:	2
Course Status:	
Course Description/Blub:	This course addresses business processes management and improvement. Areas to be covered include concepts and methods in business process management (e.g. lean & six sigma process), business process models and charts, business process reengineering and improvement cases
Basic Requirements:	
Academic Year:	2020
Semester:	
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

### Course Objectives

By the end of this course, the student will be able to:

- Manage business process analysis and reengineering
- Apply various business process models and charts in Business process analysis

## **Modules and Units**

### **Module 1: Business Processes Management**

UNIT 1: Key concepts in Business Process Management

UNIT 2: Business Process Management Tools

UNIT 3: Business Process Management Lifecycle

UNIT 4: Business Process Management Types

### **MODULE 2: Business Process Models and Charts**

UNIT 1: Basic concepts and application of business process models

UNIT 2: Business Process Modelling techniques

UNIT 3: Business Process Workflows

### **MODULE 3: Business Process Reengineering**

UNIT 1: Business Process Reengineering Lifecycle

UNIT 2: Process Management & Improvement

UNIT 3: Business Process Measurement

UNIT 4: Business Process Benchmarking

UNIT 5: Business Process Design Frameworks

UNIT 6: Business Process Measurement

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE 1 UNIT1 Key concepts in Business Process Management	Evaluate Business Process Management	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 1 UNIT 2 Business Process Management Techniques	Appraise different business management techniques	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 1 UNIT 3 Business Process Management Lifecycle	Assess business process management lifecycle	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 1 UNIT 4 Business Process Management Types and Incorporation	Solve real life problem using business process and incorporation	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources and Forum on a topic that will allow the students share their experience	Assignment 1: Review of three posts on the discussion page	5
MODULE 2 UNIT 1 Basic Concepts & Application of Business Process Models	Evaluate the quality of a business and its success	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 2 UNIT 2 Business Process Modelling Methods	Create typical Unified Modelling Language and Business Process Model and Notation	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
MODULE 2 UNIT 3 Business Process Workflows	Illustrate partial automation of business processes	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Assignment 2: Review of two case Studies and one Scenarios with support from what the student has learnt	5
MODULE 3 UNIT 1 Business Process Reengineering Lifecycle	<ul style="list-style-type: none"> <li>Map two different states of the business process: As-is, the state of the process as it is right now, without making any changes or improvements, and To-be, the future state, after making the changes or improvements</li> </ul>	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 3 UNIT 2 Process Management & Improvement	<ul style="list-style-type: none"> <li>Compare Evolutionary Change with Revolutionary Change</li> <li>Use the process management and improvement tools including Six Sigma, Total Quality Management (TQM) etc. and their difference with BPR</li> </ul>	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 3 UNIT 3 Business Process Measurement	Choose a process model that will enhance business process management	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
MODULE 3 UNIT 4 Business Process Benchmarking	Evaluate a business process benchmarking	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 3 UNIT 5 Business Process Design Frameworks	Design a framework for business processes	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple questions	5
MODULE 3 UNIT 6 Success and Failures of Business Process Reengineering	<ul style="list-style-type: none"> <li>Identify CSFs and KPIs for various BPR projects</li> <li>Manage business through process reengineering</li> </ul>	Case studies and Problem-Solving Scenario	Students read the materials, watch video and respond to the activities	Generic Resources	Assignment 3: Mini Project	5

## Course Information

Course Code:	MIS807
Course Title:	Innovation Management and Organizational Change
Credit Unit:	2
Course Status:	
Course Description/Blub:	This course addresses an understanding of how organizations can recognize, innovate and cope with change due to updates in current and new information technologies to address business opportunities. Areas to be covered include: monitoring the technology environment, managing innovation with emerging technologies, innovating for sustainability, applying design thinking for innovation to solve technology-related issues, understanding organizational development and change management methods, change management in project lifecycle.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Innovation and Entrepreneurship

## Course Objectives

By the end of this course, the student will be able to:

- Develop innovative domain activity models that rely on new uses of existing technology or new technologies
- Develop a plan to exploit new and emerging methods and technologies for new purposes in an organisation
- Appreciate the role of innovation in responding to challenges and sustaining organisational value.

- Gain understanding of the concepts and ‘tools’ needed to analyse an organisation’s innovation and technology strategies, and know how to use these concepts/tools critically in a project analysis of organisational activities;
- Cross-link knowledge about firms’ management of technology and innovation to broader government regulation, competitiveness and economic issues.
- Contribute positively to organisationally based initiatives through the effective diagnosis, planning, management and implementation of organisational change and development interventions;

## Modules and Units

### Module 1: Innovation Management

- UNIT 1: Concepts and theories of innovation management
- UNIT 2: The management of product, service and experience innovations
- UNIT 3: Adoption lifecycle and use of “open” innovation
- UNIT 4: Managing creative people, processes and teams

### Module 2: Strategy and Innovation

- UNIT 1: Strategic management
- UNIT 2: Building and Sustaining innovation for organisation
- UNIT 3: Digital Transformation for Innovation

### Module 3: Design Thinking for Innovation

- UNIT 1: Overview of design thinking
- UNIT 2: The Design Thinking Process
- UNIT 3: Design thinking tools for solving complex problems

### Module 4: Organisational Change Management

- UNIT 1: Organisational Change strategies
- UNIT 2: Change management methods
- UNIT 3: Change management in a project lifecycle.

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE 1 UNIT 1 Concepts and Theories of Innovation Management	<ul style="list-style-type: none"> <li>Use the main innovation management terminology and concepts</li> <li>Manage innovations using appropriate theory</li> <li>Use the concepts and theories behind innovation managements</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 1 UNIT 2 The Management of Product, Service and Experience Innovations	<ul style="list-style-type: none"> <li>Demonstrate ability to classify and manage the different types of innovation and apply their different requirements to the innovation process</li> <li>Justify the success of an organizational innovation.</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 1 UNIT 3 Adoption lifecycle and use of "open" innovation	<ul style="list-style-type: none"> <li>Explain the dynamics of open innovation</li> <li>Describe the adoption of life cycle and discriminate between the various adopter groups</li> <li>Prepare an organisation for the change an innovation is bringing into the organisation</li> <li>Manage the factors that hinder innovation in an organisation</li> </ul>	<ul style="list-style-type: none"> <li>Scenario based simulation</li> <li>Case Study</li> <li>Problem solving method</li> <li>Cooperative lesson</li> </ul>	<ul style="list-style-type: none"> <li>Scenario based</li> <li>Team work/group work on determining the factors hindering adoption</li> </ul> <p>Read course materials</p>	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE 1 UNIT 4 Managing creative people, processes and teams	<ul style="list-style-type: none"> <li>Manage people with creative innovative ideas in a specific environment</li> <li>Develop team spirit to work with people</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Assignment 1	5
MODULE 2 UNIT 1 Strategic management	<ul style="list-style-type: none"> <li>Develop strategy and innovation in a global context.</li> <li>Apply the tools of strategic analysis in creating strategies for innovation.</li> <li>Establish frameworks, tools, and concepts in order to develop innovative strategies in a holistic way so as to achieve leadership positions</li> <li>Implement innovation strategies that creates unique value for consumers</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 2 UNIT 2 Building and Sustaining innovation for organisation	<ul style="list-style-type: none"> <li>Develop product concept by implementing the three pillars of a successful product strategy.</li> <li>Analyse the challenges associated with environmental sustainability and (specifically) climate change for firm competitiveness;</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Apply common approaches, frameworks and analytical techniques used in responding to challenges faced with innovation in the organisation.</li> </ul>					
MODULE 2 UNIT 3 Digital Transformation for Innovation	<ul style="list-style-type: none"> <li>Create digital innovative idea to solve human challenges</li> <li>Gain practical insights on the implications of digital innovation on firms, industry, and policy behaviours and strategies.</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 3 UNIT 1 Overview of design thinking	<ul style="list-style-type: none"> <li>Use design thinking approach to address innovation challenges from a human-centred perspective</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 3 UNIT 2 The Design Thinking Process	<ul style="list-style-type: none"> <li>Use design thinking to generate innovative ideas</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 3 UNIT 3 Design thinking for solving complex problems	<ul style="list-style-type: none"> <li>Apply the design thinking process to complex problems in order to generate innovative and user-centric solutions</li> <li>Develop creative ideas through structured brainstorming sessions.</li> <li>Develop rapid prototypes to bring their ideas into</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Assignment 2:	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	reality as quickly as possible and obtain feedback.					
MODULE 4 UNIT 1 Organisational change strategies	Design strategies to manage changes in organization	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 4 UNIT 2 Change management methods	Evaluate techniques for management change	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Self-Assessment Exercise: Five multiple choice questions	5
MODULE 4 UNIT 3 Change management in project lifecycle.	Evaluate changes in product lifecycle.	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the content, watch the video and respond to the activities	Generic Resources	Assignment 3:	5

## Course Information

Course Code:	MIS808
Course Title:	Ethics and Society
Credit Unit:	2
Course Status:	Core
Course Description/Blub:	This course addresses key questions on environmental and social sustainability, safety and health, privacy and integrity as they relate to information systems. Areas to be covered include: designing, managing and aligning IT operations for organizational sustainability. Basic concepts of responsibility, accountability, and liability in IS procurement practices. Other areas to include: ensuring protection of privacy and integrity in compliance with legislations, regulations and standards.

Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

Ethics and Sustainability

## Course Objectives

By the end of this course you will be able to:

- Apply sustainable approaches for IT solutions development, IT procurement, IT operations, IT resources management, and other IT practices.
- Analyse to ensure safety and avoid health hazards for contract arrangements with external parties and internal systems development, maintenance, and reuse.
- Evaluate privacy and integrity guide of IT practices.

- Interpret legislative and regulatory requirements governing IT practices as well as industry standards for IT practices.
- Shape compliance behaviours through ethics and behaviour

## Modules and Units

### **Module 1:** IT Management

- Unit1: IT Management Techniques
- Unit2: IT Solutions Design and Development
- Unit3: IT Governance
- Unit4: Integrating IT Solutions to Complex Situations

### **Module2:** Safety Management Systems

- Unit1: Component of Safety Management
- Unit2: Regulatory Perspective in Safety management
- Unit3: Hazard Avoidance and Safety Implementation
- Unit4: IT system maintenance and reuse

### **Module3:** IT Practices

- Unit1: IT Operational Management
- Unit2: Best Practice Trends and Profile
- Unit3: Risk Management Techniques

### **Module4:** IT and Government

- Unit1: Regulatory requirement and compliance
- Unit2: Culture and Information Technology

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module I Unit1 IT Management Techniques	<ul style="list-style-type: none"> <li>Identify and use top management techniques</li> <li>Identify Modern Management Techniques</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module I Unit2 IT Solutions Design and Development	<ul style="list-style-type: none"> <li>Develop requirement in solution design</li> <li>Implement a working solution</li> <li>Demonstrate Solution Life Cycle</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module I Unit3: IT Governance	<ul style="list-style-type: none"> <li>Identify the role of IT governance</li> <li>Demonstrate the Government work frame</li> <li>Analyze Corporate Governance of Information Technology</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module I Unit4: Integrating IT Solutions to Complex Situations	<ul style="list-style-type: none"> <li>Analyze Complex situations in the IT environment</li> <li>Recognize solution in Enterprise systems</li> <li>Use System Integration Methods</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Assignment 1	2
Module 2 Unit1: Component of Safety Management	<ul style="list-style-type: none"> <li>Identify safety component</li> <li>Organise safety management system</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module 2	<ul style="list-style-type: none"> <li>Interpret Regulatory requirements</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> </ul>	Students will read the content, watch	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Unit2: Regulatory Perspective in Safety management	<ul style="list-style-type: none"> <li>Integrate Regulatory requirement into Information Systems Design and implementation</li> </ul>	Problem Solve Scenario	video and take the exercises			
Module 2 Unit3: Hazard Avoidance and Safety Implementation	<ul style="list-style-type: none"> <li>Manage risks using different techniques</li> <li>Implement safety plan</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module 2 Unit4: IT system maintenance and reuse	<ul style="list-style-type: none"> <li>Develop maintenance technique that can enhance industry</li> <li>Execute component reusability</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module 3 Unit1: IT Operational Management	<ul style="list-style-type: none"> <li>Design IT operation flow</li> <li>Integrate IT operations with corresponding IT application</li> <li>Observe Management Strategies</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module 3 Unit2: Best Practice Trends and Profile	<ul style="list-style-type: none"> <li>Measure best practice</li> <li>Apply best practice to IT operations and organization</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2
Module 3 Unit3: Risk Management Techniques	Choose a Risk avoidance Technique to mitigate	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Assignment 2	2
Module 4 Unit1: Regulatory requirement and compliance	Manage the regulatory requirement and compliance of the use of IT	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Self-Assessment Exercise. 3 Multiple Choice Questions	2

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module IV Unit2: Culture and Information Technology	Evaluate the culture and information technology in the industry	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solve</li> <li>Scenario</li> </ul>	Students will read the content, watch video and take the exercises	Generic Resources	Assignment 3	2

## Course Information

Course Code:	MIS 809
Course Title:	IS Strategy Planning & Governance
Course Unit:	2
Course Status:	
Course Description/Blub:	This course addresses the use of information systems to achieve strategic organizational goals and objectives. Areas to be covered include: Mission objectives and goals setting. Strategy levels and hierarchy. Information capital needs and value. Capacity and capability planning. Making financial case for IS. Planning and implementing IS Governance including critical review and analysis of governance frameworks.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours of Study:	65

### Course Core Competencies:

### Course Objectives

By the end of this course, the student will be able to:

- Conduct IS strategic analysis
- Justify Financial Case for IS
- Manage IS/IT sourcing strategies
- Engage in IS strategic planning
- Plan and implement IS Governance
- Plan and improve sustainability of IS

## **Modules and Units**

### **Module 1: IS strategic analysis**

UNIT 1: Concepts and Theories of Strategic Management

UNIT 2: Business Goals and Objectives Definitions

UNIT 3: Organizational Structure Analysis

### **Module 2: Make Financial Case for IS**

UNIT 1: Cost Benefit Analysis

UNIT 2: Market Research & Value Chain Analysis

UNIT 3: Information capital, needs and value

### **Module 3: IS Strategic Planning**

UNIT 1: Strategy levels and hierarchy

UNIT 2: Change Strategy

UNIT 3: Capacity and capability planning

UNIT 4: IS Strategy Tools and Techniques

### **Module 4: IS Governance**

UNIT 1: Analysis of Governance Frameworks

UNIT 2: Strategy Formulation and IS Governance

UNIT 3: Sustainability in IS use

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
MODULE 1 UNIT 1 Concepts and Theories of Strategic Management	Theorize strategic management towards idea generation for effective management	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
MODULE 1 UNIT 2 Business Goals and Objectives Definitions	Extrapolate business goals and objectives	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
MODULE 1 UNIT 3 Organizational Structure Analysis	Analyse organisational structure for effective business growth	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources Forum discussion	Assignment 1	5
MODULE 2 UNIT 1 Cost Benefit Analysis	Evaluate the cost benefit in IS towards achieving effective performance	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
MODULE 2 UNIT 2 Market Research & Value Chain	<ul style="list-style-type: none"> <li>Analyse market demand gap</li> <li>Design research instruments</li> <li>Analyse data for effective information generation</li> <li>Establish strategies for value improvement</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
MODULE 3 UNIT 1 Strategy levels and hierarchy	<ul style="list-style-type: none"> <li>Develop strategy and innovation in organizational context</li> <li>Apply common approaches, frameworks and analytical techniques used in responding</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	to challenges faced with innovation in the organisation.					
MODULE 3 UNIT 2 Change Strategy	<ul style="list-style-type: none"> <li>Define key organisational change strategies, such as business process re-engineering and outsourcing, analyse their benefits and constraints, and describe implementation methods</li> <li>Apply appropriate change management model for an organisation to survive.</li> <li>Establish that are strategies appropriate to all stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
MODULE 3 UNIT 3 Capacity and capability planning	<ul style="list-style-type: none"> <li>Delineate the processes involved in determining the capacity needed by organizations to meet changing demands and reduce inefficiency</li> <li>Establish appropriate skills and resources required for organizational planning like managerial skills, resource-based view etc.</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
MODULE 3 UNIT 4 IS Strategy Tools and Techniques	Use the appropriate tools and techniques necessary to develop, plan and manage strategy for organizations e.g. Hypothesis Testing, Balance Score Card, PESTLE & SWOT Analysis	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Assignment 2	5
MODULE 4 UNIT 1	<ul style="list-style-type: none"> <li>Use various IT Governance Frameworks for Information Systems Management in organizations e.g. COBIT</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Analysis of Governance Frameworks	<ul style="list-style-type: none"> <li>Integrate IT Governance for both Public and Private Organizations</li> </ul>		respond to the activities			
MODULE 4 UNIT 2 Strategy Formulation and IS Governance	<ul style="list-style-type: none"> <li>Create a formal way to align IT with business strategy</li> <li>Create strategic war room to manage new innovation's intersection with strategy</li> <li>Apply the 6 main steps involved in the process of strategy formulation – from setting objectives to strategy selection</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
MODULE 4 UNIT 3 Sustainability in IS use	<ul style="list-style-type: none"> <li>Apply Design thinking and know common strategy execution techniques for appropriate IS implementation</li> <li>Differentiate link between governance and sustainability</li> <li>Apply sustainability (maturity) models for IS implementation</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> </ul>	Student read the text, listen to video and respond to the activities	Generic Resources	Assignment 3	5

## Course Information

Course Code:	MIS810
Course Title:	Information Systems Management and Operations
Credit Unit:	2
Course Status:	Core
Course Description/Blub:	This course addresses operations, management and decision making of an effective IS organization. Areas to be covered include: principles and strategies of operations management. Managing IS functions, staff, service productions and sourcing models. Managing and coordinating information resources. Managing IS project portfolio, software and hardware development and maintenance. Use of project management tools and techniques. Implementing relevant IT governance frameworks within the organization based on strategic guidance in line with laws and regulations directly affecting IS management and operations.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

IS Management and Operations

## Course Objectives

By the end of this course you will be able to:

- Monitor the environment in order to identify and evaluate new IS methods and trends in terms of their appropriateness for an organization.
- Develop innovative domain activity models that rely on new uses of existing technology or new technologies themselves.

- Develop a plan to exploit new and emerging methods and technologies for new purposes in an organization.
- Devise new ways of structuring and performing domain activities at different levels (individual, team, process, and organization) while considering the enabling and enhancing effects of information technology applications.
- Estimate the benefits of the new designs, assess the consequences of their implementation, and anticipate potential adverse consequences.

## Modules and Units

### **Module 1:** Information Systems Methods and Trends

- Unit1: Project Management tools and techniques
- Unit2: Functions in Information System
- Unit3: Information System Staff Management

### **Module 2:** Information management Models and Technology

- Unit1: Emerging Technologies
- Unit2: Managing Information System service production
- Unit3: Models for Information System sourcing
- Unit4: Domain Activities in Information System
- Unit5: Information System Resource management

### **Module 3:** Information System Application

- Unit1: Implementing IT framework
- Unit2: Information Systems Management and small business
- Unit3: Information Systems Operation
- Unit4: Modern System Design

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Module I Unit1: Project Management Tools and Techniques	<ul style="list-style-type: none"> <li>Evaluate tools used in Project Management</li> <li>Choose suitable techniques of Project Planning</li> <li>Evaluate the principles of Project Management</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, instructional video, and forum	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5
Module I Unit2: Functions In Information System	<ul style="list-style-type: none"> <li>Apply the components of Information Systems in practical analysis</li> <li>Develop a basic Information System</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5
Module I Unit3: Information System Staff Management	<ul style="list-style-type: none"> <li>Evaluate the role of Information System in Human Resource Management</li> <li>Evaluate the component of Human Resource Information System</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, instructional video, and assignment	Generic Resources	Assignment 1	5
Module 2 Unit1: Emerging Technologies	<ul style="list-style-type: none"> <li>Assess trends of technology evolution</li> <li>Evaluate the current fields of exploration in Information System</li> <li>Create trend using the available technologies</li> <li>Develop plan to exploit new and emerging methods and technologies for new purposes in an organization</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 2 Unit2: Managing Information System Service Production	<ul style="list-style-type: none"> <li>• Manage service production line</li> <li>• Develop a model for Information System Service Production</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5
Module 2 Unit3: Models For Information System Sourcing	<ul style="list-style-type: none"> <li>• Explore the decision model for Information System Outsourcing</li> <li>• Examine Sourcing Strategy in Information System development</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5
Module 2 Unit4: Domain Activities In Information System	<ul style="list-style-type: none"> <li>• Demonstrate skills in the developing solutions that conform to an overall corporate strategy</li> <li>• Devise new ways of structuring and performing domain activities</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5
Module 2 Unit5: Information System Resource Management	Demonstrate skills in the management of Hardware, software and human component of the Information system	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, instructional video, and assignment	Generic Resources	Assignment 2	5
Module 3 Unit1: Implementing IT Framework	<ul style="list-style-type: none"> <li>• Design a framework</li> <li>• Develop a solution using a designed framework</li> <li>• Estimate the benefits of the new design</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5
Module 3 Unit2: Information Systems Management	Integrate Information System to the management of small business	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5

<b>Modules and Units</b>	<b>ILOs - By the end of this unit, you will be able to:</b>	<b>Teaching Technique</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Required Hours for Study</b>
Module 3 Unit3: Information Systems Operation	<ul style="list-style-type: none"> <li>• Use a working solution coordinating the operations of small business</li> <li>• Establish adverse consequences</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, and instructional video,	Generic Resources	Self-Assessment Exercise: 3 multiple choice questions	5
Module 3 Unit4: Modern System Design	Create an advancement of system solutions	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Scenarios</li> </ul>	In-text question, self-assessment exercise, instructional video, assignment, and forum	Generic Resources	Assignment 3:	5

## Course Information

Course Code:	MIS811
Course Title:	Information Systems Requirements Engineering
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blurb:	This course addresses issues relating to analysis, specification and documenting requirements for IT artefacts. It also covers design of systems, services and user experiences. Areas to be covered include overview and potentials of emerging technologies in supporting modern businesses. Systems requirements gathering, specification and documentation. Systems design and implementation alternatives. Designing systems, services and user experiences.
Basic Requirements:	
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Ability to develop and deploy information systems that meet stakeholders needs

## Course Objectives

By the end of this course, you would have learnt about:

- Emerging technologies in information systems
- Software processes and process models
- Plan-based and agile development processes
- Verification and validation of software requirements
- Specification and documentation of software requirements

- UML models for documenting requirements

## **Modules and Units**

Module 1: Emerging technologies for modern businesses

Unit 1: Introduction to emerging technologies

Unit 2: Role of emerging technologies on modern businesses

Module 2: Software development processes

Unit 1: Software development activities

Unit 2: Plan-based and agile processes

Module 3: Agile software development

Unit 1: Fundamentals of agile software development

Unit 2: Extreme programming

Module 4: Systems requirements

Unit 1: Functional, non-function and domain requirements

Unit 2: Methods of gathering requirements

Unit 3: Methods and tools for documenting requirements

Unit 4: Case-study for practical requirements gathering

Module 5: Requirements engineering process

Unit 1: Requirement elicitation methods

Unit 2: Requirements analysis

Unit 3: Requirements specification and documentation

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1, Unit 1:</b> Introduction to emerging technologies	<ul style="list-style-type: none"> <li>Appreciate of the need for emerging technologies</li> <li>Identify emerging technologies</li> <li>Establish major drivers of emerging technologies</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum disuccsion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-asement exercises. 4 multiple choice questions	5
<b>Module 1, Unit 2:</b> Emerging technologies and modern businiesses	<ul style="list-style-type: none"> <li>appreciate the value addition of emerging technologies to businesses</li> <li>Establish the impacts of emerging technologies on modern businesses</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum disuccsion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Assignment 1: Students should investigate emerging technologies in their context	• 5
<b>Module 2, Unit 1:</b> Software development activities	<ul style="list-style-type: none"> <li>Distinguish software processes and software process models</li> <li>Identify the key activities involved in software development</li> <li>Apply each of the activities in the software development process in real life situation</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Problem Solving Scenario</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum disuccsion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-asement exercises. 4 multiple choice questions	• 5
<b>Module 2, Unit 2:</b> Plan-based and agile processes	<ul style="list-style-type: none"> <li>Distinguish between plan-based, agile and hybrid processes</li> <li>Identify scenarios where plan-based/agile processes are applicable</li> <li>Explain the relative merits and demerits of plan-based and agile processes</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum disuccsion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-asement exercises. 4 multiple choice questions	• 5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 3, Unit 1:</b> Fundamentals of agile software development	<ul style="list-style-type: none"> <li>Appreciate the motive behind the agile software development process</li> <li>Explain the agile manifesto</li> <li>Explain the agile principles</li> <li>Apply agile software in solving real life problem</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Problem Solving Scenario</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum disuccsion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-asement exercises. 4 multiple choice questions	<ul style="list-style-type: none"> <li>5</li> </ul>
<b>Module 3, Unit 2:</b> Extreme programming (XP)	<ul style="list-style-type: none"> <li>Demonstrate the use of XP as extreme form of an agile process</li> <li>Identify and explain key XP practices</li> <li>Apply the agile principles in XP</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum disuccsion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Assignment 2:	<ul style="list-style-type: none"> <li>5</li> </ul>
<b>Module 4, Unit 1:</b> Functional, non-function and domain requirements	<ul style="list-style-type: none"> <li>Distinguish between functional, non-function and domain requirements</li> <li>Manage the challenges of imprecision, completeness and consistency of requirements</li> <li>Evaluate the non-functional and domain requirements as constraint that may generate additional functional requirements</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum disuccsion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-asement exercises. 4 multiple choice questions	<ul style="list-style-type: none"> <li>5</li> </ul>
<b>Module 4, Unit 2:</b>	<ul style="list-style-type: none"> <li>Identify different methods of gathering requirements</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> </ul>	Two multiple-choice self-asement exercises.	<ul style="list-style-type: none"> <li>5</li> </ul>

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
Methods of gathering requirements	<ul style="list-style-type: none"> <li>Assess the relative merits and suitability of different requirements gathering methods</li> </ul>	<ul style="list-style-type: none"> <li>Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Participation in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Internet</li> </ul>	4 multiple choice questions	
<b>Module 4, Unit 3:</b> Methods and tools for documenting requirements	<ul style="list-style-type: none"> <li>Identify common requirements document structure</li> <li>Explain different requirements documentation methods</li> <li>Integrate modern tools for documenting requirements</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-assessment exercises. 4 multiple choice questions	<ul style="list-style-type: none"> <li>5</li> </ul>
<b>Module 4, Unit 4:</b> Case-study for practical requirements gathering	<ul style="list-style-type: none"> <li>Apply the case-study example selected for course</li> <li>Formulate similar case-studies in different IS domains</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-assessment exercises. 4 multiple choice questions	<ul style="list-style-type: none"> <li>5</li> </ul>
<b>Module 5, Unit 1:</b> Requirement elicitation methods	<ul style="list-style-type: none"> <li>Investigate an existing system and elicit requirements from it</li> <li>Establish requirements elicitation for the case-study example</li> <li>develop requirements for a similar case-study in another domain</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-assessment exercises. 4 multiple choice questions	<ul style="list-style-type: none"> <li>5</li> </ul>
<b>Module 5, Unit 2:</b> Requirements analysis	<ul style="list-style-type: none"> <li>Investigate requirements</li> <li>Validate requirements</li> <li>Prioritize requirements</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Two multiple-choice self-assessment exercises. 4 multiple choice questions	<ul style="list-style-type: none"> <li>5</li> </ul>

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
		<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> </ul>				
<b>Module 5, Unit 3:</b> Requirements specification and documentation	<ul style="list-style-type: none"> <li>Specify gathered requirements</li> <li>Evaluate requirements using UML</li> </ul>	<ul style="list-style-type: none"> <li>Process Oriented Guided Inquiry Lessons (POGIL)</li> <li>Cooperative learning</li> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Reading</li> <li>Participation in forum discussion</li> </ul>	<ul style="list-style-type: none"> <li>Course material</li> <li>Laptop/mobile phone</li> <li>Internet</li> </ul>	Assignment 3: Mini project	<ul style="list-style-type: none"> <li>5</li> </ul>

## Course Information

Course Code:	MIS812
Course Title:	Systems Development and Deployment
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blurb:	This course addresses issues on development, deployment and testing IT artefacts that meet specified requirements. Topics covered include systems development approaches: software architecture, object-oriented design and modelling. Implementing, testing, installing and integrating a new application. Developing and deploying a new system to organizational use. Software management.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours for Study:	65

## Course Core Competencies

- Ability to develop and deploy information systems that meet stakeholders needs

## Course Objectives

By the end of this course, you would have learnt about:

- Information systems architecture
- Object-oriented design and modelling
- Implementing and testing information systems
- Integrating and deploying information systems
- Software management

## Modules and Units

### Module 1: Information Systems Architecture

Unit 1: Fundamentals of software architecture

Unit 2: Case-Study: developing software architecture

### Module 2: Information Systems Design and Modelling

Unit 1: Object-oriented design using UML

Unit 2: Case-Study: structural modelling using UML

Unit 3: Case-Study: dynamic modelling using UML

### Module 3: Information Systems Development

Unit 1: User privileges and user categories

Unit 2: User-interface design

Unit 3: Data modelling

Unit 4: Implementation and testing

Unit 5: Integration and deployment

### Module 4: Software Project Management

Unit 1: Project management

Unit 2: Managing plan-driven projects

Unit 3: Managing agile projects

Table 2: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
<b>Module 1, Unit 1:</b> Fundamentals of software architecture	<ul style="list-style-type: none"> <li>Integrate the importance of architectural design of software to improve organisational IT needs</li> <li>Establish decisions to enhance architectural design</li> <li>Distinguish architectural patterns commonly used in different information systems</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources Discussion forum	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 1, Unit 2:</b> Case-Study: developing software architecture	<ul style="list-style-type: none"> <li>Select the most appropriate architectural patterns for a given application type</li> <li>Develop the architecture of a given application</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 2, Unit 1:</b> Object-oriented design using UML	<ul style="list-style-type: none"> <li>Evaluate object-oriented designs</li> <li>Use UML to design a specific application</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 2, Unit 2:</b> Case-Study: structural modelling using UML	<ul style="list-style-type: none"> <li>Interprete case studies on dynamic modelling with UML</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources Discussion	Self-Assessment Exercise: 5 multiple choice questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Develop a structural model of a given application using UML</li> </ul>	Learning (PBL)				
<b>Module 2, Unit 3:</b> Case-Study: dynamic modelling using UML	<ul style="list-style-type: none"> <li>Appreciate the need for structural modelling of software</li> <li>Develop structural model of a given application using UML</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Assignment 1: To comment on five post on a specific topic on the forum page following the given guidelines	5
<b>Module 3, Unit 1:</b> User privileges and user categories	<ul style="list-style-type: none"> <li>Establish user roles from a given software requirements document</li> <li>Define user categories from a given software requirements document</li> <li>Develop a user and roles matrix</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 3, Unit 2:</b> User-interface design	<ul style="list-style-type: none"> <li>Identify characteristics that make interfaces provide good user experience</li> <li>Identify tools for rapid development of user interface mock ups</li> <li>Develop user interface for a practical application</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 3, Unit 3:</b> Data modelling	<ul style="list-style-type: none"> <li>Identify data entities from a given software requirements document</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	<ul style="list-style-type: none"> <li>Develop a data model for a given application</li> <li>Draw and interpret entity relationship diagrams</li> </ul>	Learning (PBL)				
<b>Module 3, Unit 4:</b> Implementation and testing	<ul style="list-style-type: none"> <li>Identify and implement functional requirement from a system requirements document</li> <li>Develop test cases for basic system services</li> <li>Perform unit testing of implemented services</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 3, Unit 5:</b> Integration and deployment	<ul style="list-style-type: none"> <li>Integrate different system services implemented and tested separately</li> <li>Develop test cases for integrated system services</li> <li>Perform integration testing of implemented services</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Assignment 2	5
<b>Module 4, Unit 1:</b> Project management	<ul style="list-style-type: none"> <li>Establish the principal tasks of software project managers</li> <li>Identify risks that may arise in software projects and how to manage them</li> <li>Explain issues related to teamwork and</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5

Modules and Units	ILOs - By the end of this unit, you will be able to:	Teaching Technique	Learning Activities	Resources/Learning Devices	Assessments	Required Hours for Study
	managing people in software projects					
<b>Module 4, Unit 2:</b> Managing plan-driven projects	<ul style="list-style-type: none"> <li>Develop a plan for software project</li> <li>Identify the key elements of plan-driven development process</li> <li>Manage a plan-driven software project</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 4, Unit 3:</b> Managing agile projects	<ul style="list-style-type: none"> <li>Identify the key elements of agile software development process</li> <li>Manage an agile software project</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning (PBL)</li> </ul>	Self-Assessment Exercise, In-text Questions, instructional video, feedback comments	Generic Resources	Assignment 3: Mini Project	5

## **Ph.D. Management Information System (MIS)**

## **Programme Competencies**

1. Mastery of data mining and knowledge discovery algorithms
2. Demonstrate ability to mine big data from e-commerce applications
3. Apply modern software tools for Web analytics
4. Develop and implement business performance management metrics
5. Perform risk planning and management of business infrastructure
6. Develop research and training ability in key areas of Business Intelligence

## **Courses**

1. MIS901 Web Computing and Mining (3 Credit Units)
2. MIS902 Systems Security Management (3 Credit Units)
3. MIS903 Business Intelligence (3 Credit Units)
4. MIS904 Data Mining for Business Intelligence (3 Credit Units)
5. MIS905 Design Science Research Methodologies (2 Credit Units)
6. MIS906 Research Topics in Business Intelligence (2 Credit Units)
7. MIS919 Seminar (1 Credit Unit)
8. MIS920 Seminar (1 Credit Unit)
9. MIS999 Thesis (12 Credit Units)

## Programme Competencies

Table 1: Programme Competences

Competences	MIS901	MIS902	MIS903	MIS904	MIS905	MIS906	MIS919	MIS920	MIS999
Mastery of data mining and knowledge discovery algorithms	x			x	x	x			x
Demonstrate ability to mine big data from e-commerce applications	x		x	x	x			x	
Apply modern software tools for Web analytics	x		x	x	x	x			
Develop and implement business performance management metrics			x				x		
Perform risk planning and management of business infrastructure		x		x		x			
Develop research and training ability in key areas of Business Intelligence	x	x			x	x	x	x	x

## Course Information

- Course Code: MIS901
- Course Title: Web Computing and Mining
- Credit Unit: 3
- Course Status: Compulsory
- Course Description/Blurb: This course introduces data structures and algorithms that are suited for developing Internet-based information systems in business intelligence, search engines, digital libraries, knowledge management systems, web/data/text mining, national security and biomedical informatics. The course contains lectures, readings, programming assignments, lab sessions and a large-scale hands-on system development project. The course will begin with select fundamental yet useful data structures (e.g., stacks, queues, lists, trees and graphs) and sorting and searching algorithms. Newer and more robust web/data/text mining algorithms (e.g., neural networks, decision trees, genetic algorithms, spreading activation, information retrieval, natural language processing) are then introduced in the context of modern and emerging information systems in business, engineering and bioinformatics.
- Basic Requirements:
- Academic Year: 2020
- Semester: First
- Course Duration: 13 weeks
- Required Hours of study: 91

## Course Core Competencies

- Ability to apply appropriate data structures and data mining algorithms for developing internet-based business information systems

## Course Objectives:

By the end of this course, you would have learnt about:

- Basic data structures
- Data mining and Web mining fundamentals
- Web mining algorithms
- Tools for Web mining
- Analytics for e-commerce and Web marketing

## **Modules and Units**

### Module 1: Review of Data Structures

- Unit 1: Linear data structures
- Unit 2: Tree data structures
- Unit 3: Graph data structures

### Module 2: Data Mining and Knowledge Discovery

- Unit 1: Overview of data mining and Web mining
- Unit 2: Data preparation and pre-processing
- Unit 3: Frequent patterns mining

### Module 3: Data Mining Algorithms

- Unit 1: Basic concepts in classification and prediction
- Unit 2: Distance-based classification and prediction
- Unit 3: Classification and prediction using WEKA
- Unit 4: Basic clustering concepts and algorithms

### Module 4: Analytics for E-Commerce and Web Marketing

- Unit 1: Data preparation for Web usage analytics
- Unit 2: Web usage mining for E-business analytics
- Unit 3: E-business analytics case studies

**Table 3: Course Units Intended Learning Outcomes (ILOs)**

<b>Modules and Units</b>	<b>ILOs—By the end of this unit, you will be able to</b>	<b>Teaching Approaches/Methods</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Hours of Study Required</b>
<b>Module 1, Unit 1:</b> Linear Data Structures	<ul style="list-style-type: none"> <li>• Categorise the different linear data structures</li> <li>• Select the best linear data structure for a given application using a given procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>• Read the content</li> <li>• Watch video</li> <li>• Respond to the activities</li> </ul>	Generic Resources	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 1, Unit 2:</b> Tree Data Structures	<ul style="list-style-type: none"> <li>• Categorise the different types of trees and their applications</li> <li>• Select the most appropriate tree type for a given application</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>• Read the content</li> <li>• Watch video</li> <li>• Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>• Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 1, Unit 3:</b> Graph Data Structures	<ul style="list-style-type: none"> <li>• Categorise graphs and trees</li> <li>• Apply different graph traversal algorithms to solve real life problem</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>• Read the content</li> <li>• Watch video</li> <li>• Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>• Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>• Assignment 1</li> </ul>	5
<b>Module 2, Unit 1:</b> Overview of Data Mining and Web Mining	<ul style="list-style-type: none"> <li>• Distinguish the differences between data mining and web mining</li> <li>• Analyse the different forms of Web mining</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>• Read the content</li> <li>• Watch video</li> <li>• Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>• Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 2, Unit 2:</b>	<ul style="list-style-type: none"> <li>• Explain different characteristics of data to be mined</li> <li>• Use WEKA for preprocessing data</li> </ul>	<ul style="list-style-type: none"> <li>• Case Studies</li> <li>• Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>• Read the content</li> <li>• Watch video</li> <li>• Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>• Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>• Self-Assessment Exercise: 4 multiple questions</li> </ul>	5

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
Data Preparation and Pre-Processing						
<b>Module 2, Unit 3:</b> Frequent Patterns Mining	<ul style="list-style-type: none"> <li>Perform market basket analysis and association rule mining</li> <li>Use WEKA for association rules mining</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Read the content</li> <li>Watch video</li> <li>Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 3, Unit 1:</b> Basic Concepts in Classification And Prediction	<ul style="list-style-type: none"> <li>Explain key concepts in classification and prediction</li> <li>Build decision tree and Bayesian classification that can be used for decision making</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Read the content</li> <li>Watch video</li> <li>Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 3, Unit 2:</b> Distance-Based Classification and Prediction	<ul style="list-style-type: none"> <li>Explain key concepts in predictive modeling (e.g., distances and similarities)</li> <li>Use k-nearest neighbour model specific concept</li> <li>Solve specific real life challenges using predictive modeling in recommender systems</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Modelling activity using problem solving technique</li> </ul>	<ul style="list-style-type: none"> <li>Modelling software</li> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 3, Unit 3:</b>	<ul style="list-style-type: none"> <li>Use WEKA to predict the level of success of a specific outcome</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Application of WEKA to real life situation</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 4 multiple questions</li> </ul>	5

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
Classification and Prediction Using Weka						
<b>Module 3, Unit 4:</b> Basic Clustering Concepts And Algorithms	<ul style="list-style-type: none"> <li>Demonstrate the use of basic clustering concepts and clustering algorithms</li> <li>Identify popular applications of clustering in Web mining, user profiling and personalization</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Read the content</li> <li>Watch video</li> <li>Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resoures</li> </ul>	<ul style="list-style-type: none"> <li>Assignment 2</li> </ul>	5
<b>Module 4, Unit 1:</b> Data Preparation For Web Usage Analytics	<ul style="list-style-type: none"> <li>Organise data for Web usage analytics</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Read the content</li> <li>Watch video</li> <li>Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resoures</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 4, Unit 2:</b> Web Usage Mining For E-Business Analytics	<ul style="list-style-type: none"> <li>Perform Web usage mining for e-business analytics</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Read the content</li> <li>Watch video</li> <li>Respond to the activities</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resoures</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 4 multiple questions</li> </ul>	5
<b>Module 4, Unit 3:</b>	<ul style="list-style-type: none"> <li>Manage e-business using the e-business analytics case studies</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Technique</li> </ul>	<ul style="list-style-type: none"> <li>Students respond to case studies</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resoures</li> </ul>	Assignment 3	5

<b>Modules and Units</b>	<b>ILOs—By the end of this unit, you will be able to</b>	<b>Teaching Approaches/Methods</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Hours of Study Required</b>
E-Business Analytics Case Studies						

**Course Information:**

Course Code: MIS902  
Course Title: Systems Security Management  
Credit Unit: 3  
Course Status: Compulsory

Course Description/Blurb: The information security arena contains a broad array of multi-level models for assessing, planning, implementing and monitoring the mitigation of security risks. At the very core of this information security spectrum are the actual system and network devices which store, manage, transmit and secure information. Areas to be covered include risk assessment; operational issues, planning, and design. proper safeguarding of operating systems and related components: issues and techniques, Other areas are covered around Information Assurance topics such as Security policy, international conflict, and cyber warfare, Security and privacy in online social networks, mobile and web security, security applications of program analysis, botnets and malware analysis, Hardware and software system vulnerabilities. This course offers a solid base for system administrators and technical managers.

**Basic Requirements:**

Academic Year: 2020  
Semester: Second  
Course Duration: 13 weeks  
Required Hours of study: 91

**Course Core Competencies**

- Ability to assess, plan, implement and monitor systems risks, ensuring business assurance and continuity

**Course Objectives**

By the end of this course, you would have learnt about:

- Information systems risk assessment
- Techniques and tools for safeguarding operating systems and related components

- International conflicts and cyber warfare
- Security and privacy issues in cloud computing and social media
- Security application of different analyses methods

## Modules and Units

### Module 1: Information Systems Risk Assessment

Unit 1: Fundamentals of information systems risks

Unit 2: Risk planning

Unit 3: Risks mitigation and management strategies

### Module 2: Operating Systems (OS) Risks Management

Unit 1: Operating systems risks and vulnerabilities: hardware and software

Unit 2: Tools and techniques for mitigating OS risks

### Module 3: International Conflicts and Cyber Warfare

Unit 1: Conflicts and cyber wars

Unit 2: Policies and pacts against cyber war

### Module 4: Security in Cloud Computing and New Media

Unit 1: Introduction to cloud computing

Unit 2: Threats and vulnerabilities in cloud computing

Unit 3: Tools and techniques for managing cloud computing security

Unit 4: Security issues and mitigation strategies on new media

### Module 5: Security analysis Methods

Unit 1: Security applications of program analysis

Unit 2: Botnets and malware analysis

**Table 3: Course Units Intended Learning Outcomes (ILOs)**

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
<b>Module 1, Unit 1:</b> Fundamentals of information systems risks	<ul style="list-style-type: none"> <li>Identify potential risks that information systems face</li> <li>Explain the major causes and sources of those risks</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> </ul>	Read the material, watch video, and respond to questions	Generic Resources	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 1, Unit 2:</b> Risk planning	<ul style="list-style-type: none"> <li>Identify and explain risk planning steps</li> <li>Develop a risk plan for a business</li> <li>Execute a risk plan to reduce vulnerability of a business</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning</li> </ul>	<ul style="list-style-type: none"> <li>Develop a risk plan</li> <li>Execute the risk plan</li> </ul>	<ul style="list-style-type: none"> <li>Simulation</li> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 1, Unit 3:</b> Risks mitigation and management strategies	<ul style="list-style-type: none"> <li>Design actions that can be used to avoid and reduce threats from risks.</li> <li>Identify vulnerabilities and threats.</li> <li>Monitor and mitigate risks</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Learning</li> </ul>	<ul style="list-style-type: none"> <li>Present case study for students to monitor and mitigate risks</li> </ul>	<ul style="list-style-type: none"> <li>Simulation</li> <li>Generic Resources</li> </ul>	Assignment 1	7
<b>Module 2, Unit 1:</b> Operating systems risks and vulnerabilities: hardware and software	<ul style="list-style-type: none"> <li>Distinguish between hardware and software risks and vulnerabilities to OSs</li> <li>Explain steps to take to address OS risks and vulnerabilities</li> </ul>	<ul style="list-style-type: none"> <li>Problem Based Scenario</li> </ul>	<ul style="list-style-type: none"> <li>Read the material, watch video, and respond to questions</li> </ul>	Generic Resources	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
<b>Module 2, Unit 2:</b> Tools and techniques for mitigating OS risks	<ul style="list-style-type: none"> <li>Investigate techniques for mitigating OS risks</li> <li>Analyse key tools for mitigating OS risks</li> <li>Use techniques and tools for protecting OSs to solve real life problem</li> </ul>	<ul style="list-style-type: none"> <li>Problem Based Scenario</li> </ul>	A problem scenario is created for the students to resolve	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 3, Unit 1:</b> Conflicts and cyber wars	<ul style="list-style-type: none"> <li>Establish sources and causes of conflict and cyber wars</li> <li>Derive strategies for avoiding conflicts and cyber wars in a specified scenario</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Read the material, watch video, and respond to questions</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 3, Unit 2:</b> Policies and pacts against cyber war	<ul style="list-style-type: none"> <li>Identify national provisions against cyber crime</li> <li>Identify international provisions and agreements against cyber war</li> <li>Develop user interface for a practical application</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenario</li> </ul>	<ul style="list-style-type: none"> <li>Read the material, watch video, and respond to questions</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	Assignment 2:	7
<b>Module 4, Unit 1:</b> Introduction to cloud computing	<ul style="list-style-type: none"> <li>Manage the advantages of cloud computing in achieving desirable result in an organisation</li> <li>Explain cloud computing types</li> <li>Identify common cloud computing services</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Based Scenario</li> </ul>	<ul style="list-style-type: none"> <li>Read the material, watch video, and respond to questions</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
<b>Module 4, Unit 2:</b> Threats and vulnerabilities in cloud computing	<ul style="list-style-type: none"> <li>Manage the threats and vulnerabilities in a cloud platform</li> <li>Derive research themes in cloud computing security</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>Derive research theme from a given scenario</li> <li>Present case study with threats for the student to manage</li> </ul>	<ul style="list-style-type: none"> <li>Simulation</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 4, Unit 3:</b> Tools and techniques for managing cloud computing security	<ul style="list-style-type: none"> <li>Assess the techniques for managing security on the cloud</li> <li>Apply tools for managing cloud security</li> </ul>	<ul style="list-style-type: none"> <li>Problem Based Scenario</li> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Read the material, watch video, and respond to questions</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 4, Unit 4:</b> Security issues and mitigation strategies on new media	<ul style="list-style-type: none"> <li>Manage security issues facing users of social media using appropriate techniques</li> <li>Use the tools for managing security on social media</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>Student solve particular social media threats using specific tools</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 5, Unit 1:</b> Security applications of program analysis	<ul style="list-style-type: none"> <li>Analyse security applications program for specific problem solving</li> <li>Conduct program analysis for security purposes</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Read the material, watch video, and respond to questions</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	<ul style="list-style-type: none"> <li>Self-Assessment Exercise: 5 multiple choice questions</li> <li>An in-text question</li> </ul>	7
<b>Module 5, Unit 2:</b>	<ul style="list-style-type: none"> <li>Distinguish botnets, malware and similar threats</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> </ul>	<ul style="list-style-type: none"> <li>Read the material, watch video, and</li> </ul>	<ul style="list-style-type: none"> <li>Generic Resources</li> </ul>	Assignment 3	7

<b>Modules and Units</b>	<b>ILOs—By the end of this unit, you will be able to</b>	<b>Teaching Approaches/Methods</b>	<b>Learning Activities</b>	<b>Resources/Learning Devices</b>	<b>Assessments</b>	<b>Hours of Study Required</b>
Botnets and malware analysis	<ul style="list-style-type: none"> <li>Conduct analysis on botnets and malware</li> </ul>		respond to questions			

## Course Information

Course Code: MIS903  
Course Title: Business Intelligence  
Credit Unit: 3  
Course Status: Compulsory

Course Description/Blurb: The objective of this course is to give students a broad overview of managerial, strategic and technical issues associated with Business Intelligence and Data Warehouse design, implementation and utilization. Areas to be covered include: the principles of dimensional data modeling, techniques for extraction of data from source systems, data transformation methods, data staging and quality, data warehouse architecture and infrastructure and the various methods for information delivery. Critical issues in planning, physical design process, deployment and ongoing maintenance will also be examined. Students will learn how data warehouses are used to help managers successfully gather, analyze, understand and act on information stored in data warehouses. Others areas around components and design issues relating to data warehouses and business intelligence techniques for extracting meaningful information from data warehouses will be emphasized. The course will use state-of-the-art data warehouse and OLAP software tools to provide hands-on experience in designing and using Data Warehouses and Data Marts. Students will also learn how to gather strategic decision making requirements from businesses, develop key performance indicators (KPIs) and corporate performance management metrics using the Balanced Scorecard, and design and implement business dashboards.

- Basic Requirements:
- Academic Year: 2020
- Semester:
- Course Duration: 13 weeks
- Required Hours of study: 91

## Course Core Competencies

- Integrate business strategy and technology for an organization
- Manage the information systems resources for organizations
- Demonstrate project management and collaboration skills
- Demonstrate research and knowledge sharing ability in key areas of Business Intelligence

## Course Objectives

**By the** end of the course, you will be able to:

- Analyse the historical view of business intelligence and data warehouse.
- Model a business intelligence for any product.
- Apply Business intelligence to project management
- Use state-of-the-art software to build business intelligence applications

## Modules and Units

Module 1: Overview of Business Intelligence and Data Warehouse

Unit 1: Business Intelligence and Information Exploitation

Unit 2: Data Warehousing

Unit 3: Trend in Data Warehousing

Unit 4: Online Analytical Processing (OLAP)

Module 2: Dimensional Modelling

Unit 1: Introduction to Dimensional Modelling

Unit 2: DW/BI architectures

Unit 3: Dimensional Modelling Techniques

Unit 4: Dimensional Modelling Process and Tasks

Unit 5: Dimensional Modelling Case Studies

Module 3: Business Intelligence Project Management  
 Unit 1: Planning and Management  
 Unit 2: Design and Development  
 Unit 3: Deployment, Maintenance, and Future Growth  
 Unit 4: Business Performance Management

Table 3: Course Units Intended Learning Outcomes (ILOs)

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
Module 1, Unit 1: Business intelligence and information exploitation	<ul style="list-style-type: none"> <li>Appraise business intelligence and information exploration</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 1, Unit 2: Data Warehousing	<ul style="list-style-type: none"> <li>Review formal definitions of a data warehouse</li> <li>Examine some key defining features of the data warehouse</li> <li>Distinguish between data warehouses and data marts</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	<ul style="list-style-type: none"> <li>iDashboards</li> <li>Sisense</li> </ul>	Self-Assessment Exercise: 5 multiple choice questions	7
Module 1, Unit 3: Trend in Data warehousing	<ul style="list-style-type: none"> <li>Review the continued growth in data warehousing</li> <li>manage data warehousing as mainstream</li> <li>Identify major trends in data warehousing</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
	<ul style="list-style-type: none"> <li>Use the concept of web-enabled data warehouse to solve real life challenges</li> </ul>					
Module 1, Unit 4: Online Analytical Processing (OLAP)	<ul style="list-style-type: none"> <li>Analyse the demand for online analytical processing (OLAP)</li> <li>Examine the major features and functions of OLAP</li> <li>Examine the different OLAP models and determine which is suitable for different organizations</li> <li>Implement OLAP in a typical data warehouse environment</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	<ul style="list-style-type: none"> <li>iDashboards</li> <li>Sisense</li> </ul>	Assignment 1	7
Module 2, Unit 1: Introduction to dimensional modelling	<ul style="list-style-type: none"> <li>Interpret the basics of dimensional modelling</li> <li>Use dimension modelling to deliver data that is understandable to the business users.</li> <li>use dimension modelling to address the requirement to deliver fast query</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
	performance in an organisation					
Module 2, Unit 2: DW/BI architectures	<ul style="list-style-type: none"> <li>Examine the key components of DW/BI environment</li> <li>Employ ETL procedures to solve basic challenges</li> <li>Integrate the two prominent architectures (Inmon versus Kimball) in project design</li> <li>Respond to different types of data warehouse architectures</li> <li>Identify components in a typical data warehouse architectures</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 2, Unit 3: Dimensional Modelling techniques	<ul style="list-style-type: none"> <li>Identify techniques for modeling data in a dimensional way</li> <li>Apply the techniques in every dimensional design</li> <li>Distinguish between E-R Modelling and Dimensional Modelling</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 2, Unit 4: Dimensional Modelling Process and Tasks	<ul style="list-style-type: none"> <li>Explore the dimensional modelling processes</li> <li>Identify the business process.</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
	<ul style="list-style-type: none"> <li>Prioritize activities to establish the bus matrix row that will be modelled</li> <li>Declare the grain of the business process for a project.</li> <li>Determine the appropriate dimensions and facts.</li> </ul>					
Module 2, Unit 5: Dimensional modelling case studies	<ul style="list-style-type: none"> <li>Use the principles of dimensional modelling in real cases from a range of businesses</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Assignment 2	7
Module 3, Unit 1: Planning and Management	<ul style="list-style-type: none"> <li>Assess the organization's readiness for the DW/BI initiative</li> <li>Collect business requirements and identify priorities.</li> <li>Establish the preliminary scope and justification</li> <li>Define business requirements and align it with the DW/BI initiatives</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	<ul style="list-style-type: none"> <li>Tableau</li> <li>Microsoft Power BI</li> <li>SAP Crystal Reports</li> </ul>	Self-Assessment Exercise: 5 multiple choice questions	7
Module 3, Unit 2: Design and Development	<ul style="list-style-type: none"> <li>Identify factors that must be considered during the design phase</li> <li>Design the right technical architecture for a project</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
	<ul style="list-style-type: none"> <li>Identify tasks associated DW/BI product selection</li> <li>Select the right modelling technique and tool for a project</li> <li>Choose the right standards such as naming conventions, calculations, libraries, and coding standards</li> </ul>					
Module 3, Unit 3: Deployment, Maintenance, and Future Growth	<ul style="list-style-type: none"> <li>Assess the readiness of the DW/BI deliverables</li> <li>Identify resources required to manage the new business environment</li> <li>Outline recommendations to ensure successful completion of a project</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 3, Unit 4: Business Performance Management	<ul style="list-style-type: none"> <li>Identify different classes of users of data warehouse</li> <li>Identify the modes of delivering business intelligence</li> <li>Organise delivery tools for different organizations</li> <li>Evaluate system performance</li> </ul>	<ul style="list-style-type: none"> <li>Case Study</li> <li>Problem Solving Scenario</li> </ul>	Students read the text, watch the video, participate in the video conferencing and take the activities	Generic Resources	Assignment 3	7

## Course Information:

Course Code:	MIS904
Course Title:	Data Mining for Business Intelligence
Credit Unit:	3
Course Status:	Compulsory
Course Description/Blub:	This course will cover advanced micro-level data analytics, advanced data mining techniques to discover knowledge and acquire business intelligence from massive datasets, pattern recognition, including fraud detection, consumer behavior, credit approval etc. The course will also cover the most important data mining techniques—classification, clustering, association rule mining, visualization, prediction—through a hands-on approach using XL Miner, Rapid miner and other specialized software, such as the open-source WEKA software, R language.
Basic Requirements:	
Academic Year:	2020
Semester:	
Course Duration:	13 weeks
Required Hours of study:	91

## Course Core Competencies

- Demonstrate skills in Web mining IT architecture, design and implementation
- Demonstrate research and knowledge sharing ability in key areas of Business Intelligence

## Course Objectives:

By the end of this course, you would have learnt about:

- Data analytic approaches in solving business problems
- The concepts of data mining for business intelligence
- Business intelligence tools/techniques for various business problems

## **Modules and Units**

### **Module 1: Business Intelligence and Data Mining Concepts**

Unit 1: Business intelligence and applications

Unit 2: Introduction to Data Warehousing

Unit 3: Data Pre-processing

### **Module 2: Concepts of Classification**

Unit 1: Decision Tree Methods

Unit 2: Bayes Classification Methods

Unit 3: Rule-Based Classification

### **Module 3: Association Rule Mining**

Unit 1: Business Applications of Association Rules

Unit 2: Algorithms for Association Rule

Unit 3: Market Basket Analysis using data mining tool

### **Module 4: Clustering Analysis**

Unit 1: Clustering Analysis and Business Applications

Unit 2: Regression Techniques

Unit 3: K-Means algorithm for clustering

Unit 4: Artificial neural networks (ANN)

**Table 3: Course Units Intended Learning Outcomes (ILOs)**

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
Module 1, Unit 1: Business intelligence and applications	<ul style="list-style-type: none"> <li>Identify the components of business intelligence.</li> <li>Use different applications of business intelligence to provide solution to a specific area of business.</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 1, Unit 2: Introduction to Data Warehousing	<ul style="list-style-type: none"> <li>Justify the need of data warehousing in business</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 1, Unit 3: Data Preprocessing	<ul style="list-style-type: none"> <li>Describe different categories of data processing</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>XL miner, Rapid miner, WEKA, R language</li> </ul>	Self-Assessment Exercise: 5 multiple choice questions	7
Module 2, Unit 1: Decision Tree Methods	<ul style="list-style-type: none"> <li>Identify suitability of decision tree method for a given problem</li> <li>Construct decision tree for a given problem</li> <li>Apply an efficient decision tree algorithm</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>XL miner, Rapid miner, WEKA, R language</li> </ul>	Self-Assessment Exercise: 5 multiple choice questions	7
Module 2, Unit 2:	<ul style="list-style-type: none"> <li>Identify suitability of Bayes classification</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and	<ul style="list-style-type: none"> <li>XL miner, Rapid miner,</li> </ul>	Self-Assessment Exercise: 5	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
Bayes Classification Methods	algorithm for a given problem <ul style="list-style-type: none"> <li>• Apply Bayes classification algorithm to classification problem</li> </ul>		respond to the activities	WEKA, R language	multiple choice questions	
Module 2, Unit 3: Rule-Based Classification	<ul style="list-style-type: none"> <li>• Identify suitability of rule-based classification method for a given problem</li> <li>• Apply rule-based classification algorithm to classification problem</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>• XL miner, Rapid miner, WEKA, R language</li> </ul>	Assignment 1	7
Module 3, Unit 1: Business Applications of Association Rules	<ul style="list-style-type: none"> <li>• Identify the applications of mined patterns in business environment</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 3, Unit 2: Algorithms for Association Rule	<ul style="list-style-type: none"> <li>• Apply an efficient associative rule algorithm for pattern mining</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>• XL miner, Rapid miner, WEKA, R language</li> </ul>	Self-Assessment Exercise: 5 multiple choice questions	7
Module 3, Unit 3: Market Basket Analysis using data mining tool	<ul style="list-style-type: none"> <li>• Perform classification and prediction using data mining tool like WEKA, Rapid miner</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>• XL miner, Rapid miner, WEKA, R language</li> </ul>	Self-Assessment Exercise: 5 multiple choice questions	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
Module 3, Unit 4: Clustering Analysis and Business Applications	<ul style="list-style-type: none"> <li>Explain basic clustering concepts and identify basic clustering algorithms</li> <li>Apply popular applications of clustering in Web mining, user profiling and personalization to solve identified problem</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>XL miner, Rapid miner, WEKA, R language</li> </ul>	Assignment 2	7
Module 4, Unit 1: Regression Techniques	<ul style="list-style-type: none"> <li>Identify applications of regression techniques in solving business decision problems.</li> <li>Apply an efficient regression technique for a given problem</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	7
Module 4, Unit 2: K-Means algorithm for clustering	<ul style="list-style-type: none"> <li>Explain the concept of clustering and its applications in business environment</li> <li>Apply an efficient clustering algorithm to a given problem</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>XL miner, Rapid miner, WEKA, R language</li> </ul>	Self-Assessment Exercise: 5 multiple choice questions	7
Module 4, Unit 3: Artificial neural networks (ANN)	<ul style="list-style-type: none"> <li>Explain the concepts of neural networks</li> <li>Build neural network models</li> </ul>	Case Studies, Problem Solving Scenario	Students read the text, watch the video, and respond to the activities	<ul style="list-style-type: none"> <li>XL miner, Rapid miner, WEKA, R language</li> </ul>	Assignment 3	7

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
	<ul style="list-style-type: none"> <li>Apply neural network technique to solve classification and prediction problem</li> </ul>					

## **COURSE INFORMATION**

Course Code:	MIS905
Course Title:	DESIGN SCIENCE RESEARCH METHODOLOGIES
Credit Unit:	2
Course Status:	Core
Course Description/Bulb:	This course introduces doctoral degree students and advanced master's degree students to important research and survey articles in the field of management information systems.
Academic Year:	2020
Semester:	First
Course Duration:	13 weeks
Required Hours of Study:	65

## **Course Objectives**

By the end of this course, you will be able to:

1. Design science research to meet organisational needs
2. Demonstrate the skills of research in Management Information System
3. Use the different elements in Management Information System to solve business challenges
4. Develop solutions that can be use in the field of Management Information System

## **MODULE I: The Methodology in Research Framework**

UNIT1:	Research as a process in the methodology
UNIT2:	The Conceptual and Technical Design
UNIT3:	Integration
UNIT4:	Scientific quality and ethical considerations in the design MIS research

**MODULE 2: The Methodology in MIS research framework in practice**

- UNIT1: Conceptual Framework  
UNIT2: Teaching with Methodology in MIS  
UNIT3: Recent Development

**MODULE 3: Researching with Methodology in MIS Research**

- UNIT1: Research Objectives and Research Questions  
UNIT2: Study Design  
UNIT3: Instrument Selection and Design  
UNIT4: Sampling Design  
UNIT5: Data Analysis Plan  
UNIT6: Execution

Table 3: Intended Learning Outcomes (ILOs) and Course Specification

Modules and Units	ILOs - By the end of this Unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessment	Hours of Study Required
<b>MODULE I: The Methodology in Research Framework</b>						
UNIT1 Research as a process in the methodology	<ul style="list-style-type: none"><li>Evaluate the steps in Research Process</li><li>Identify the steps in Research Process</li></ul>	<ul style="list-style-type: none"><li>Scaffolding</li><li>Problem Solving Scenarios</li><li>Case Study</li></ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5
UNIT2 The Conceptual and Technical Design	<ul style="list-style-type: none"><li>Demonstrate intellectual capability in developing a research idea into a realistic and appropriate research design</li></ul>	<ul style="list-style-type: none"><li>Scaffolding</li><li>Problem Solving Scenarios</li><li>Case Study</li></ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5

Modules and Units	ILOs - By the end of this Unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessment	Hours of Study Required
	<ul style="list-style-type: none"> <li>Demonstrate ability to plan the way to approach a research and pick the methods to use. Taking into consideration suitability, availability, durability, feasibility, ethics e.t.c</li> </ul>					
UNIT3 Integration	<ul style="list-style-type: none"> <li>Plan research, help generate insights <i>and</i> help find solutions using creative problem-solving techniques</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5
UNIT4 Scientific quality and ethical considerations in the design of MIS research	<ul style="list-style-type: none"> <li>Integrate the aims of research, such as knowledge, truth, and avoidance of error that are often isolated in research</li> <li>Promote the values that are essential to collaborative work, such as trust, accountability, mutual respect, and fairness</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Assignment 1	5
<b>MODULE 2: The Methodology in MIS research framework in practice</b>						
UNIT1 Conceptual Framework	<ul style="list-style-type: none"> <li>Evaluate the role of conceptual framework in research</li> <li>Evaluate conceptual framework in thesis</li> <li>Identify the different types of conceptual framework</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5
UNIT2	<ul style="list-style-type: none"> <li>Structure a research methods class so that students gain a</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> </ul>	Students work through the materials and	Generic Resources	Self-Assessment	5

Modules and Units	ILOs - By the end of this Unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessment	Hours of Study Required
Teaching with Methodology in MIS	<ul style="list-style-type: none"> <li>practical knowledge of how research is done</li> <li>Demonstrate ability to collect data, use statistical software and write results</li> </ul>	<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	respond to the activities		Exercise: 3 Multiple choice questions	
UNIT3 Recent Development	<ul style="list-style-type: none"> <li>Explore emerging developments and trends in research</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Assignment 2:	5
<b>MODULE3: Researching with Methodology in MIS Research</b>						
UNIT1 Research Objectives and Research Questions	<ul style="list-style-type: none"> <li>Develop a research Objective</li> <li>Develop research questions and hypotheses that will lead to adequate research design to solve a specific problem</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5
UNIT2 Study Design	<ul style="list-style-type: none"> <li>Identify the different study designs in research</li> <li>Create a research design</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5
UNIT3 Instrument Selection and Design	<ul style="list-style-type: none"> <li>Evaluate Instrument Design in research</li> <li>Identify Research Instrument and types</li> <li>Develop a research instrument</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5
UNIT4 Sampling Design	<ul style="list-style-type: none"> <li>Collect information through a survey for some population, or universe, of interest</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> </ul>	Students work through the materials and	Generic Resources	Self-Assessment Exercise: 3	5

Modules and Units	ILOs - By the end of this Unit, you will be able to:	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessment	Hours of Study Required
	<ul style="list-style-type: none"> <li>Define a sampling frame that represents the population of interest, from which a sample is to be drawn</li> </ul>	<ul style="list-style-type: none"> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	respond to the activities		Multiple choice questions	
UNIT5 Data Analysis Plan	<ul style="list-style-type: none"> <li>Analyse and interpret data</li> <li>Write a research data analysis</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Self-Assessment Exercise: 3 Multiple choice questions	5
UNIT6 Execution	<ul style="list-style-type: none"> <li>Perform a research</li> </ul>	<ul style="list-style-type: none"> <li>Scaffolding</li> <li>Problem Solving Scenarios</li> <li>Case Study</li> </ul>	Students work through the materials and respond to the activities	Generic Resources	Assignment 3: Mini Project	5

## Course Information

Course Code:	MIS906
Course Title:	Research Topics in Business Intelligence
Credit Unit:	2
Course Status:	Compulsory
Course Description/Blurb:	This course aims to explore topical and emerging issues in Business Intelligence Research. Topics to be covered include self-service business intelligence (reporting/analysis), reporting/analysis across multiple systems, unlocking data buried in systems, reducing cost of reports production, mobile business intelligence, replacing a business intelligence system.
Basic Requirements:	
Academic Year:	2020
Semester:	Second
Course Duration:	13 weeks
Required Hours of study:	65

## Course Core Competencies

- Ability to conduct research in emerging areas of business intelligence

## Course Objectives:

By the end of this course, you would have learnt about:

- Self-service business intelligence
- Reporting and analysis across multiple systems
- Unlocking data buried in systems
- Strategies for mitigating reports production costs
- Mobile business intelligence
- Replacing business intelligence systems

## **Modules and Units:**

### Module 1: Self-service Business Intelligence

Unit 1: Traditional versus self-service business intelligence

Unit 2: Self-service vendors and services

Unit 3: Self-service business intelligence tools

### Module 2: Reporting and Analysis across Multiple Platform

Unit 1: Multiplatform reporting and analysis

Unit 2: Tools for reporting across platforms

### Module 3: Unlocking Data Buried in Systems

Unit 1: Strategies of uncovering hidden data

Unit 2: Tools for hidden data extractions

### Module 4: Report Production and Costs

Unit 1: Report production methods

Unit 2: Economy of report production

### Module 5: Mobile Business Intelligence

Unit 1: Desktop versus mobile BI

Unit 2: Tools and techniques for mobile BI

### Module 6: Replacing Business Intelligence Systems

Unit 1: Needs and challenges for replacing BI systems

Unit 2: Tools for replacing BI systems

**Table 2: Course Units Intended Learning Outcomes (ILOs)**

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
<b>Module 1, Unit 1:</b> Traditional Versus Self-Service Business Intelligence	<ul style="list-style-type: none"> <li>Distinguish between traditional and self-service BI strategies</li> <li>Explain challenges of self-service BI</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	Generic Resources And software for data analysis	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 1, Unit 2:</b> Self-Service Vendors And Services	<ul style="list-style-type: none"> <li>Identify leading self-service vendors and their offerings</li> <li>Distinguish leading self-services for BI and their relative merits and demerits</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 1, Unit 3:</b> Self-Service Business Intelligence Tools	<ul style="list-style-type: none"> <li>Identify and distinguish leading self-service BI tools</li> <li>Apply self-service BI tools</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	And software for data analysis	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 2, Unit 1:</b> Multiplatform Reporting And Analysis	<ul style="list-style-type: none"> <li>Explain the needs and challenges of multiplatform reporting and analysis</li> <li>Distinguish between the requirements of single and multiplatform reporting and analysis</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
<b>Module 2, Unit 2:</b> Tools for Reporting Across Platforms	<ul style="list-style-type: none"> <li>Identify and distinguish tools cross platform reporting</li> <li>Perform cross platform reporting</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	And software for data analysis	Assignment 1	5
<b>Module 3, Unit 1:</b> Strategies of Uncovering Hidden Data	<ul style="list-style-type: none"> <li>Explain the needs and challenges for uncovering hidden data</li> <li>Explain strategies for extracting hidden data</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 3, Unit 2:</b> Tools for Hidden Data Extractions	<ul style="list-style-type: none"> <li>Evaluate tools for hidden data extraction</li> <li>Extract hidden data from applications</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	And software for data analysis	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 4, Unit 1:</b> Report Production Methods	<ul style="list-style-type: none"> <li>Evaluate report production methods</li> <li>Use different report production methods</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 4, Unit 2:</b> Economy of Report Production	<ul style="list-style-type: none"> <li>Apply cost models for report production in BI</li> <li>Apply strategies for reducing report production costs</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	And software for data analysis	Assignment 2:	5
<b>Module 5, Unit 1:</b>	<ul style="list-style-type: none"> <li>Distinguish between desktop and mobile BI</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5

Modules and Units	ILOs—By the end of this unit, you will be able to	Teaching Approaches/Methods	Learning Activities	Resources/Learning Devices	Assessments	Hours of Study Required
Desktop Versus Mobile Bi	<ul style="list-style-type: none"> <li>Investigate the challenges and promises of mobile BI</li> </ul>		assigned activities			
<b>Module 5, Unit 2:</b>  Tools and techniques for mobile BI	<ul style="list-style-type: none"> <li>Analyse mobile BI tools</li> <li>Apply tools and techniques for mobile BI</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	And software for data analysis	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 6, Unit 1:</b>  Needs and challenges for replacing BI systems	<ul style="list-style-type: none"> <li>Explain the needs and challenges of replacing BI systems</li> <li>Devise strategies for replacing BI systems</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	Generic Resources	Self-Assessment Exercise: 5 multiple choice questions	5
<b>Module 6, Unit 2:</b>  Tools for replacing BI systems	<ul style="list-style-type: none"> <li>Identify and assess tools for replacing BI systems</li> <li>Design tools for replacing BI systems</li> </ul>	<ul style="list-style-type: none"> <li>Case Studies</li> <li>Problem Solving Scenarios</li> </ul>	Read, watch video, participate in forum, do other assigned activities	And software for data analysis	Assignment 3	5