AMERICAN UNIVERSITY OF NIGERIA

SCHOOL OF IT & COMPUTING (SITC)

UNDERGRADUATE CATALOG

2022 – 2025

SITC Undergraduate Catalog Disclaimer

SITC makes every reasonable effort to provide accurate information in this catalog. This catalog is effective from 2022 academic year and the content is subject to change. Its purpose is to provide current students and other interested persons with information about the school. All changes will be effective as authorized by the appropriate offices. It is the student's responsibility to remain aware of expectations for his/her level of study.

Contents

Dean's Message 7

School of IT & Computing 8

Minor in Information Management & Technology 8

Bachelor of Science Degree Program Requirement 10

General Education Requirement (50 credits)....11

Writing and Mathematics Requirement*.... 12

Free Electives.... 12

BACHELOR OF SCIENCE (B.Sc.) IN COMPUTER SCIENCE 13

AIM 13

OBJECTIVES 13

Bachelor of Science in Computer Science Program Requirement 14

Computer Science Concentration Areas 14

Generic....14

Artificial Intelligence.... 15

Cryptocurrencies & Blockchain.... 15

Networks & Distributed Computing....15

Web and Mobile Application Development....15

FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN COMPUTER SCIENCE 17

FIRST YEAR.... 17

SECOND YEAR....18

THIRD YEAR....19

FOURTH YEAR.... 20

BACHELOR OF SCIENCE (B.Sc.) IN DATA SCIENCE & ANALYTICS 21

AIM 21

OBJECTIVES 21

Bachelor of Science in Data Science & Analytics Degree Program Requirement 23

Data Science & Analytics Major Electives 24

FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN DATA SCIENCE & ANALYTICS 25

FIRST YEAR.... 25

SECOND YEAR....27

THIRD YEAR....28

FOURTH YEAR.... 29

BACHELOR OF SCIENCE (B.Sc.) IN INFORMATION SYSTEMS 30

AIM 30

OBJECTIVES 30
Bachelor of Science in Information Systems Program Requirement 32
Information Systems Concentration Areas 33
Generic....33
Database Administration.... 33
Information Security and Assurance....33
Management Information Systems (MIS).... 33
Software Applications Development.... 34
FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN INFORMATION SYSTEMS 35
FIRST YEAR.... 35
SECOND YEAR....36
THIRD YEAR....37
FOURTH YEAR.... 38
BACHELOR OF SCIENCE (B.SC.) IN SOFTWARE ENGINEERING 39
AIM 39
OBJECTIVES 39
Bachelor of Science in Software Engineering Degree Program Requirement 40
Software Engineering Major Electives 41
FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN SOFTWARE ENGINEERING 42
FIRST YEAR.... 42
SECOND YEAR....43
THIRD YEAR....44
FOURTH YEAR.... 45
Course Descriptions 46
CIE 105 Principles of Programming 1 (3)....46
CIE 106 Principles of Programming 2 (3)....46
CIE 111 Introduction to Computers & Computing (3)....46
CIE 231 Introduction to Databases, Web Technologies, and Applications (3)....46
CIE 302 Principles of Operating Systems (3).... 46
CIE 321 Information Technology (IT) Project Management (3)....46
CSC 202 Data Structures and Algorithms (3)....46
CSC 213 Discrete Structures (3).... 47
CSC 214 Logic in Computer Science I (3)....47
CSC 232 Computer Organization and Architecture (3)....47
CSC 301 Systems Programming (3).... 47
CSC 314 Introductions to Data Science (3)....47

CSC 350 System Administration (3)....47
CSC 364 Design and Analysis of Algorithms (3)....47
CSC 384 Database Systems (3)....47
CSC 408 Mobile Application Development (3)....49
CSC 409 Game Development (3)....49
CSC 410 Functional Programming (3)....49
CSC 411 Open-Source Packaged Solutions (3)....49
CSC 413 Introductions to Cryptography (3)....49
CSC 414 Blockchain Innovations (3)....49
CSC 415 Advanced Programming Skills (3)....50
CSC 416 Crypto Economics (3)....50
CSC 417 Survey and Organization of Programming Languages (3)....50
CSC 423 Computer Networks and Communications (3)....50
CSC 434 Theory of Computation (3)....50
CSC 438 Internet and Web Technologies (3)....50
CSC 440 Computer Graphics and Visualization (3)....51
CSC 453 Advanced Database Systems (3)....51
CSC 456 Design of Web-based Systems (3)....51
CSC 457 Web Application Development (3)....51
CSC 465 Artificial Intelligence (3)....51
CSC 470 Numerical Analysis....52
CSC 485 Advanced Object-Oriented Analysis (3)....52
CSC 494 Research Methodologies in Computer Science (3)....52
CSC 496 Final Year Project (3)....52
CSC 497 Internship 1 (SIWES) (3)....52
CSC 499 Internship 2 (SIWES) (3)....53
DSA 201 Fundamentals of Data Science 1 (3)....53
DSA 202 Fundamentals of Data Science 2 (3)....53
DSA 231 Database System Design & Management (3)....53
DSA 288 Intensive Programming in Linux (3)....53
DSA 303 Biostatistics (3)....53
DSA 320 Financial Data Analytics (3)....53
DSA 331 Analysis of Categorical Data (3)....54
DSA 350 Computers, Society and Ethics (3)....54
DSA 370 Introduction to Artificial Intelligence (3)....54
DSA 430 Analytical and Computational Neuroscience (3)....54

DSA 435 Advanced Data Structures and Algorithm Design (3)..... 54
DSA 444 Introduction to Big Data Technologies (3)..... 55
DSA 450 Data Visualization (3)..... 55
DSA 461 Statistical Computing with SAS and R (3)..... 55
DSA 475 Machine Learning with Deep Learning (3)..... 55
DSA 478 Statistical Method in Data Science (3)..... 55
DSA 482 Fundamentals of Data Mining (3)..... 55
DSA 492 Senior Project 1 (3)..... 56
DSA 493 Senior Project 2 (3)..... 56
DSA 494 Internship 1 (SIWES) (3)..... 56
DSA 495 Internship 2 (SIWES) (3)..... 56
DSA 351 Introduction to Cybersecurity (3)..... 56
INF 102 Introduction to Information Systems (3)..... 56
INF 201 Principles of Information Systems (3)..... 57
INF 202 Data Structures and Algorithms (3)..... 57
INF 260 Systems Analysis and Design (3)..... 57
INF 302 Program Development and Implementation (3)..... 57
INF 303 E-Business Systems Development (3)..... 57
INF 310 Principles of Information Security Assurance (3)..... 57
INF 320 Applications in Information Security and Assurance (3)..... 58
INF 330 Policy and Administration in Information Security and Assurance (3)..... 58
INF 331 Database Analysis and Design (3)..... 58
INF 332 Data Communication and Networking (3)..... 58
INF 341 Enterprise Integration (3)..... 58
INF 352 Computer Crimes, Forensics, and Auditing (3)..... 58
INF 353 Database Security and Auditing (3)..... 59
INF 361 Process Modeling and Solution Blueprinting (3)..... 59
INF 402 Information Technology for Development (3)..... 59
INF 403 Information Resource Management (3)..... 59
INF 410 Database Programming (3)..... 59
INF 411 Database Analysis and Design (3)..... 59
INF 421 Client Operating System Security (3)..... 60
INF 438 Information Storage and Management Technologies (3)..... 60
INF 451 Java Support for E-Business (3)..... 60
INF 461 Information Systems Planning (3)..... 60
INF 465 Information Technology and Business Analytics (3)..... 60

INF 478 Advanced Application Development (3)..... 60
INF 485 Mobile Application Development (3).....60
INF 486 Data Administration (3)..... 60
INF 487 Systems Thinking, Modeling, and Computer Simulation (3).....61
INF 489 Web Database Driven Application Development (3)..... 61
INF 493 Internship 1(SIWES) (3).....61
INF 496 Internship 2 (SIWES) (3).....61
INF 497 Research Methodology in Information Systems (3).....61
INF 499 Final Year Project (3).....61
SEN 301 Introduction to Software Engineering (3)..... 62
SEN 306 Object Oriented Software Construction (3).....62
SEN 312 User Interface Design and HCI (3).....62
SEN 313 Human Computer Interface (3).....62
SEN 400 Professional Ethics (3).....62
SEN 405 Software Requirements Analysis and Specification (3).....63
SEN 408 Software Project Management (3)..... 63
SEN 415 Software Quality Assurance and Testing Quality (3).....63
SEN 416 Software Design and Architecture (3).....63
SEN 469 Software Testing: Verification and Validation (3).....63
SEN 470 Engineering Economics (3).....63
SEN 474 Principles of Distributed and Concurrent Software Systems (3).....64
SEN 478 Engineering of Software Sub Systems (3)..... 64
SEN 490 Software Engineering Capstone (3)..... 64
SEN 493 Students Industrial Work Experience (SIWES) (6).....64
SEN 494 Senior Design Project 1 (3).....64
SEN 495 Senior Design Project 2 (3).....64
SEN 496 Internship 1(SIWES)..... 65
SEN 497 Internship 2 (SIWES)..... 65
SITC FACULTY 66



Dean's Message

Welcome to the exciting world of IT and Computing at the American University of Nigeria (AUN). We invite you to join us as we embark on a journey that will equip you with the skills and knowledge you need to succeed in a rapidly evolving field.

IT and Computing are integral to every aspect of our lives, from the devices we use to the businesses and organizations we work for. As students of this revolutionary discipline, you will have the opportunity to develop the skills necessary to make a real difference in the world by learning from distinguished faculty and leading experts. We have in the School of Information Technology and Computing (SITC) four fundamental programs: Information Systems, Computer Science, Software Engineering, and Data Science and Analytics.

With the advances in technologies, especially the internet, computing technologies have become very popular. In our School, we have faculty from various countries like - Turkey, India, Russia, and France. We also have faculty from Nigeria and Cameroon, and they are all qualified faculty.

Our curriculum and teaching methods are designed to produce graduates with a solid foundation in Computing and practical industry skills so they can take advantage of the expanding global opportunities to emerge leaders, experts and researchers in a variety of emerging fields, including data science, machine learning, algorithms and complexity, artificial intelligence, information security and assurance, software application development, and many others.

Since 2005, we have been educating the brightest and best students from all over Nigeria and the African Continent for industry and academics. Our alumni are distinguishing themselves as innovators, entrepreneurs, and researchers, and they are providing leadership in the ICT industry by bridging the digital divide and income disparity between Africa and much of the world. We are pacesetters in IT and Computing, having pioneered the introduction of Software Engineering, Information Science, Data Science & Analytics curriculum to the Nigerian education system.

We are proud that AUN-SITC has emerged as a one-stop shop for undergraduate and graduate computing degree programs, for young people in and outside Nigeria. In addition, we also offer online Professional Master's degree programs in Information & Communication Science and Telecommunication & Wireless Technologies. These two are designed for working professionals to update their industry skills and knowledge and give students an advantage in emerging new areas.

AUN has a world-class computing infrastructure, high bandwidth fiber-optic and wireless Internet connectivity across the entire campus, and a robust data center supporting a suite of server-based open-source applications assembled by SITC faculty and their students that power the university's major operations; an Enterprise Resource Planning system (OpenERP) and the Canvas Learning Management System. Our American-style liberal arts curriculum which incorporates across curriculum and Community Service Learning enables our graduates to develop critical thinking and problem solving abilities which sets them apart from their contemporaries. Welcome to the School of IT & Computing, come and explore boundless opportunities at Africa's Premier Development University, AUN.

Özcan Asilkan
Professor & Dean, School of IT & Computing

School of IT & Computing

The School of IT & Computing (SITC) is a flagship school and an important pillar in AUN's mission as a Development University. Currently we offer the following undergraduate degree programs along with their concentrations:

B.Sc. Computer Science

Concentrations:

- Artificial Intelligence
- Cryptocurrencies & Blockchain
- Networks & Distributed Computing
- Web and Mobile Application Development
- Computer Systems and Applications

B. Sc. Information Systems

Concentrations:

- Generic (general studies)
- Database Administration
- Information Security & Assurance
- Management Information Systems
- Software Application Development

B.Sc. Software Engineering

B.Sc. in Data Science & Analytics

We also offer a minor in Information Management & Technology. This minor is tailored to support students of other majors, such as in the Schools of Business, Arts, and Sciences, where information technology (IT) skills can make all the difference in the student's career path.

Minor in Information Management & Technology

With the all-important role computers and IT play in today's workplace, this minor provides students with a distinctive edge and opportunity to differentiate themselves from their peers in the marketplace from day one. It offers a balanced combination of traditional IT and analytics.

A student must complete a total of 18 credit hours including the major program credit hours requirements to be eligible to receive a **Minor in Information Management & Technology.**

12 credits of the Minor Core are required.

Course Code	Course Title	Credit Hours
CIE 105	Principles of Programming I	3
INF 201	Principles of Information Systems	3
CIE 231	Introduction to Databases, Web Technologies, and Applications	3
INF 102	Introduction to Information Systems	3

Two (6 credits) other information management and technology minor electives from the list below are required.

Course Code	Course Title	Credit Hours
CIE 106	Principles of Programming II	3
CIE 321	Information Technology (IT) Project Management	3
INF 310	Principles of Information Security Assurance	3
INF 352	Computer Crimes, Forensics, and Auditing	3
INF 465	Information Technology and Business Analytics	3

The general philosophy of our computing degree programs is to produce computer science graduates who are not just ready for the growing pool of careers in the field but who can leverage and adapt computing technology to the needs of Nigeria and the Sub-Sahara Africa region and continue to expand the frontiers of the field through relevant research and practice.

Since AUN was launched, SITC has already earned its place as a leader in ICTs in Nigeria and Sub-Saharan Africa. Many of our graduates have completed Masters and Ph.D. programs from world-class universities such as Carnegie Mellon, Columbia, Georgetown in DC, Alberta University in Canada, Osaka University in Japan, and South-bridge in South Korea. A good number of graduates from SITC are entrepreneurs in the IT industry in Nigeria, running their own IT companies as CEOs. SITC boasts a world-class expatriate faculty and an IT and Internet infrastructure not found in any other university in Nigeria. We are poised to become that one-stop-shop and center of excellence for computing degree programs, including the all-important area of Data Science and Analytics.

As computers continue to penetrate every aspect of modern life, the computing sector, especially software engineering and data science, are already the largest area of employment in the USA and emerging economies like India and China. From 2021 to 2031, it is anticipated that employment of software developers, quality assurance analysts, and testers will increase overall by 25%, which is substantially faster than the average for all jobs. Over the next ten years, there will, on average, be about 162,900 opportunities for software developers, quality assurance analysts, and testers (Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2022). Data scientists' employment is expected to increase by 36% between 2021 and 2031, which is substantially faster than the average for all occupations. Over the next ten years, there are expected to be, on average, 13,500 job openings for data scientists (Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2022).

Graduates of the AUN computing programs will be prepared for careers in Computer Science, Software Engineering, Information Systems and Data Science & Analytics. Some of the possible job titles our graduates can expect to hold include:

- Programmer
- Systems Analyst
- Security Analyst
- Software Developer
- Web Developer
- Software Consultant
- Systems Administrator
- Software Consultant
- Software Engineer
- Systems Architect
- Data Scientist
- IT Project Manager

- Systems Engineer
- IT Director
- Computer Scientist
-

They can also expect to contribute in:

- Consulting Engineering Firms
- Engineering Sales
- The Ministry of Communications
- Research & Development

All SITC students are required to successfully complete the following credit hour breakdown to meet the minimum four-year program. Students should meet with their faculty advisor/ chair for further consultation.

BACHELOR OF SCIENCE REQUIREMENT						
Major Programs	**Major**					**Overall Graduation Requirement**
	GENED	**CORE**	**Free Electives**	**Major Electives**	**Concentration Electives**	
	Minimum Total Credit Hours					
Computer Science	50+1*	63	9	-	6	**129**
Data Science & Analytics	50+1*	63	9	6		**129**
Information Systems	50	66	9	-	6	**131**
Software Engineering	50+1*	66	9	6	-	**132**

*All SITC student except for IS majors are strongly encouraged to enroll in two 4-credit hour courses to satisfy Natural & Physical Sciences which is a total of 8 credit hours and not 7 credit hours as listed in General Education requirements.

	Credit Hour Load Breakdown			
	CS	**DSA**	**IS**	**SEN**
Year 1	**31**	**32**	**31**	**31**
Year 2	**32**	**34**	**33**	**32**
Year 3	**33**	**33**	**34**	**36**
Year 4	**33**	**30**	**33**	**33**

Bachelor of Science Degree Program Requirement

All SITC students must complete the University wide required General Education program (50 credits). This program supports a Liberal Arts experience that prepares students for success in their majors and personal & professional lives after graduation.

General Education Requirement (50 credits)

This general education requirement below is specific to **School of IT & Computing** programs.

Students are required to complete all General Education courses as listed below.

Discipline	Course Code	Course Title	Credit Hours
First Year Experience (Total 1 credit)	AUN 101	First Year Experience	1
Arts and Humanities (Total 9 credits)	GEN 102 GEN 103 PHI 300	Nigerian Peoples and Culture History and Philosophy of Sc. Ethics and Leadership	3 3 3
Community Service (Total 3 credits)	CDV 2XX	Community Development	3
Critical Thinking and Problem Solving (Total 3 credits)	AUN 300	Critical Thinking and Problem Solving	3
Entrepreneurship (Total 6 credits)	ENT 101 ENT 201	Introduction to Entrepreneurship Entrepreneurship 2	3 3
Information Technology (Total 3 credits)	CIE 111	Introduction to Computers and Computing	3
Mathematics* and Statistics (Total 6 credits)	MAT 110/MAT112/MAT 210 **(MAT 210 for all SITC programs except IS majors)/**STA 101	Pre-Algebra/Pre-Calculus/ Calculus I Introduction to Statistics I	3 3
Natural and Physical Sciences** (Total 7 credits)	**PHY 131/PHY 205 required for all SITC programs - except IS** **PHY 132/206 (4 credits) required for all SITC programs - except IS**	Refer to Course Description	4 3+1
Social Behavioral Sc. (Total 6 credits)	***ECO 101 – required*** ANT/CIV/ECO/HIS/ICP/SOC/PSY	Refer to Course Description	3 3
Writing* (Total 6 credits)	WRI 101 and WRI 102	Composition I Composition II	3 3
		TOTAL	**50+1**
**SITC students are strongly encouraged to complete two four (4) credit hours of Natural & Physical Sciences as a General Education requirement to reach the minimum total overall graduating credit hours required hence a total of 51 total credits of GENED is earned.			

Writing and Mathematics Requirement*

Dependent on the results of the placement test, this will determine the number of courses required.

If a student is placed in…		**Credit Hours**
WRI 100 Intro. to Compositions	*This is a non-university credit bearing course and does NOT count towards the overall total graduation credits required. This course does not satisfy GENED requirement. Upon successful completion, a student must enroll in WRI 101.*	*0*
MAT 100 Pre-Algebra	*This is a non-university credit bearing course and does NOT contribute towards the overall total graduation credits required. This course does not satisfy GENED requirement. Upon successful completion, a student will enroll in MAT 110.*	*0*
MAT 110 University Algebra	This course does not satisfy GENED requirement for all SITC programs except for IS major. ***NOTE – this course may satisfy FREE ELECTIVE (min. C grade required). Consult with program chair.***	3
MAT 112 Pre-Calculus	This course does not satisfy GENED requirement except for IS major. ***NOTE – this course may satisfy FREE ELECTIVE (min. C grade required). Consult with program chair.***	3
MAT 210 Calculus I	This course satisfies GENED requirement.	3

Free Electives

Free electives are required by all SITC students, a minimum of 9 credits is required as part of the degree program.

Requirement	Course Code	Course Title	Credit Hours
FREE ELECTIVES (min. 9 credits)	XXX xxx	Visit program chair	1-4
	XXX xxx		1-4
	XXX xxx		1-4

BACHELOR OF SCIENCE (B.Sc.) IN COMPUTER SCIENCE

AIM

The program is designed to produce graduates who demonstrate understanding of the fundamentals of computing theory, are sufficiently equipped with practical computing skills and can optimally marry both the theory and practice to provide computational solutions to problems in industries, business, commerce, education, medicine, government, agriculture, and the society in general; and can contribute to development and research in these areas.

OBJECTIVES

The detailed objectives are to:

- ✔ produce graduates ready for graduate and other advance courses in computer science and or related areas, thus supporting development and research in these areas.
- ✔ produce graduates capable of applying computer science, computer technology and information technology in solving problems arising in industries, business, commerce, education, medicine, government, and the society in general.
- ✔ provide suitable service courses for specialists in other disciplines to enable these specialists to increase their competences, skills, and level of proficiency in their different fields.
- ✔ engender new developments in computer science with a view to nurturing interest in entrepreneurship and growing the abilities of potential graduates to create wealth and become employers of labor using information technology.
- ✔ serve as a foundation program for our other computing and IT related programs that serve as key pillars to the university's mission as a development university.

Bachelor of Science in Computer Science Program Requirement

The Bachelor of Science in Computer Science requires a minimum of 129 graduation credit hours. Computer Science majors are required to successfully complete the major core courses including Free Electives as outlined:

Requirement	Course Code	Course Title	Credit Hours
MAJOR CORE (63 credits)	CIE 105	Principles of Programming I	3
	CIE 106	Principles of Programming II	3
	CIE 231	Introduction to Databases, Web Technologies & Applications	3
	CIE 302	Principles of Operating Systems	3
	CIE 321	Information Technology (IT) Project Management	3
	CSC 202	Data Structures & Algorithms	3
	CSC 213	Discrete Structures	3
	CSC 214	Logic in Computer Science	3
	CSC 232	Computer Organization & Architecture	3
	CSC 364	Design & Analysis of Algorithms	3
	CSC 384	Database Systems	3
	CSC 423	Computer Networks and Communications	3
	CSC 434	Theory of Computation	3
	CSC 440	Computer Graphics and Visualization	3
	CSC 465	Artificial Intelligence	3
	CSC 494	Research Methodologies in Computer Science	3
	CSC 496	Final Year Project	3
	CSC 497	Internship 1 (SIWES)	3
	CSC 499	Internship 2 (SIWES)	3
	MAT 211	Calculus II	3
	SEN 301	Introduction to Software Engineering	3
	ECO 101	***These courses satisfy GENED requirement. Refer to GENED list of courses.***	***3***
	PHY 131/PHY 205		***4***
	PHY 132/PHY206		***4***

Computer Science Concentration Areas

Computer Science students are required to complete (6) credit hours in one of the five (5) concentration areas listed below. A student's concentration area will be indicated in his or her diploma.

The concentration areas are as follows:

Generic

Requirement	
CONCENTRATION ELECTIVES (6 credits)	Student may choose from any courses listed in the concentrations. Visit program chair for course consultation.

Artificial Intelligence

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	CSC 401	Machine Learning Algorithms	3
	CSC 402	Data Science	3
	CSC 466	Symbolic Artificial Intelligence	3

Cryptocurrencies & Blockchain

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	CSC 403	Blockchain Technologies	3
	CSC 404	Cyber Security	3
	CSC 413	Introduction to Cryptography	3
	CSC 414	Blockchain Innovations	3
	CSC 416	Crypto Economics	3

Networks & Distributed Computing

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	CSC 404	Cyber Security	3
	CSC 405	Cloud Computing	3
	CSC 406	Internet of Things	3
	CSC 413	Introduction to Cryptography	3

Web and Mobile Application Development

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	CSC 408	Mobile Application Development	3
	CSC 409	Game Development	3
	CSC 438	Internet and Web Technologies	3
	CSC 456	Design of Web-based Systems	3
	CSC 457	Web Application Development	3

Computer Systems and Applications

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	CSC 410	Functional programming	3
	CSC 411	Open-Source Packaged Solutions	3
	CSC 415	Advanced Programming Skills	3
	CSC 417	Survey and Organization of Programming Languages	3

For more information about concentration electives, visit your program chair for further consultation.

FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN COMPUTER SCIENCE

FALL & SPRING ADMISSION

This study plan is meant as a guide only.

This study plan assumes no remedial courses (WRI 100, MAT 100). Due to staff and scheduling changes, some courses may not be offered during the semesters indicated. Please check with your faculty and academic advisors along with your program chair each semester to be up to date with changes to the study plan.

FIRST YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
1	WRI 101	Writing Composition I	3	Placement Test	GENED
	MAT 210	Maths & Statistics Mathematics	3	MAT 112 or Placement Test	GENED
	CIE 111	Info.Technology Introduction to Computers & Computing	3	None	GENED
	AUN 101	First Year Experience First year experience	1	None	GENED
	ENT 101	Entrepreneurship Intro. to Entrepreneurship	3	None	GENED
	GEN 102 or GEN 103	Arts & Humanities Select one	3	None	GENED
		Total	**16**		
2	CIE 105	Principles of Programming I	3	CIE 111	CORE
	STA 101	Maths & Statistics Intro. to Statistics	3	MAT 110	GENED
	WRI 102	Writing Composition II	3	WRI 101	GENED
	ANT/CIV/ ECO/HIS/ICP /PSY/SOC	Social & Behavioral Sciences ECO 101 – required	3	Refer to course description	GENED
	GEN 102 or GEN 103	Arts and Humanities Select one	3	None	GENED
		Total	**15**		

SECOND YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
3	CIE 106	Principles of Programming II	3	CIE 105	CORE
	CSC 213	Discrete Structures	3	CIE 105	CORE
	BIO/CHE/GEO /NES/PHY	Natural & Physical Sc. *PHY 205 or PHY131* required (Lab)	4	Refer to course description	GENED
	CDV 2XX	Community Service select one	3	None	GENED
	MAT 211	Calculus II	3	MAT 210	CORE
		Total	**16**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
4	CSC 202	Data Structures and Algorithms	3	CIE 106	CORE
	BIO, CHE. GEO, NES, PHY	Natural and Physical Science *PHY 206 or PHY132 Required*	4	Refer to course description	GENED
	CSC 232	Computer Organization and Architecture	3	CIE 105	CORE
	CSC 214	Logic in Computer Science	3	CSC 213	CORE
	CIE 231	Introduction to Databases, Web Technologies & Applications	3	CIE 106	CORE
		Total	**16**		

THIRD YEAR

Semester	Course code	Course Title	Credit Hours	Prerequisites	Requirement
5	PHI 300	Arts and Humanities Ethics & Leadership	3	3rd year standing	GENED
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	CSC 364	Design & Analysis of Algorithms	3	CSC 202	CORE
	CIE 302	Principles of Operating Systems	3	CIE 106	CORE
	CIE 321	Information Technology (IT) Project Management	3	CIE 106	CORE
	CSC 384	Database Systems	3	CSC 202 & CIE 231	CORE
		Total	**18**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
6	CSC 497	Internship 1 (SIWES)	3	3rd year standing	CORE
	CSC 494	Research Methodologies in Computer Science	3	3rd year standing	CORE
	AUN 300	Critical Thinking & Problem Solving Critical Thinking & Problem Solving	3	3rd year standing	GENED
	SEN 301	Intro. to Software Eng.	3	CIE 231	CORE
	ENT 201	Entrepreneurship Entrepreneurship 2	3	ENT 101	GENED
		Total	**15**		

FOURTH YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
7	CSC 423	Computer Networks and Communications	3	4th year standing	CORE
	CSC 434	Theory of Computation	3	CSC 364	CORE
	CSC 440	Computer Graphics and Visualization	3	CSC 364	CORE
	CSC 465	Artificial Intelligence	3	CSC 364	CORE
	CSC 496	Final Year Project	3	CSC 494	CORE
	CSC 499	Internship 2 (SIWES)	3	CSC 497	CORE
		Total	**18**		

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
8	XXX xxx	See Concentration Elective list	3	4th year standing	CONCENTRATION ELECTIVE
	XXX xxx	Visit program chair	3	None	FREE ELECTIVE
	XXX xxx	See concentration list	3	4th year standing	CONCENTRATION ELECTIVE
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	ANT/CIV/ECO/ HIS/ICP/ PSY/SOC	Social & Behavioral Sc. Select one	3	None	GENED
		Total	**15**		

BACHELOR OF SCIENCE (B.Sc.) IN DATA SCIENCE & ANALYTICS

AIM

The Data Science and Analytics programme aims at introducing students to the basic principles and tools to solve real-world data related problems. Students will learn the concepts, techniques, and tools needed to deal with various facets of data science practices. Working with data requires the mastery of a variety of skills and concepts, including fields such as probability, statistics, mathematics, and computational science.

The Data Science and Analytics Programme has the advantage of combining fields of probability, statistics, mathematics, machine learning, databases, and modern programming languages such as R, Python, and MATLAB. This multidisciplinary program will provide students with tools for extracting knowledge from data originating from any source. Decision-makers can then use this knowledge to make evidence-based decisions in the government, business, and private sector.

OBJECTIVES

The objectives of the programme are to:

- Establish a career as a data scientist who possesses analytical tools for extracting knowledge from data originating from any source.

- Thoroughly analyze complex data sets in various domains and effectively communicate the results to domain specialists in solving real world problems.

- Adhere to high standards of conduct, practice, and qualifications of the data science profession for national and international standards.

Learning Outcomes:

a) Regime of Subject Knowledge

- Obtain, clean/process, and transform data
- Analyze and interpret data using an ethically responsible approach
- Apply quantitative modeling and data analysis techniques to the solution of real-world business problems, communicate findings, and effectively present results using data visualization techniques.
- Apply computing theory, languages, and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses
- Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues

b) Competences and Skills

- Demonstrate a broad insight, understanding and intuition of the whole process line of extracting knowledge from data
- Formulate and use appropriate models of data analysis to solve hidden business -related challenges
- Employ cutting-edge tools and technologies to analyze Big Data.
- Apply algorithms to build machine intelligence.

- Demonstrate team working and leadership skills, decision making and organization theory.
- Present data findings effectively to any audience, orally, visually, and in written formats

c) Behavioral Attributes

- Demonstrate an understanding of cultural and global perspectives as they apply to all forms of enterprise, the management of information, and communications with a wide range of stakeholders
- Articulate and evaluate appropriate legal and ethical standards pertaining to all forms of communications and network security
- Ability to communicate and collaborate effectively with a range of audiences.
- Understand professional, ethical, legal, security and social issues and responsibilities.

Overall Program Focus:

The focus of the Data Science program is to develop a work force with necessary computational thinking and data analysis skills to meet the demand of data scientists across all the industry sectors, from healthcare and technology to education, agriculture, finance, business, entrepreneurship, transportation, and beyond.

Related Fields:

i. Computer Science
ii. Statistics
iii. Mathematics
iv. Operation Research
v. Economics
vi. Machine Learning
vii. Business Intelligence

Primary Areas of Specialization:

I. Data Engineering and Data Warehousing
II. Data Mining and Statistical Analysis
III. Big Data
IV. Database Management
V. Business Intelligence and Strategy
VI. ML / Cognitive Computing Development
VII. Data Visualization and Presentation
VIII. Operations-Related Data Analytics
IX. Market-Related Data Analytics
X. Sector-Specific Data Analytics (Healthcare, Finance, Insurance, etc.)

Bachelor of Science in Data Science & Analytics Degree Program Requirement

The Bachelor of Science in Data Science & Analytics requires a minimum of 129 graduation credit hours. In addition to the General Education requirements, Data Science & Analytics majors are required to successfully complete the courses listed below:

Requirement	Course Code	Course Title	Credit Hours
CORE (63 credits)	CIE 105	Principles of Programming I	3
	CIE 106	Principles of Programming II	3
	MAT 244	Introduction to Probability Theory	3
	DSA 201	Fundamentals of Data Science I	3
	DSA 202	Fundamentals of Data Science II	3
	DSA 231	Database System Design & Management	3
	DSA 288	Intensive Programming in Linux	3
	DSA 303	Biostatistics	3
	DSA 331	Analysis of Categorical Data	3
	DSA 350	Computers, Society and Ethics	3
	DSA 370	Introduction to Artificial Intelligence	3
	DSA 435	Advanced Data Structures and Algorithm Design	3
	DSA 444	Introduction to Big Data Technologies	3
	DSA 450	Data Visualization	3
	DSA 475	Machine Learning with Deep Learning	3
	DSA 478	Statistical Methods in Data Science	3
	DSA 482	Fundamentals of Data Mining	3
	DSA 492	Senior Project 1	3
	DSA 493	Senior Project 2	3
	DSA 494	Internship 1 (SIWES)	3
	DSA 495	Internship 2 (SIWES)	3
	ECO 101	***These courses satisfy GENED requirement. Refer to GENED list of courses.***	***3***
	PHY 131/PHY 205		***4***
	PHY 132/PHY206		***4***

Data Science & Analytics Major Electives

Data Science & Analytics students should consult with their Chair in selecting elective courses that will augment their program of study and their preparation for careers. Students may choose any two (2) from the list below as major electives (6 credit hours). Additionally, Data Science & Analytics students are encouraged to use most of their free elective credits to specialize further in a specific area of Data Science & Analytics.

Requirement	Course Code	Course Title	Credit Hours
MAJOR ELECTIVES (6 credits)	DSA 320	Financial Data Analytics	3
	DSA 351	Introduction to Cybersecurity	3
	DSA 430	Analytical and Computational Neuroscience	3
	DSA 461	Statistical Computing with SAS and R	3

Upon completion of all degree requirements, students will receive a Bachelor of Science degree in Data Science & Analytics.

FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN DATA SCIENCE & ANALYTICS

This study plan is a guide only.

This study plan does not reflect remedial courses (MAT 100/WRI 100). Due to faculty and scheduling changes, some courses may not be offered during the semesters indicated. Please check with your faculty and academic advisors along with your program chair each semester to be up to date with changes to the study plan.

FALL & SPRING ADMISSION

FIRST YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
1	WRI 101	Writing Composition 1	3	None	GENED
	MAT 210	Maths & Statistics Mathematics	3	MAT 112 or Placement Test	GENED
	CIE 111	Information Technology Introduction to Computers and Computing	3	None	GENED
	GEN 102/ GEN 103	Arts and Humanities (Select one)	3	Refer to course description	GENED
	AUN 101	First Year experience First Year Experience	1	None	GENED
	ENT 101	Entrepreneurship Introduction to Entrepreneurship	3	None	GENED
		Total	**16**		
2	WRI 102	Writing Composition II	3	WRI 101	GENED
	ECO 101	Social & Behavioral Sciences ECO 101 - required	3	None	GENED
	PHY 131/PHY 205	Natural and Physical Sciences (Lab) Select one	4	None	GENED
	GEN 103/ GEN 102	Arts and Humanities (Select one)	3	Refer to course description	GENED
	CIE 105	Programming Principles I	3	CIE 111	CORE
		Total	**16**		

SECOND YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
3	CIE 106	Programming Principles II	3	CIE 105	CORE
	PHY 132/PHY 206	Natural and Physical Sciences (Lab) Select one	4	*PHY 131/PHY 205*	GENED
	STA 101	Maths and Statistics Introduction to Statistics	3	MAT 110 or higher	GENED
	DSA 201	Fundamentals of Data Science I	3	CIE 105	CORE
	ANT/CIV/ECO/HIS/ICP/PSY/ SOC	Social & Behavioral Sc. Select one	3	Refer to course description	GENED
		Total	**16**		
Semester	**Course Code**	**Course Title**	**Credit Hours**	**Prerequisites**	**Requirement**
4	PHI 300	Arts and Humanities Ethics and Leadership	3	3rd year standing	GENED
	CDV 2XX	Community Service Select one	3	2nd year standing	GENED
	DSA 202	Fundamentals of Data Science II	3	DSA 201	CORE
	MAT 244	Introduction to Probability Theory	3	MAT 210	CORE
	DSA 231	Database System Design & Management	3	CIE 106	CORE
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
		Total	**18**		

THIRD YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
5	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	DSA 203	Biostatistics	3	STA 101	CORE
	AUN 300	Critical Thinking and Problem Solving / Critical Thinking and Problem Solving	3	3rd year standing	GENED
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	DSA 331	Analysis of Categorical Data	3	DSA 202	CORE
		Total	**15**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
6	DSA XXX	Elective I	3	2nd Year Standing	MAJOR ELECTIVE
	DSA 288	Intensive Programming in Linux	3	CIE 106	CORE
	DSA 494	Internship 1 (SIWES)	3	3rd year standing	CORE
	DSA 370	Introduction to Artificial Intelligence	3	DSA 202	CORE
	DSA 350	Computers, Society and Ethics	3	WRI 102	CORE
	ENT 201	Entrepreneurship	3	ENT 101	GENED
		Total	**18**		

FOURTH YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
7	DSA 478	Statistical Methods in Data Science	3	3rd Year Standing	CORE
	DSA 435	Advanced Data Structures and Algorithm Design	3	DSA 331	CORE
	DSA 492	Senior Project 1 - Technical Report Writing	3	3rd Year Standing	CORE
	DSA 482	Fundamentals of Data Mining	3	DSA 370	CORE
	DSA 494	Internship 2 (SIWES)	3	DSA 494	CORE
		Total	**15**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
8	DSA 450	Data Visualization	3	DSA 370	CORE
	DSA 475	Machine Learning with Deep Learning	3	DSA 370	CORE
	DSA 444	Introduction to Big Data Technologies	3	DSA 231	CORE
	DSA XXX	Elective II	3	3rd Year Standing	MAJOR ELECTIVE
	DSA 493	Senior Project-II	3	DSA 492	CORE
		Total	**15**		

BACHELOR OF SCIENCE (B.Sc.) IN INFORMATION SYSTEMS

AIM

The Information Systems programme aims to produce graduates who can integrate information technology solutions and business processes to meet the information needs of businesses and other enterprises, enabling them to achieve their objectives effectively and efficiently. This discipline's perspective on information technology emphasizes information and views technology as an instrument for generating, processing, and distributing information.

OBJECTIVES

The objectives of the programme are to:

- Provide students with a broad and balanced foundation of Information Systems knowledge and practical skills.
- Develop in students a range of transferable and applicable skills of information technology to business organizations and other aspects of human endeavor.
- Develop students for the purpose of self-employment and job placements in the government and industry.
- Generate in students an appreciation of the importance of information systems in an industrial, economic, technological, and sociological context.
- Develop students through a sound foundation in information technology as a basis for further studies in information systems or multi-disciplinary studies involving information systems.
- Prepare students for professional careers in Information Systems.
- Develop student with strong analytical and critical thinking skills to thrive within the complex competitive global environment.
- Develop students with strong ethical principles and interpersonal communication skills.
- Develop students with strong skills and project management.

The Information Systems program provides students with a solid foundation in information technology principles and information management practice. The emphasis is leveraging IT to derive information for management decision-making at all levels, rather than the computer and computing mechanisms. The core courses for the information systems major include principles of information systems, programming, operating systems, database design, data analytics, data applications, systems analysis, and design information security and project management. Students also take statistics, operations management, IT organizations, and financial systems courses.

Each graduate of the program should be able to analyze, design, and implement high-quality software solutions to "real life" problems; orally present developed software projects; develop software solutions completely observing professional and engineering/cultural, ethical obligations; function effectively in team-oriented cooperative work; pursue independent continuous learning, and have a solid background in basic IS Knowledge.

Students may also decide to pursue a general B.Sc. degree in Information Systems with no concentration by selecting appropriate courses of interest from the concentration areas. The major is designed to prepare students for professional careers in the discipline of Information

Systems/Technology. Through required and elective courses and a concentration, students will be prepared for career positions such as:

- Application Programmers
- Systems Analysts
- Software Analysts
- Network Analysts
- Security Analysts
- Information Security Professionals
- Database Analysts
- Database Administrator
- Network Administrator
- IT Project Manager
- IT Consultant
- Application Support Specialist
- Network Integration Specialist
- Client/Server Analysts
- Project Technologist

The curriculum prepares students for top notch graduate study in IT, business, and other related fields. The ubiquitous nature of computing in everyday life and other professions means that graduates of our IS program can also pursue careers in other application areas needing computing skills.

Bachelor of Science in Information Systems Program Requirement

The Bachelor of Science in Information System requires a minimum of 132 graduation credit hours.

In addition to the General Education requirements, Information Systems students are required to successfully complete the CORE courses listed.

Requirement	Course Code	Course Title	Credit Hours
CORE (66 credits)	CIE 105	Principles of Programming I	3
	CIE 106	Principles of Programming II	3
	CIE 231	Introduction to Databases, Web Technologies, & Applications	3
	CIE 302	Principles of Operating Systems	3
	CIE 321	Information Technology Project Management	3
	INF 102	Introduction to Information Systems	3
	INF 201	Principles of Information Systems	3
	INF 202	Data Structures and Algorithms	3
	INF 260	System Analysis and Design	3
	INF 303	E-Business Systems Development	3
	INF 310	Principles of Information Security Assurance	3
	INF 332	Data Communication and Networking	3
	INF 341	Enterprise Integration	3
	INF 352	Computer Crimes, Forensics, and Auditing	3
	INF 361	Process Modeling and Solution: Blueprinting	3
	INF 402	Information Technology for Development	3
	INF 487	Systems Thinking, Modeling, and Computer Simulation	3
	INF 493	Internship 1 (SIWES)	3
	INF 496	Internship 2 (SIWES)	3
	INF 497	Research Methodology in Information Systems	3
	INF 499	Final Year Project	3
	MGT 201	Principles of Management	3
	ECO 101	***This course is mandatory for all SITC students.*** ***This course satisfies GENED requirement.*** ***Refer to GENED list of courses and study plan.***	***3***

Information Systems Concentration Areas

Information Systems students are required to complete (6) credit hours in one of the five (5) concentration areas listed below. Students can also elect to declare their concentration area as 'Generic' and complete six (6) credits from any of the concentration areas listed below. A student's concentration area will be indicated in his or her diploma.

There are five (5) main concentration areas in the Information Systems major. Students can choose from any of the following:

Generic

Requirement	
CONCENTRATION ELECTIVES (6 credits)	Student may choose from any courses listed in the concentrations. Visit program chair for course consultation.

Database Administration

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	INF 353	Database Security and Auditing	3
	INF 410	Database Programming	3
	INF 411	Database Analysis and Design	3
	INF 486	Database Administration	3

Information Security and Assurance

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	INF 320	Applications in Information Security and Assurance	3
	INF 330	Policy & Administration in Information Security & Assurance	3
	INF 353	Database Security and Auditing	3
	INF 403	Information Resource Management	3
	INF 421	Client Operating Systems Security	3

Management Information Systems (MIS)

Requirement	Course Code	Course Title	Credit Hours
CONCENTRATION ELECTIVES (6 credits)	INF 302	Program Development and Implementation	3
	INF 403	Information Resource Management	3
	INF 438	Information Storage and Management Technologies	3
	INF 461	Information Systems Planning	3
	INF 465	Information Technology and Business Analytics	3

Software Applications Development

Requirement	Course Code	Course Title	Credit Hours

CONCENTRATION ELECTIVES (6 credits)	INF 302	Program Development and Implementation	3
	INF 451	Java Support for E-Business	3
	INF 478	Advanced Application Development	3
	INF 485	Mobile Application Development	3
	INF 489	Web Database Driven Application Development	3
	XXX xxx	Any programming course – visit program chair	3

For more information about concentration electives, visit your program chair for further consultation.

FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN INFORMATION SYSTEMS

This study plan is a guide only.

This study plan does not reflect remedial courses (MAT 100/WRI 100). Due to faculty and scheduling changes, some courses may not be offered during the semesters indicated. Please check with your faculty and academic advisors along with your program chair each semester to be up to date with changes to the study plan.

FALL & SPRING ADMISSION

FIRST YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
1	WRI 101	Writing Composition 1	3	Placement Test	GENED
	MAT 110/ MAT 112/ MAT 210	Maths & Statistics Mathematics	3		GENED
	CIE 111	Information Technology Introduction to Computers and Computing	3	None	GENED
	AUN 101	First Year experience First Year Experience	1	None	GENED
	ENT 101	Entrepreneurship Intro. to Entrepreneurship	3	None	GENED
	BIO/CHE/ GEO/NES/ PHY	Natural and Physical Science Select one	3	None	GENED
		Total	**16**		
2	WRI 102	Writing Composition II	3	WRI 101	GENED
	ANT/CIV/ ECO/HIS/ICP/ PSY/SOC	Social & Behavioral Sciences ECO 101 - required	3	Refer to course description	GENED
	GEN 102/ GEN 103	Arts and Humanities Select one	3	None	GENED
	INF 102	Introduction to Information Systems	3	CIE 111	CORE
	CIE 105	Principles of Programming-I	3	CIE 111	CORE
		Total	**15**		

SECOND YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
3	CIE 106	Principles of Programming-II	3	CIE 105	CORE
	GEN 103/ GEN 102	Arts and Humanities Select one	3	None	GENED
	STA 101	Maths and Statistics Introduction to Statistics	3	MAT 110 or higher	GENED
	INF 201	Principles of Information Systems	3	INF 102	CORE
	ANT/CIV/ECO /HIS/ICP/PSY/ SOC	Social & Behavioral Sc. –Select one	3	Refer to course description	GENED
		Total	**15**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
4	PHI 300	Arts and Humanities Ethics and Leadership	3	3rd year standing	GENED
	CDV 2XX	Community Service Select one	3	2nd year standing	GENED
	INF 260	Systems Analysis and Design	3	INF 201	CORE
	INF 202	Data Structures and Algorithms	3	CIE 106	CORE
	MGT 201	Principles of Management	3	WRI 102	CORE
	CIE 231	Introduction to Databases, Web Technologies, and Applications	3	CIE 106	CORE
		Total	**18**		

THIRD YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
5	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	INF 303	E-Business Systems Development	3	MGT 201	CORE
	INF 341	Enterprise Integration	3	INF 201	CORE
	AUN 300	Critical Thinking and Problem Solving / Critical Thinking and Problem Solving	3	3rd year standing	GENED
	CIE 302	Principles of Operating Systems	3	CIE 106	CORE
	CIE 321	Information Technology (IT) Project Management	3	INF 260	CORE
		Total	**18**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
6	INF 332	Data Communications and Networking	3	CIE 302	CORE
	INF 310	Principles of Information Security Assurance	3	INF 201	CORE
	INF 493	Internship 1 (SIWES)	3	3rd year standing	CORE
	INF 352	Computer Crimes, Forensics, and Auditing	3	INF 201	CORE
	ENT 201	Entrepreneurship / Entrepreneurship 2	3	ENT 101	GENED
		Total	**15**		

FOURTH YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
7	INF 496	Internship 2 (SIWES)	3	INF 493	CORE
	INF 497	Research Methodology in Information Systems	3	3rd year standing	CORE
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	BIO/CHE/ GEO/NES/ PHY	Natural and Physical Sciences (Lab)	4	None	GENED
	INF 361	Process Modelling & Solution Blueprinting	3	INF 260	CORE
		Total	**16**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
8	XXX xxx	Refer to Concentration Elective list	3	Refer to course description	CONCENTRATION ELECTIVE
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	INF 402	Information Technology for Development	3	4th year standing	CORE
	INF 487	Systems Thinking, Modeling, and Computer Simulation	3	4th year standing	CORE
	INF 499	Final Year Project	3	INF 497	CORE
	XXX xxx	Refer to Concentration Elective list	3	Refer to course description	CONCENTRATION ELECTIVE
		Total	**18**		

BACHELOR OF SCIENCE (B.SC.) IN SOFTWARE ENGINEERING

The software engineering major builds on the computer science major with advanced course work in software architecture and design, software metrics, verification and validation, requirements analysis and specification and the software engineering process.

AIM

The goal of our software engineering program is to develop technical professionals who can develop and deliver software systems that are reliable, cost effective and adaptable to developing country environments. Graduates of our software engineering program will be prepared for careers requiring skills in the design, implementation, and testing of a variety of software systems. They will also be equipped with requirements analysis and product and process measurement and will be able to contribute hugely to any software development project with flexible roles.

OBJECTIVES

The detailed objectives are:

- ✔ To produce graduates ready for the software industry or who can champion the emergence and growth of that industry within the Sub Sahara Africa region.
- ✔ to support and lead the growth of the software industry.
- ✔ to nurture interest in entrepreneurship and grow the abilities of our graduate to become employers of labor and wealth creators.
- ✔ to provide suitable service courses for specialists in other disciplines to enable these specialists to increase their competences, skills, and level of proficiency in their different fields.
- ✔ to lead developments in open-source software within the region.
- ✔ to serve as the engineering basis program in developing IT solutions to development and entrepreneurial efforts championed by the university in its mission as a development university.

Graduates of the AUN Software Engineering program are expected to be ready for the growing software & IT industry. Some of the possible job titles our graduates can expect to hold include:

- Programmer
- Systems Analyst
- Software Developer
- Web Developer
- Software Consultant
- Systems Administrator (DBA, network administrator, deployer)
- Software Consultant
- Software Engineer
- Systems Architect
- Information Technology Specialist
- IT Project Manager
- Systems Engineer

- IT Director

Bachelor of Science in Software Engineering Degree Program Requirement

The Bachelor of Science in Software Engineering requires a minimum of 132 graduation credit hours. In addition to the General Education requirements, Software Engineering majors are required to successfully complete the courses listed below:

Requirement	Course Code	Course Title	Credit Hours
CORE (66 credits)	CIE 105	Principles of Programming I	3
	CIE 106	Principles of Programming II	3
	CIE 231	Intro. to Databases, Web Tech. & Applications	3
	CIE 302	Principles of Operating Systems	3
	CIE 321	Information Technology (IT) Project Management	3
	CSC 202	Data Structures & Algorithms	3
	CSC 213	Discrete Structures	3
	CSC 232	Computer Organization & Architecture	3
	CSC 364	Design and Analysis of Algorithms	3
	CSC 384	Database Systems	3
	MAT 211	Calculus II	3
	MAT 312	Linear Algebra	3
	SEN 301	Introduction to Software Engineering	3
	SEN 306	Object-Oriented Software Construction	3
	SEN 313	Human Computer Interface	3
	SEN 405	Software Requirements Analysis & Specification	3
	SEN 415	Software Testing & Quality Assurance	3
	SEN 416	Software Design & Architecture	3
	SEN 494	Senior Design Project-1	3
	SEN 495	Senior Design Project-2	3
	SEN 496	Internship 1 (SIWES)	3
	SEN 497	Internship 2 (SIWES)	3
	ECO 101	***These courses satisfy GENED requirement. Refer to GENED list of courses.***	***3***
	PHY 131/PHY 205		***4***
	PHY 132/PHY206		***4***

Software Engineering Major Electives

Software Engineering students should consult with their Chair in selecting elective courses that will augment their program of study and their preparation for careers. Students may choose any two (2) from the list below as major electives (6 credit hours). Additionally, Software Engineering students are encouraged to use most of their free elective credits to specialize further in a specific area of software engineering.

Requirement	Course Code	Course Title	Credit Hours
MAJOR ELECTIVES (6 credits)	CSC 453	Advanced Database Systems	3
	CSC 456	Design of Web-based Systems	3
	CSC 465	Artificial Intelligence	3
	CSC 470	Numerical Analysis	3
	CSC 485	Advanced Object-Oriented Analysis	3
	INF 302	Program Development and Implementation	3
	INF 487	Systems Thinking, Modeling, and Computer Simulation	3
	MAT 310	Calculus III	3
	SEN 321	Formal Methods of Specification in Software Engineering	3
	SEN 408	Software Processes and Project Management	3
	SEN 469	Software Testing: Verification & Validation	3
	SEN 470	Engineering Economics	3
	SEN 474	Principles of Information Systems Design	3
	SEN 478	Engineering of Software Sub-Systems	3

Upon completion of all degree requirements, students will receive a Bachelor of Science degree in Software Engineering.

FOUR YEARS STUDY PLAN FOR BACHELOR OF SCIENCE (B.Sc.) IN SOFTWARE ENGINEERING

FALL & SPRING ADMISSION

FIRST YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
1	WRI 101	Writing Composition I	3	Placement Test	GENED
	Mat 110 or Mat 112 or Mat 210	Maths and Statistics Mathematics	3		GENED
	CIE 111	Info. Technology Intro. to Computer and Computing	3	None	GENED
	AUN 101	First year Experience First Year Experience	1	None	GENED
	GEN 102 or GEN 103	Arts and Humanities Select one	3	None	GENED
	ENT 101	Entrepreneurship Introduction to Entrepreneurship	3	None	GENED
		Total	**16**		
2	CIE 105	Principles of Programming I	3	CIE 111	CORE
	STA 101	Maths & Statistics Introduction to Statistics	3	MAT 110 or higher	GENED
	WRI 102	Writing Composition II	3	WRI 101	GENED
	ANT/CIV/ECO/ HIS/ICP/PSY/ SOC	Social & Behavioural Sc. ECO 101-required	3	None	GENED
	GEN 102 or GEN 103	Arts and Humanities select one	3	None	GENED
		Totals	**15**		

SECOND YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
3	CIE 106	Principles of Programming II	3	CIE 105	CORE
	CSC 202	Data Structures and Algorithms	3	CIE 106	CORE
	CSC 213	Digital Systems	3	CIE 105	CORE
	BIO/GEO/CHE/NES/PCE/PHY	Natural & Physical Science	4	Refer to course description	GENED
	PHY206/PHY132 required (Lab)	PHY 205/PHY 131 required (Lab)			
4	CSC 232	Computer Organization and Architecture	3	CIE 105	CORE
	CDV 2XX	Community Service Community Development	3	min. 2nd yr. standing	GENED
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	MAT 211	Calculus II	3	MAT 210	CORE
	CIE 231	Intro. to Database, Web Tech. & Applications	3	CIE 106	CORE
		Total	**16**		
		Total	**16**		

THIRD YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
5	AUN 300	Critical Thinking & Problem Solving Critical Thinking & Problem Solving	3	min. 3rd yr. standing	GENED
	CSC 364	Design and Analysis of Algorithms	3	CSC 202	CORE
	CIE 302	Principles of Operating Systems	3	CIE 106	CORE
	CSC 384	Database Systems	3	CSC 202 & CIE 231	CORE
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	ENT 201	Entrepreneurship Entrepreneurship 2	3	None	GENED
		Total	**18**		

Semester	Course Code	Course Title	Credit Hours	Prerequisites	Requirement
6	SEN 494	Senior Design Project-1	3	Senior Student Status	CORE
	PHI 300	Arts & Humanities Ethics & Leadership	3	3rd year standing	GENED
	SEN 301	Introduction to Software Engineering	3	CIE 231	CORE
	SEN 496	Internship 1 (SIWES)	3	2nd yr. standing	CORE
	MAT 312	Linear Algebra	3	MAT 211	CORE
	XXX xxx	Visit program chair	3	None	MAJOR ELECTIVE
		Total	**18**		

FOURTH YEAR

Semester	Course Code	Course Title	Credit Hours	Prerequisite	Requirement
7	SEN 415	Software Quality Assurance & Testing	3	SEN 301	CORE
	SEN 306	Object-Oriented Software Construction	3	SEN 301	CORE
	CIE 321	Information Technology (IT) Project Management	3	CIE 106	CORE
	XXX xxx	Visit program chair	3	Refer to course description	FREE ELECTIVE
	SEN 495	Senior Design Project-2	3	Senior Student Status	CORE
	SEN 497	Internship 2 (SIWES)	3	SEN496	CORE
		Totals	**18**		
Semester	**Course Code**	**Course Title**	**Credit Hours**	**Prerequisites**	**Requirement**
8	XXX xxx	Refer to Elective list	3	Refer to course description	MAJOR ELECTIVE
	SEN 416	Software Design and Architecture	3	SEN 306	CORE
	SEN 312	User Interface Design & HCI	3	SEN 301	CORE
	SEN 405	Software Requirements Analysis & Specification	3	SEN 301	CORE
	ANT/CIV/ECO/ HIS/ICP/PSY/ SOC	Social & Behavioral Sciences Select one	3	None	GENED
		Totals	**15**		

Course Descriptions

CIE 105 Principles of Programming 1 (3)

Introduces the basic principles of programming and the fundamentals of object-oriented programming including objects, classes, inheritance, polymorphism, aggregation/ composition, state, methods, loops, selection, exceptions, events, and container types using a language such Ruby to teach and practice with cross cutting, language agnostic mechanisms. **Prerequisite: CIE 111**

CIE 106 Principles of Programming 2 (3)

Expands on CIE 105 course with intermediate to advanced programming principles and mechanisms emphasizing object oriented and functional techniques such as inheritance, polymorphism, and interfaces; exception handling, design patterns, simple GUI programming, multi-threaded programming, abstract and dynamic containers such as linked lists, stacks, queues, and trees and their associated algorithms including those based on recursion. **Prerequisite: CIE 105**

CIE 111 Introduction to Computers & Computing (3)

Aims to introduce all AUN students to: 1. The computer as a tool/platform for content creation, storage, processing, and access to applications and services online, and 2. Computing methods to problem solving. Emphasis is placed on gaining literacy and some practice on concepts and the broad areas of computing. Topics: concepts, principles and mechanisms in hardware, software, networking, computer security, algorithms, computer programming, database, Artificial Intelligence, e-commerce, decision support systems, and other emerging technologies such as blogs, wiki, RSS, podcasting, cloud computing, mobile computing, and Google applications. Additional lectures examine social, legal, ethical issues including privacy, intellectual property, health concerns, green computing, and accessibility. **Prerequisite: none**

CIE 231 Introduction to Databases, Web Technologies, and Applications (3)

Broadly examines the role of databases and web technologies in the current computing landscape and the emergence of database driven web applications supporting new computing platforms such as Cloud Computing. Introduces concepts and principles of database management systems (DBMS); basic data analysis, data modeling, database design and database implementation using an open-source relational DBMS, transaction management, concurrency control, distributed, multi-tier client/server architectures and the specific role of databases in web development. **Prerequisite: CIE 106**

CIE 302 Principles of Operating Systems (3)

Surveys methods and algorithms used in operating systems. Concurrent distributed operation is emphasized. The main topics covered are an introduction to operating systems, process management, process scheduling, inter process communications, memory management techniques, virtual memory, I/O management, deadlock avoidance, file system design, socket programming, distributed operation; distributed data; performance evaluation, protection, and security. **Prerequisite: CIE 106**

CIE 321 Information Technology (IT) Project Management (3)

Topics include: Project management tools such as MS Project; analysis of options and risks; project planning; cost estimation and productivity metrics; scheduling; factors influencing productivity and success; release and configuration management; management of expectations; planning for change; software process standards; process implementation; software contracts and intellectual property; approaches to maintenance and quality assurance; project reporting and case studies of real industrial projects. **Prerequisite: CIE 106**

CSC 202 Data Structures and Algorithms (3)

The course covers, from an object-oriented programming language perspective, Abstract Data Types (ADTs) and their implementations. Topics include recursion, complexity analysis, linear data structures (stacks, queues, priority queues, lists and strings), and non-linear data structures (hash tables, binary trees, search trees, balanced trees, heaps), searching and sorting algorithms, and graph algorithms. This will also include substantial programming assignments and projects. **Prerequisite: CIE 106**

CSC 213 Discrete Structures (3)

This course covers the mathematics needed for computer science. Topics covered include functions, relations, propositional and first order predicate logic, set theory, proofs and their construction, counting and elementary probability. **Prerequisite: CIE 105**

CSC 214 Logic in Computer Science I (3)

Topics include valid and invalid arguments; translating from English to the language of propositional and predicate logic; formal deduction and its role in proving the validity of an argument; logic and computer science; how to build circuits from logic gates and how to minimize circuits using propositional logic; introduction to Prolog a programming language based on logic; and the applications of logic in computer science AI, automated theorem provers, expert systems, and so on. **Prerequisite: CSC 213**

CSC 232 Computer Organization and Architecture (3)

This is a bottom-up course that covers CPU organization and micro architectural level design; Instruction set design; register transfer; RISC design principles; data path design; controller design; memory system; addressing; microprogramming; computer arithmetic; survey of real computers and microprocessors; peripheral devices and input/output busses; and introduction to parallel computing. The course is a broad introduction to all aspects of computer systems organization and architecture and serves as the foundation for subsequent computer systems courses. **Prerequisite: CIE 105.**

CSC 301 Systems Programming (3)

This course is an introduction to systems programming concepts and techniques. Topics include: the Intel system architecture, its assembly language, the C language, and how to use these tools for system calls with the low-level hardware and the Unix operating system and inter-process communication threads. The functions of an operating system, operating system utilities and programming embedded systems for set top devices will be taught using Java and/or C. **Prerequisite: CIE 106**

CSC 314 Introductions to Data Science (3)

This is an advanced course in discrete mathematics primarily dealing with discrete dynamical systems, algorithms, combinatorics, and graph theory. This course will cover several topics, including propositional logic, techniques of proof, lattice, algebraic structures, discrete numeric function, generating functions, recurrence relations and graph theory. **Prerequisite: CSC 213**

CSC 350 System Administration (3)

This course will be an in depth look at some of the functions that a system platform administrator performs daily including planning, resource allocation and sharing configuration and optimizations for a run time hosting system covering both hardware (network and non-network) and software (from operating system to application server and client systems). **Prerequisite: CSC 301**

CSC 364 Design and Analysis of Algorithms (3)

This is a study of techniques to design and analyze the complexity of algorithms. The course builds on understanding and application of many classical algorithms and their complexity and will introduce the area of NP completeness. **Prerequisite: CSC 202**

CSC 384 Database Systems (3)

The course will cover the concepts, principles, components, development, and application of database systems emphasizing the relational model. The conceptual models and structures necessary to designing and implementing a relational database system will be taught. Topics to be covered: entity relationship, relational data models, relational algebra, SQL, normalization, file organization, indexing, hashing, and enterprise-wide web-based applications that employ databases and emerging database systems supporting Cloud Computing. **Prerequisites: CSC 202 and CIE 231**

CSC 401 Machine Learning Algorithms (3)

This course will introduce the students to machine learning algorithms, focusing on the core concepts of supervised and unsupervised learning. The topics covered in this course include inductive classification, ensemble learning, decision tree learning, artificial neural networks, support vector machines, robust optimization, and text classification. The practical sessions in this course will cover the application of machine learning to a range of real-world problems. **Prerequisite: 3rd year standing**

CSC 402 Data Science (3)

Data Science is a dynamic field involving key concepts from statistics and computer science. Data Science is used extensively in a wide range of areas including large-scale retailing, telecommunications, astronomy, and internet social media. This course will emphasize practical techniques for working with large-scale data. The topics covered in this course include statistical modeling and machine learning, data pipelines, programming languages, exploratory data analysis, statistical inference and modeling, data visualization, machine learning, high-dimensional data analysis, and big data tools. The use of statistical and data manipulation software will be required. R programming will be used in this course. **Prerequisite: 3rd year standing**

CSC 403 Blockchain Technologies (3)

This course will provide an overview of the technological concepts of the blockchain technologies. Distributed ledger technologies, including blockchains, have become an enormous field of interest since the introduction of Bitcoin. The course will focus towards giving students a basic understanding of how blockchains work, where they are used, their limitations, and how they affect organizations and society now and in the future. Students will work on the prominent smart contract platform Ethereum and its main programming language Solidity. **Prerequisite: 3rd year standing**

CSC 404 Cyber Security (3)

This course will cover the key principles and concepts in cyber security. This course covers several key topics including cryptography, security management, wireless networking, and organizational security policy. Other topics covered in this course include an overview of information security frameworks, network infrastructure security, security and cryptography, information security policy, and defense. **Prerequisite: 3rd year standing**

CSC 405 Cloud Computing

Cloud computing has a broad-ranging effect across IT, information architecture, business, software engineering, and data storage. This course covers several key topics in cloud computing for individuals and organizations, including service deployment models, infrastructure, architecture, security, risks, benefits, and interoperability issues. The students will be able to explore the key issues in cloud computing environments and will be able to perform an audit assessment of a cloud computing environment. **Prerequisite: 3rd year standing**

CSC 406 Internet of Things (3)

This course will cover the key concepts and technologies forming the Internet of Things (IoT), including the technology used to build these kinds of devices, how they communicate, how they store data, and the kinds of distributed systems needed to support them. This will include several topics, including IoT technologies, cybersecurity

concepts, networking protocols, and cloud computing technologies. The course will focus on creative thinking and hands-on IoT project development. **Prerequisite: CSC 384**

CSC 408 Mobile Application Development (3)

This course will introduce students to application development for mobile devices. Students will learn about the various constraints facing mobile application designers, both with respect to hardware and with respect to user expectation. Students will also learn how to address these constraints with techniques in implementation, software design, and user-interaction design. Additionally, students will also learn about concepts at the core of modern mobile computing, such as software and data distribution models and location awareness. The topics covered in this course include mobile application development frameworks, architecture, design and engineering issues, techniques, methodologies for mobile application development. Students will do so by leveraging the Java programming language, the Android SDK, and Android Studio developer tools. Students will gain fundamental knowledge essential to not only Android application development, but mobile development in general. **Prerequisite: 3rd year standing**

CSC 409 Game Development (3)

This is a hands-on course on game design and game programming. This course covers several topics including the fundamentals of 2D and 3D graphics, network-based games, scenarios, and strategies for designing and developing games. In this course, students will work in teams to design, implement and test a three-dimensional game with interactivity, animation, sound, constraints, and networking capabilities. This course will be taught using the Unity API in conjunction with C# programming language. **Prerequisite: 3rd year standing**

CSC 410 Functional Programming (3)

This course explores the functional programming paradigm and the implementation technology for functional programming languages. This course aims to develop a broad understanding of the functional programming style and recursive programming techniques using the language Haskell. This course covers several topics including proofs by induction, Haskell class system, infinite lists, higher order types, recursion, and induction. **Prerequisite: 3rd year standing**

CSC 411 Open-Source Packaged Solutions (3)

This course will cover the principles, concepts, and applications of open-source software development. The topics covered in this course include common open-source software licenses, open-source project structure, distributed team software development, and current events in the open-source world. Students will also work on an open-source project and will be expected to make a significant contribution. This course will also over economy, business, societal and intellectual property aspects of open-source software. **Prerequisite: 3rd year standing**

CSC 413 Introductions to Cryptography (3)

This course is an introduction to modern cryptography and its applications to computer security. This course will cover the fundamentals of symmetric cryptography (i.e., encryption and message authentication) and public-key cryptography (i.e., key-exchange and signatures) as well as cryptographic protocols like zero-knowledge proof systems. In this course cryptographic tools, encryption, message authentication codes, hash functions, digital signatures will be taught and implemented. The mathematical foundations guiding cryptographic algorithms will be covered. Students are expected to complete several written and programming assignments. Students shall also be expected to write a term paper to demonstrate their ability to communicate their ideas in English. **Prerequisite: 3rd year standing**

CSC 414 Blockchain Innovations (3)

This course will be on Blockchain Technology and innovations. The most well-known example of Blockchain Technology in wide use today is as the storage and transaction mechanism for the cryptocurrency Bitcoin. A key focus for the course will be on the decisions between challenge and implementation. The design process can take a very long time. Bitcoin represents an elegant technical solution to a series of long posed problems and partial solutions. After covering Blockchain technology, students will explore current and potential future applications of Blockchain Technology. Although the course uses bitcoin to explain the Blockchain technology, the focus will be on potential uses of Blockchain beyond cryptocurrency. **Prerequisite: 3rd year standing**

CSC 415 Advanced Programming Skills (3)

The goal of this course is to introduce the students to a specific programming paradigm and an appropriate high level dynamic programming language chosen from those that are currently important in industry or that show high promise of becoming important. A significant portion of the learning curve occurs through programming assignments with exemplary solutions discussed later in class. **Prerequisites: 3rd year standing**

CSC 416 Crypto Economics (3)

This course focuses on understanding Blockchain technology and its future potential in some economic sectors. This course will examine the ways in which Blockchain will create breakthrough innovations addressing some of the largest problems in these economic sectors. The course will explore the role of Blockchain technology in promoting fundamental values like human rights, transparency, democracy, and fair trade. Students will examine use cases like the role of Blockchain technology in eliminating blood diamonds from the diamond supply chain. They will also complete a project applying Blockchain Technology to solve a problem in an economic sector they select or to create a new venture that produces breakthrough innovation. **Prerequisites: 3rd year standing**

CSC 417 Survey and Organization of Programming Languages (3)

In this course, students learn to use different approaches to programming, and languages and language features that support them: object-oriented, functional, and logical. By the end of the course, students can learn new languages quickly, and choose appropriate language and approaches. This course is a comprehensive introduction to the principal features and design of programming languages. This course is a survey of programming concepts and constructs including data types, control structures, subprograms and parameter passing, nesting and scope, derived data types, input and output, and dynamically varying structures. **Prerequisites: 3rd year standing**

CSC 423 Computer Networks and Communications (3)

The course will introduce networking concepts, including protocols, network architecture, reference models, layering, service, interface, multiplexing, switching, and standards. It will cover recent advances in network control and management architectures by introducing the concepts of software-defined networking (SDN) and network (function) virtualization. Topics covered in this course include Internet (TCP/IP) architecture and protocols, network applications, congestion/flow/error control, routing and internetworking, data link protocols, error detection and correction, channel allocation and multiple access protocols, communication media and selected topics in wireless and data center networks. Students taking this course will gain hands-on experience in network programming using the socket API, network traffic/protocol analysis, and assessing alternative networked systems and architectures. **Prerequisite: 3rd year standing**

CSC 434 Theory of Computation (3)

This is an introduction to the classical and contemporary theory of computation covering regular, context free and computable (recursive) languages with finite state machines, pushdown automata and Turing machines. Basic concepts of computability theory and NP theory. Prerequisite: Senior standing. **Prerequisite: CSC 364**

CSC 438 Internet and Web Technologies (3)

This course focuses on Internet and Web technologies and the underlying principles of distributed systems, information retrieval, and data management. The material covered will include web and applications server architectures, XML and semi structured data, schema mediation, document indexing and retrieval, peer to peer systems, distributed transactions, and remote procedure calls. The course has a substantial group implementation project. **Prerequisite: 3rd year standing**

CSC 440 Computer Graphics and Visualization (3)

This course covers topics including hardware aspects, plotters microfilm, plotters display, graphic tablets, light pens, other graphical input aids facsimile, and its problems. Other topics covered in this course include refresh display, refresh huggers, changing images, light pen interaction. Two and three-dimensional transformation, perspective clipping algorithms, hidden line removal, bolded surface removal, Warnock's method, shading, and data reduction for graphical input are covered in this course. **Prerequisite: CSC 364**

CSC 453 Advanced Database Systems (3)

This course covers data structures and algorithms used to implement database management systems. Topics include physical data organizations, indexing and hashing, query processing and optimization, database recovery techniques, transaction management, concurrency control and database performance evaluation. Programming projects will be required. **Prerequisite: CSC 384**

CSC 456 Design of Web-based Systems (3)

This course introduces students to the underlying infrastructure of the Internet and the World Wide Web. Topics include Internet protocols that support a variety of applications including file transfer, client server computing, peer to peer computing, and Internet messaging and Web syndication. Covers front, middle and back-end technologies for non-trivial Internet applications. Introduction to service-oriented architectures and Web services and the semantic Internet. Includes and Internet programming project. **Prerequisite: 3rd year standing**

CSC 457 Web Application Development (3)

The Advanced Web Application Development course concentrates primarily on building rich client web applications in the browser. The course is divided into various modules covering in depth the following technologies: HTML5, CSS, Asynchronous JavaScript, and XML). In addition, students will learn how to manage software versions and host their projects source code online, using GitHub or GitLab. Along with the fundamentals underlying these technologies, several applications will be showcased as case studies. Students work with these technologies starting with simple applications and then examining real world complex applications. At the end of this course, students would have mastered the latest and widely used web application development methodologies. **Prerequisite: 3rd year standing**

CSC 465 Artificial Intelligence (3)

This course introduces the field of artificial intelligence. The topics covered in this course include knowledge acquisition, knowledge representation, knowledge-based search techniques, machine reasoning and learning. Emphasis will be put on algorithms for search, inference, constraint satisfaction and optimization. Applications in tasks such as

expert systems, data mining, game playing, natural language understanding, computer vision, speech recognition, robotics and other knowledge intensive problems requiring smart agents will be examined. **Prerequisite: CSC 364**

CSC 466 Symbolic Artificial Intelligence (3)

The Symbolic Artificial Intelligence builds on CSC 465 – Artificial Intelligence. This course is targeted at giving the student in depth skills and techniques in the design and implementation of symbolic Artificial Intelligence systems. This course is aimed at providing the conceptual and practical foundations for knowledge representation and reasoning in Symbolic Artificial Intelligence. It is focused at solving issues around adaptability, generalizability, robustness, explainability, abstraction, common sense, causal reasoning, etc. This course covers syntax and semantics of propositional and first-order logic, application of propositional logic for automated reasoning in Artificial Intelligence, search algorithms in Artificial Intelligence such as depth and breadth-first, iterative deepening, A* etc. Furthermore, adversarial search in games (Minimax, alpha-beta pruning), basic planning algorithms (including planning and acting in partially observable domains, nondeterministic domains, multiagent planning), and the fundamentals of logic programming for knowledge representation (unification, resolution, SLDNF, and logic programs) will be covered. Again, symbolic reasoning in Artificial Intelligence and machine learning will be covered in this course. Python programming will be used to illustrate and implement the above topics Students are expected to complete several written and programming assignments. Students shall also be expected to write a term paper to demonstrate their ability to communicate their ideas in English. **Prerequisite: CSC 465**

CSC 470 Numerical Analysis

This course will emphasize the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use. The emphasis of the course will be the thorough study of numerical algorithms to understand (i) the guaranteed accuracy that various methods provide, (2) the efficiency and scalability for large scale systems. and (3) issues of stability. Topics include the standard algorithms for numerical computation. **Prerequisite: 3rd year standing**

CSC 485 Advanced Object-Oriented Analysis (3)

Advanced Object-Oriented Programming is a continuation of Object-Oriented Programming Essentials. Learners will focus on more advanced object-oriented concepts in this course. Learners will demonstrate object-oriented concepts using an industry identified programming language. This course is an advanced course and learners will be working with and creating complex programs. There is a strong emphasis on complete solutions from design to implementation that are efficient, and customer focused. **Prerequisite: SEN 306**

CSC 494 Research Methodologies in Computer Science (3)

This is a research methodology course that focuses on developing researching and writing skills in computer science & software engineering domains. As the software development requires multidisciplinary approach, many of the concepts are borrowed from diverse domains, this course will help students investigate the empirical research methods for their applicability and suitability to a research problem. At the end of this course students must submit a proposal **Prerequisite: 3rd year standing**

CSC 496 Final Year Project (3)

An independent or group investigation development of a software or hardware system to address a business problem under

the supervision of a lecturer. Before registering, the student must submit a written proposal to the supervisor to review. The proposal should give a brief outline of the project, estimated schedule of completion, and computer resources needed. A formal written report is essential, and an oral presentation is also required. **Prerequisite: CSC 494**

CSC 497 Internship 1 (SIWES) (3)

Is an internship field experience that abides by SIWES requirement. Internship prepares students for industrial work situations. This course is to be completed over summer. Students are expected to complete a daily logbook during their internship experience and upon completion of internship, a written report must be submitted. Internship supervisors are expected to conduct site visitation. **Prerequisite: 3rd year standing**

CSC 499 Internship 2 (SIWES) (3)

Is an internship field experience that abides by SIWES requirement. Internship prepares students for industrial work situations. This course is to be completed over summer. Students are expected to complete a daily logbook during their internship experience and upon completion of internship, a written report must be submitted. Internship supervisors are expected to conduct site visitation. **Prerequisite: CSC 497**

DSA 201 Fundamentals of Data Science 1 (3)

This course will introduce the fundamentals of the data science domain. The fundamentals of R and Python programming language and other related tools in Data Science will be covered. The programming languages will be utilized for problem solving. Topics covered in this will include Basic statistics, data gathering, preparation, and analysis, data visualization, case studies, and some ethical issues. **Prerequisite: CIE 105**

DSA 202 Fundamentals of Data Science 2 (3)

In-depth knowledge about R, Python, and MATLAB programming language and related tools for data science will be covered. Statistical concepts needed for data science will be covered in detail. Issues around data gathering, preparation, and analysis will be handled in more detail. Machine learning concepts will be introduced for data visualization, and further case studies. **Prerequisite: DSA 201**

DSA 231 Database System Design & Management (3)

This course will introduce the fundamental aspects of database design and management within the context of a relational data base management system and object-oriented databases. Other topics that will be covered will include relational model, database design life cycle, database design optimization, client/server architecture, data modeling, SQL, database security, database management, data warehousing, internet database environment. Students will gain hands-on experience in analysis, design, implementation, and management of relational data base systems and object-oriented databases. **Prerequisite: CIE 106**

DSA 288 Intensive Programming in Linux (3)

This course will cover programming topics in Linux Operating System using C, Python, and PHP as primary languages. The course will consist of the following modules: basic tools and utilities for system level software development, such as Bash, C programming, and Unix/Linux system API; methods and algorithms for processing web data, such as searching trees and matrix computing; end-to-end applications; and extending the applications to run on multiple machines. The course will provide students with utilities and hands-on experience for programming relatively large applications in Linux environment. **Prerequisite: CIE 106**

DSA 303 Biostatistics (3)

Introduction to important topics in biological, medical, health, and environmental statistical concepts and reasoning will be covered in this course. Basic topics covered in this course will include Introduction to Biological data Processing and Analysis, Hypothesis testing, nonparametric tests, Logistic regression, Poisson regression, Statistical methodologies in analysis of survival data. Other important areas covered in this course will include Kaplan-Meier estimator, Cox's proportional hazards models, time-dependent covariates, multiple failure outcomes, and typical biomedical applications which will include clinical trials. The course will include an applied project using computer programming language such as R or Python or MATLAB. **Prerequisite: STA 101**

DSA 320 Financial Data Analytics (3)

This course will cover data analytics for common finance applications using popular programming languages, such as Python or R or MATLAB. Topics covered in this course will include introduction to programming basics and analytical skills for applications in finance. Furthermore, two real-data applications will strengthen the students' hands-on experiences. The course will provide students with essential analytics training as needed for financial applications. **Prerequisite: 3rd year standing**

DSA 331 Analysis of Categorical Data (3)

This course will cover the analysis of discretely measured responses such as counts, proportions, nominal variables, ordinal variables, discrete interval variables with few values, continuous variables grouped into a small number of categories, etc. Other topics covered will include detection of outliers in categorical data; Inference and distributions for discrete data; Inference for contingency tables; Generalized linear models for count data; Models for binary and multinomial response (logistic regression, Poisson regression, Loglinear models); Classification and regression trees; and Cluster analysis for categorical data. Students will carry out an applied project using computer programming language such as R or Python or MATLAB. **Prerequisite: DSA 202**

DSA 350 Computers, Society and Ethics (3)

This course will cover various ethical frameworks that consider issues regarding concepts of personhood, privacy, and property as it relates to computer usage. Furthermore, it will consider the wider social, legal, and political implications of computers as they pertain to the nature of work, professionalism, and the determination of risk and liability. Additionally, this course will cover survey of the technology (software, hardware, and key applications), ethical obligations of computer specialists, and laws guiding computer usage. **Prerequisite: WRI 102**

DSA 370 Introduction to Artificial Intelligence (3)

This course will introduce the field of artificial intelligence. Topics covered will include knowledge representation, knowledge-based search techniques and machine learning. Emphasis will be put on algorithms for search, inference, constraint satisfaction and optimization. Applications in tasks such as expert systems, natural language understanding, perception, theorem proving, data mining and game playing will be examined. Functional programming using Lisp or a related language, and/or logic programming using Prolog or Python will be used to illustrate basic data structures for knowledge representation, reasoning and guided inference using Artificial Intelligence techniques. Programs that implement problem-solving search methods, machine learning and data mining techniques, knowledge deduction and/or inference and expert systems will be studied and developed. Students will be expected to complete several written and programming assignments. Students will also be expected to write a term paper to demonstrate their ability to communicate their ideas in English. **Prerequisite: DSA 202**

DSA 430 Analytical and Computational Neuroscience (3)

This course will cover a computational and mathematical introduction to the biophysical mechanisms that underlie physiological functions of single neurons and synapses. Topics that will be covered in this course will include voltage-dependent channel gating mechanisms, the Hodgkin-Huxley model for membrane excitability, repetitive and burst firing, nerve impulse propagation in axons and dendrites, single- and multi-compartmental modeling, synaptic transmission, calcium handling dynamics and calcium dependent currents and processes. general neural simulation system (GENESIS) and Parallel GENESIS (PGENESIS) will be used as simulation platforms in this course. **Prerequisite: 3rd year standing**

DSA 435 Advanced Data Structures and Algorithm Design (3)

This course will cover a systematic treatment of advanced data structures, algorithm analysis and abstract data types. Coding topics will include large program software engineering design, multi-dimensional arrays, string processing, primitives, compound types, and allocation of instance and static data using Python programming language. Data structure concept topics will include dynamic memory, inheritance, polymorphism, hierarchies, recursion, linked-lists, stacks, queues, trees, hash tables and graphs. Algorithm concept topics will include searching, big-O time complexity, analysis of all major sorting techniques, top-down splaying, AVL tree balancing, shortest path algorithms, minimum spanning trees and maximum flow graphs. **Prerequisite: DSA 331**

DSA 444 Introduction to Big Data Technologies (3)

This course will introduce Big Data and its concepts. Moreover, Big Data problems and associated frameworks and technologies will be covered. This course will treat programming models used for scalable big data analysis. Again, it will introduce Hadoop, and Map-Reduce Programming Model. Sampling and profiling techniques using for Big Data analysis will be covered. **Prerequisite: DSA 231**

DSA 450 Data Visualization (3)

Because science, engineering, business, and everyday human activity is increasingly producing high amount of information with high complexity, there is need to visualize data. This course will discuss visual representation methods and techniques that increase the understanding of complex data. For improved comprehension, communication, and decision making, visual interpretation of data will be thoroughly covered. Human visual system processes and perceives images, good design practices for visualization, tools for visualization of data from a variety of fields, and programming of interactive visualizations using 3D will be covered in this course. **Prerequisite: DSA 370**

DSA 461 Statistical Computing with SAS and R (3)

In this course, SAS and R statistical software will be studied from a programming language perspective. It will emphasize SAS and R data steps including getting data into SAS and R environments, working, and combining data using control flows, merge, and subsets. SAS and R mathematical, statistical, and data functions will be discussed, as well as learning to write SAS Macro and generate high resolution graphics using SAS/Graph. The emphasis will be on how SAS and R programming can be utilized as data science tools. However, several SAS and R statistical procedures or functions will be discussed and illustrated. **Prerequisite: 3rd year standing**

DSA 475 Machine Learning with Deep Learning (3)

Introduction to machine learning techniques will be covered. The supervised machine learning, unsupervised machine learning, semi-supervised machine learning, and reinforcement learning will be treated in this course. Dimensionality reduction for machine

learning techniques with a focus on practical real-world applications will be covered. Furthermore, topics covered will include Perceptron and multilayer neural networks, gradient descent, back-propagation, Convolutional Neural Network (CNN), pooling layers, CNN applications, Recurrent Neural Networks (RNN), and vanishing gradient problem. The application of these deep learning techniques on real data sets will be performed in this course. Case studies that will be considered in this course will include object detection, stock price estimation, GANs, and general cyber security solutions using deep learning techniques. **Prerequisite: DSA 370**

DSA 478 Statistical Method in Data Science (3)

This course will cover statistical concepts and applications related to data science including advanced exploratory data analysis, nonparametric inference and simulation for larger datasets, logistic regression modeling, and statistical programming. Furthermore, statistical software packages for Data Science such as R, STATA and MATLAB will be covered. **Prerequisite: 3rd year standing**

DSA 482 Fundamentals of Data Mining (3)

An introduction to the fundamental concepts of data mining will be covered. Application areas of data mining, text and web mining, and survey of techniques and models in data mining will be covered. Core topics that will be covered in this course will include data pre-processing, frequent pattern mining, clustering, and classification. Real data sets will be investigated using state-of-the-art data mining software. **Prerequisite: DSA 370**

DSA 492 Senior Project 1 (3)

The Data Science Senior Project will provide a real-world learning experience for the seniors in the B.Sc. Data Science program. This course will investigate the nature and techniques of a data-oriented computing development project. Projects will be provided by faculty members or industry partners or proposed by students. In this course, teams of project participants will carry out market research, identify appropriate data science problems, collect, and preprocess the needed data, define performance metrics, perform risk analysis, and complete an overall design of their solution that will integrate various data analytics techniques. The course instructor will mentor and evaluate all projects in conjunction with alumni advisors, and other faculty members. **Prerequisite: 3rd year standing**

DSA 493 Senior Project 2 (3)

The Data Science Project is targeted at providing a real-world project-based learning experience for seniors in the BSc Data Science program. The overall objectives of this course will be to investigate the nature and techniques of a data-oriented computing development project. Projects will be provided by faculty members or industry partners or proposed by students. In Data Science Project II, teams of project participants will refine their design, implement, and integrate component techniques into a complete software solution, present data analysis results, evaluate the system performance, and validate the proposed solution. The course instructor will mentor and evaluate all projects in conjunction with alumni advisors, available entrepreneurs, and other faculty members. **Prerequisite: DSA 492**

DSA 494 Internship 1 (SIWES) (3)

The Data Science & Analytics SIWES will give the students an opportunity to apply what they have learnt from their coursework in a related workplace setting, experiencing how data science and analytics is conducted in a business, government, or research environment. The students are expected to complete an individual or team-based project that is originated from a related organization and approved by the department. At the end of the SIWES, students will produce and submit a report to the department for grading. **Prerequisite: 3rd year standing**

DSA 495 Internship 2 (SIWES) (3)

The Data Science & Analytics SIWES will give the students an opportunity to apply what they have learnt from their coursework in a related workplace setting, experiencing how data science and analytics is conducted in a business, government, or research environment. The students are expected to complete an individual or team-based project that is originated from a related organization and approved by the department. At the end of the SIWES, students will produce and submit a report to the department for grading. **Prerequisite: DSA 494**

DSA 351 Introduction to Cybersecurity (3)

This course will give a broad overview of cybersecurity. Students will learn fundamental concepts of cybersecurity. Again, this course will help students gain knowledge of the applications to computer systems and communication security. Other topics covered in this course will include basics of cryptography, access control, malware, software security, storage and file security, operating-system security, database security and secure communication protocols. **Prerequisite: 3rd year standing**

INF 102 Introduction to Information Systems (3)

This course demonstrates how information is used by organizations to conduct business and solve problems. This course presents information systems principles and demonstrates how they form an integral part of modern organizations. Topics include systems concepts; organizational processes; technological aspects of information systems; the Internet; information technology security and ethical issues; database management; and systems development life cycle. **Prerequisite: CIE 111**

INF 201 Principles of Information Systems (3)

The objective of this course is to illustrate how business professionals can leverage Information Systems (IS) through planning, oversight, and management. This course includes topics, such as understanding the implications of IS, learning to identify and evaluate potential opportunities to employ IS, understanding the role of IS as a major facilitator of the fundamental business activities and learning to manage IS projects. **Prerequisite: INF 102**

INF 202 Data Structures and Algorithms (3)

The course covers, from an object-oriented programming language perspective, Abstract Data Types (ADTs) and their implementations. Topics include recursion, complexity analysis, linear data structures (stacks, queues, priority queues, lists and strings), and non-linear data structures (hash tables, binary trees, search trees, balanced trees, heaps), searching and sorting algorithms, and graph algorithms. This will also include substantial programming assignments and projects. **Prerequisite: CIE 106**

INF 260 Systems Analysis and Design (3)

This course presents a structured approach to analysis and design of information systems for businesses. Software development life cycle; structured top-down and bottom-up design, dataflow diagramming, entity relationship modelling; study of computer aided software engineering, input and output, prototyping design and validation, file, and database design; design of user interfaces; comparison of structured and object-oriented design. Case studies that promote critical-thinking skills provide the context for these techniques. **Prerequisite: INF 201**

INF 302 Program Development and Implementation (3)

This course involves the application of knowledge, skills, and abilities from earlier programming courses to develop and implement applications using an industry language such as C#.NET. Group work will be encouraged in the development and implementation of an expansive system to immerse students in real world enterprise

application development. **Prerequisite: CIE 106**

INF 303 E-Business Systems Development (3)

The course will be directed to provide a broad understanding of information systems to streamline intra-organizational and inter-organizational e-business process. This course also provides hands on training on developing the e-business applications and web sites using currently popular software packages, web authoring and development tools. The business processes enabled by integrating information systems, telecommunications and internet-based technologies formed in various industry, e-security challenges, along with their ethical and social impact will also be covered. This course includes an overview of e-business from design to operations of organizations engaging in the fast-paced highly competitive, global environment of e-commerce. e-Business, strategic use of information technology for competitive advantage, e-business impact on organization, globalization, and the impact on options created through applied information technology. **Prerequisite: MGT 201**

INF 310 Principles of Information Security Assurance (3)

The topics covered in this course include the history and terminology, security mindset, design principles, system/security life–cycle, security implementation mechanisms, information assurance analysis model, disaster recovery, and forensics; security mechanisms–cryptography, authentication, redundancy, and intrusion detection; operational issues–trends, auditing, cost/benefit analysis, asset management, standards, enforcement, legal issues; policy–creation of policies, maintenance of policies, prevention, avoidance, incident response (forensics), and domain integration (physical, network, internet, etc.); attacks – social engineering, denial of service, protocol attacks, active and passive attacks, buffer overflow attacks, and malware; security domains–security awareness and possible domains. **Prerequisites: INF 201**

INF 320 Applications in Information Security and Assurance (3)

This course provides both fundamental principles and technical skills for analyzing, evaluating, and developing secure systems in practice. Students will learn essentials about security models, algorithms, protocols, and mechanisms in computer programs, operating systems, networks, and database systems. Classroom instruction will be integrated with real life applications such as privacy control in health care system, protection of digital assets in web services, and security issues in supply chain management. **Prerequisite: INF 310**

INF 330 Policy and Administration in Information Security and Assurance (3)

Planning and development of policies for security and uninterrupted performance of information systems are covered in this course. Other topics to be covered include the value of information, assessment of policy alternatives and other related topics. **Prerequisite: INF 310**

INF 331 Database Analysis and Design (3)

Examines theoretical concepts of database system architectures, data models, conceptual data modeling, database schema design, relational algebra, and query languages. Related to database design and implementation it will focus on ER modeling, SQL implementation, query optimization and processing, indexing, and transaction control. Object Oriented Databases, XML and Application Design will be briefly described. This course also provides students with an opportunity to acquire practical skills in using ER modeling tools and Oracle DBMS. **Prerequisite: CIE 231**

INF 332 Data Communication and Networking (3)

This course examines computer networks and data communication. Topics include network services and applications: DNS, HTTP, peer-to-peer systems, socket programming;

network transport architectures, TCP, UDP, TCP congestion control; Routing and forwarding, intra-domain and inter-domain routing algorithms; Link layers and local area networks, especially Ethernet and Wi-Fi. This course also covers software-defined networking and network function virtualization; the Internet of Things (IoT); multimedia communications and quality of service; network measurement, inference, and management; network experimentation and performance analysis; network security; protocol verification. **Prerequisite: CIE 302**

INF 341 Enterprise Integration (3)

This course focuses on the integration of information systems in organizations, the process by which different computing systems and software applications are linked together physically or functionally. This course examines the strategies and methods for blending a set of interdependent systems into a functioning or unified whole, thereby enabling two or more applications to interact and exchange data seamlessly. The course will explore tools and techniques for systems integration as well as proven management practices for integration projects. **Prerequisite: INF 201**

INF 352 Computer Crimes, Forensics, and Auditing (3)

The course covers both the principles and practice of digital forensics. Societal and legal impact of computer activity: computer crime, intellectual property, privacy issues, legal codes; risks, vulnerabilities, and countermeasures; methods and standards for extraction, preservation, and deposition of legal evidence in a court of law. This course provides hands-on experience in different computer forensics situations that are applicable to the real world. Students will learn different aspects of digital evidence: ways to uncover illegal or illicit activities left on disk and recovering files from intentionally damaged media with computer forensics tools and techniques. **Prerequisite: INF 201**

INF 353 Database Security and Auditing (3)

The design of today's information systems is significantly influenced by database security. In this course, new directions in database security will be discussed in the context of Internet information management, along with an overview of database security principles and techniques. Database and data audits, XML access control, trust management, and privacy protection are some of the topics that will be covered. **Prerequisite: CIE 231**

INF 361 Process Modeling and Solution Blueprinting (3)

The Process Modeling and Solutions Blueprinting course presents the concepts and methodologies required to execute a methodical approach to translate business process change requirements into clear IT solutions. The course will be mostly based on the INFLUX(TM) methodology developed by Infosys Technologies Ltd. The course will cover process modeling, e-business architecture patterns and technical architecture to ensure that the students can smoothly translate enterprise business objectives into an effective IT solution architecture. **Prerequisite: INF 260**

INF 402 Information Technology for Development (3)

Information technology and communication (ICT) have an impact on development in varying degrees in the world. At the present time, this impact is less visible in less developed countries. In this course, students and their instructor will analyze the causes and the obstacles to development in African countries and through simulation; they will propose strategies to remedy the situation. Topics include ICT capacity building, ICT development planning, ICT Policy development. This course will also include key topics, such as Control Objectives for Information and Related Technology (COBIT) framework which defines a set of generic processes for the management of IT. Students will use an IT Balanced Scorecard (BSC) approach to explore issues in IT Governance

relevant to IT practitioners, which will allow students to develop the skills needed to evaluate and implement IT Governance measures across a variety of organizational types. **Prerequisite: 4th year standing**

INF 403 Information Resource Management (3)

The core ideas of information systems are covered in this course, which is crucial for organizations operating in the modern day. Information processing systems, e-commerce, hardware, software, data management, telecommunications, the Internet, and wireless technologies are among the main themes of the course that will be covered. This course looks at how information systems resource management affects organizational structure and corporate strategy. Information systems-related ethical and societal issues, change management, service management, and knowledge management will be covered in this course. Prerequisite: **4th year standing**

INF 410 Database Programming (3)

The course introduces students to the Oracle Developer application development utilities and tools and describes how to create and manipulate databases in Oracle database management system. The course provides an extensive overview of SQL and introduction to PL/SQL. Topics include data definition and manipulation languages, stored procedures, triggers, indexing techniques, and elementary query optimization. **Prerequisite: CIE 231**

INF 411 Database Analysis and Design (3)

Participants are challenged to examine contemporary society's use of modern database architecture and application critically in this course. After introducing the core concepts and methods needed for contemporary database management, the unit challenges participants to create creative database solutions to real-world issues using both proprietary and open-source database tools. On conventional database systems, the prospects, difficulties, and implications of big data, social media, data analytics, and unstructured data are examined concurrently: **Prerequisite: 4th year standing**

INF 421 Client Operating System Security (3)

This course is an exploration of programming and security issues in client/server systems from the client side. Various security challenges are explored, and students are given hands-on experience through semester long projects. **Prerequisite: CIE 302**

INF 438 Information Storage and Management Technologies (3)

This course provides a comprehensive understanding of the various storage infrastructure components in data center environments. This course will prepare students in making informed decisions on storage-related technologies in increasingly complex IT environments, which are fast changing with the adoption of software-defined infrastructure management and third platform technologies (cloud, Big Data, social, and mobile technologies). **Prerequisite: 3rd year standing**

INF 451 Java Support for E-Business (3)

The course focuses on the technical aspects of developing e-business systems using enterprise Java technologies. This course will integrate the student's prior knowledge of GUI development (JavaFX) on the client side with server-side Java applications in a multi-tiered environment that includes database connectivity. Students will use XML messaging and distributed registries along with Web Services to support the sharing of data and processes for e-business applications. **Prerequisite: CIE 231**

INF 461 Information Systems Planning (3)

This course is a concentrated study of planning methods and techniques required for defining, planning, integrating, and implementing information technology projects consistent with the organizational strategic plan and mission. **Prerequisite: 3rd year standing**

INF 465 Information Technology and Business Analytics (3)

This course provides students with the computing, data analytics, and decision support knowledge and skills needed for the converging fields of information technology and business analytics. Hands-on computer work is included. **Prerequisite: INF 201**

INF 478 Advanced Application Development (3)

Building rich client web apps in the browser is the focus of this course. The basics behind these technologies will also be discussed in this course, together with the chosen framework. As case studies, several applications will be displayed. Students use these tools, first investigating straightforward applications in the real world before moving on to more complicated ones. Students would have mastered the most recent and popular Web application development strategies by the end of this course. **Prerequisite: 3rd year standing**

INF 485 Mobile Application Development (3)

This course covers the development of Android /iOS mobile applications, beginning with mobile operating systems capabilities and application architecture and extending to major components, such as activities, services, broadcast receivers, etc. Development of interactive applications using widget libraries, web-based services, animation, an SQL database engine, and multithreading are also included in this course. **Prerequisite: 4th year standing**

INF 486 Data Administration (3)

This course focuses on database administration skills covering installation, configuration and tuning a database, administering servers and server groups, managing, and optimizing schemas, tables, indexes, and views, creating logins, configuring permissions, assigning roles, and performing other essential security tasks, backup and recovery strategies, automation, and maintenance. **Prerequisite: 3rd year standing**

INF 487 Systems Thinking, Modeling, and Computer Simulation (3)

An introduction to Business Dynamics in the context of a Complex World; the course covers the basic principles governing complex systems and some techniques for modeling and creating corresponding computer-based simulation models to study their behavior over time. A principal focus of the course is the significance of information feedback and circular causality in the behavior of business systems. The course begins with the principles of systems thinking and then moves to problem mapping and computer simulation. The emphasis is on giving students the ability to both see complex problems as systems and to better understand how to build "management flight" simulators to shed insight on problem structure and how that drives behavior over time; leading to how best to manage those situations. Students should be introduced to the most appropriate ways of visualizing complex interrelationships between the various parts of real-world dynamic problems, that is, problems that continually change over time and are resistant to corrective action. **Prerequisite: 4th year standing**

INF 489 Web Database Driven Application Development (3)

This course covers the key topics in framework-based web development. Students create interactive, dynamic web sites using a common web architecture and object-based database access. Programming for web database driven application development includes control structures, objects, functions, and use of composite data types. **Prerequisite: CIE 231**

INF 493 Internship 1(SIWES) (3)

Students are attached to private and public organizations for a period of three months with a view to making them acquire practical experience and to the extent possible, develop

skills in all areas of computing. Students are supervised during the training period and shall be expected to keep records designed for the purpose of monitoring their performance. They are also expected to submit a report on the experience gained and defend their reports. **Prerequisite: 3rd year standing**

INF 496 Internship 2 (SIWES) (3)

This is a continuation of the INF 493 course. Students are attached to private and public organizations for a period of three months with a view to making them acquire practical experience and to the extent possible, develop skills in all areas of computing. Students are supervised during the training period and shall be expected to keep records designed for the purpose of monitoring their performance. They are also expected to submit a report on the experience gained and defend their reports. **Prerequisite: INF 493**

INF 497 Research Methodology in Information Systems (3)

This course covers the foundations of research; problem identification and formulation; research design; qualitative and quantitative research; measurement; sampling; data analysis; interpretation of data and technical report writing, use of peer-reviewed resources, research guides, handbook etc., academic databases for computing discipline; use of tools/techniques for research: reference management software, software for detection of plagiarism. **Prerequisites: 3rd year standing**

INF 499 Final Year Project (3)

An independent or group investigation development of an information system to address a business problem under the supervision of a lecturer. Before registering, the student must submit a written proposal to the supervisor to review. The proposal should give a brief outline of the project, estimated schedule of completion, and computer resources needed. A formal written report is essential, and an oral presentation is also required. **Prerequisite: INF 497**

SEN 301 Introduction to Software Engineering (3)

This course introduces students to the ever-growing field of Software Engineering. Students will learn the principles of software engineering by working in a team through a real-life software development project. As a result, students will develop an understanding of why there has and continues to be a crisis in the software development field and the need to apply engineering principles to software development. Software is inherently complex and the development of industrial strength software which will support some critical functions of a business or organization requires a different approach and different tools. Software practitioners understand that for such development projects, the scale of the problem increases drastically and that frequent changes are constant. The adoption of a rigorous engineering discipline coupled with strong method/process support should improve quality in the delivered software and productivity of the development teams. **Prerequisites: CIE 231**

SEN 306 Object Oriented Software Construction (3)

This course covers the basic concepts, principles and notations of object-oriented analysis and design (OOAD). Special emphasis will be placed on critical issues for consideration in modern software development such as software quality and corresponding concepts, principles, and best practices for addressing both functional and non-functional requirements of the software system in its architecture. The topics covered in this course include specifications, abstraction techniques including typing, access control, inheritance, polymorphism, genericity and design patterns, frameworks, and architectures. Students will also learn the proper engineering use of techniques such as information hiding, classes, objects, inheritance, design by contract, exception handling, event-based systems, and concurrency. **Prerequisite: SEN 301**

SEN 312 User Interface Design and HCI (3)

This course is about interaction design and how to develop high-quality user interfaces for interactive systems and encouraging students to pay greater attention user experience design issues. Generally, the user interface relates to how the user faces the system that they usually have a direct contact and interact with to conduct activities. User interaction relates to the user experience, focusing on the orchestration of the interaction between people and interactive devices of many types - from computers to mobile communications devices to appliances. You will be introduced to the principles, guidelines, and theories needed to develop high-quality user interface (UI) and user experience (UX) designs that users can understand, predict, and control. As you will be able to design interactive systems that are enjoyable to use, that do useful things, and that enhance the lives of the people who use them. **Prerequisite: SEN 301**

SEN 313 Human Computer Interface (3)

This course is about interaction design and how to develop high-quality user interfaces for interactive systems and encouraging students to pay greater attention user experience design issues. Generally, the user interface relates to how the user faces the system that they usually have a direct contact and interact with to conduct activities. User interaction relates to the user experience, focusing on the orchestration of the interaction between people and interactive devices of many types - from computers to mobile communications devices to appliances. You will be introduced to the principles, guidelines, and theories needed to develop high-quality user interface (UI) and user experience (UX) designs that users can understand, predict, and control. As you will be able to design interactive systems that are enjoyable to use, that do useful things, and that enhance the lives of the people who use them. **Prerequisite: SEN 301**

SEN 400 Professional Ethics (3)

This course develops student understanding about historical, social, ethical, and professional issues related to the discipline of computing. This course identifies the sources for information and opinion about professionalism and ethics. Students evaluate at access ethical and professional computing case studies. This course introduces the student to ethical, moral issues and their responsibilities. **Prerequisite: 3rd year standing**

SEN 405 Software Requirements Analysis and Specification (3)

This course covers techniques for discovering and eliciting requirements and notations and models for representing requirements. Topics will include analysis and validation techniques, specifying and measuring external qualities such as performance, reliability, availability, safety, security, specifying and analyzing requirements for various types of systems such as embedded systems, consumer systems, web-based systems, business systems, systems for scientists and other engineers and resolving feature interactions. **Prerequisite: SEN 301**

SEN 408 Software Project Management (3)

This course covers project planning, cost estimation, and scheduling. The topics covered in this course also include project management tools, factors influencing productivity and success, productivity metrics, analysis of options and risks, planning for change, management of expectations, release and configuration management, software process standards and process implementation, software contracts and intellectual property, and approaches to maintenance and long-term software development. This course will involve case studies of real industrial projects. **Prerequisite: 3rd year standing**

SEN 415 Software Quality Assurance and Testing Quality (3)

This course will examine fundamental software testing and quality assurance as well as related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase

when testing different types of software. The course will also include concepts such as test generation, test oracles, test coverage, regression testing, mutation testing, program analysis (e.g., program-flow and data-flow analysis), and test prioritization. **Prerequisite: SEN 301**

SEN 416 Software Design and Architecture (3)

Software architecture has become an area of intense research in the software engineering community. Several architecture modeling notations and support tools, as well as new architectural styles, have emerged. The focus of architecture-based software development is shifted from lines-of-code to coarser-grained building blocks and their overall interconnection structure. Explicit focus on architecture has shown tremendous potential to improve the current state-of-the-art in software development and alleviate many of its problems. The goal of this course is to introduce students to common software architecture, design patterns, scenarios for quality attribute parts, and small architectural patterns. **Prerequisite: SEN 306**

SEN 469 Software Testing: Verification and Validation (3)

This course looks at testing techniques and principles: defects vs. failures, equivalence classes, and boundary testing. This course also covers types of defects, black box vs. structural testing and testing strategies, unit testing, integration testing, profiling, test driven development, state-based testing, configuration testing, compatibility testing, and web site testing, alpha, beta, and acceptance testing. In addition, coverage criteria, test instrumentation and tools, developing test plans, managing the testing process, problem reporting, tracking, and analysis are also covered in this course. **Prerequisite: SEN 301**

SEN 470 Engineering Economics (3)

Engineering Economics are about making decisions related to software engineering in a business context. Success of any software engineering project is partly dependent on effective business management. Software engineering economics provides a way to examine the attributes of software and software processes in a systematic way that relates them to economic measures. These can be weighted and analyzed when making decisions within the scope of a software engineering project and its organization. The essence of software engineering economics is aligning software technical decisions with the business goals of the organization. This course examines the key aspects of software engineering economics, including life cycle economics; risk and uncertainty; economic analysis methods and practical considerations, which tie concept and theory to contemporary software economic realities. **Prerequisite: ECO 101 and 3rd year standing**

SEN 474 Principles of Distributed and Concurrent Software Systems (3)

This course is concerned with aspects of computation beyond sequential programs. Concurrency occurs naturally in most real-world applications and is also strongly suggested by any modern computer architecture. This course introduces all basic mechanisms to analyze, design, and manage single computer as well as distributed applications. **Prerequisite: SEN 301**

SEN 478 Engineering of Software Sub Systems (3)

This course presents a detailed and in- depth analysis of design and construction software with an emphasis on design patterns and refactoring. This course also presents an introduction to formal approaches to design and includes the analysis of designs based on internal quality criteria, performance and maintainability improvement, reverse engineering, and disciplined approaches to design change. **Prerequisite: SEN 301**

SEN 490 Software Engineering Capstone (3)

Project This course involves the development of a significant software system, employing knowledge gained from courses throughout the program. It includes development of requirements, design, implementation, and quality assurance. Students may follow any suitable process model, must pay attention to quality issues, and must manage the project themselves, following all appropriate project management techniques. Success of the project is determined in large part by whether students have adequately solved their customer's problem. **Prerequisite: 4th year standing**

SEN 493 Students Industrial Work Experience (SIWES) (6)

This is an internship field experience that abides by SIWES requirement. Internship prepares students for industrial work situations. SEN 493 is to be completed over two summers - Summer A and Summer B - May-August. Students are expected to complete a daily logbook during their internship experience and upon completion of internship, a written report must be submitted. Internship supervisors are expected to conduct site visitation. **Prerequisite: 3rd year standing**

SEN 494 Senior Design Project 1 (3)

This course covers the foundations of system development life cycle giving the students opportunity to demonstrate the learning progress into the production, in this course students are expected to produce the initial and basic requirement for developing their ideas into a product peace like hardware or software product. This incorporates the research; problem identification and formulation; research design, technical report writing, use of peer-reviewed resources, research guides, handbook etc., academic databases for computing discipline; use of tools/techniques for research: reference management software, software for detection of plagiarism. **Prerequisite: 3rd year standing**

SEN 495 Senior Design Project 2 (3)

An independent or group investigation development of an information system to address a business problem under the supervision of an instructor. Before registering, the student must submit a written proposal to the supervisor to review. The proposal should give a brief outline of the project, estimated schedule of completion, and computer resources needed. A formal written report is essential, and an oral presentation is also required. **Prerequisite: SEN 494**

SEN 496 Internship 1(SIWES)

This is an internship field experience that abides by SIWES requirement. Internship prepares students for industrial work situations. This course is to be completed over summer. Students are expected to complete a daily logbook during their internship experience and upon completion of internship, a written report must be submitted. Internship supervisors are expected to conduct site visitation. **Prerequisite: 3rd year standing**

SEN 497 Internship 2 (SIWES)

This is an internship field experience that abides by SIWES requirement. Internship prepares students for industrial work situations. This course is to be completed over summer. Students are expected to complete a daily logbook during their internship experience and upon completion of internship, a written report must be submitted. Internship supervisors are expected to conduct site visitation. **Prerequisite: SEN 496**

SITC FACULTY

NAME	HIGHEST DEGREE	AREA	UNIVERSITY	RANK	STATUS
Dr. Abel Ajibesin	PhD	Computer Science, Electrical Engineering	Modibbo Adama University of Technology, Nigeria, 2014 University of Cape Town, 2016	Associate Professor	FT
Dr. Narasimha Rao Vajjhala	PhD	Information Systems and Technology	University of Phoenix, USA, 2013	Associate Professor / Chair - Information Systems	FT
Dr. Chidi Ononiwu	PhD	Information Systems	University of Cape Town, South Africa	Assistant Professor	FT
Dr. Salu George Thandekkattu	PhD	Cloud Computing and Database	Magadh University, India, 2009	Assistant Professor / Chair-Computer Science	FT
Dr. Samuel Utulu	PhD	Information Systems	University of Cape Town, South Africa, 2019	Assistant Professor	FT
Dr. Yakubu Saheed	PhD	Data Mining, Cyber-Security, Machine Learning & Bioinformatics	Kwara State University, Nigeria, 2018	Assistant Professor	FT
Dr. Jean-Paul Cleron	PhD	System Dynamics/Business modelling/Data Analytics	University of Paris, France, 1975	Assistant Professor	FT
Dr. Augustine Nsang	PhD	Artificial Intelligence and Machine Learning	University of Cincinnati, USA	Assistant Professor	FT

Dr. Rabiu Ibrahim	PhD.	ICTs	Al-Madinah International University, Saudi Arabia	Assistant Professor / Chair -Software Engineering	FT
Dr. Aamo Iorliam	PhD	Data Science, Cyber Security, Artificial Intelligence	Univ. of Surrey, UK, 2016	Assistant Professor / Chair – Data Science	FT
Dr. Ibrahim Inuwa	PhD	Information Systems & Corruption	American University of Nigeria, Nigeria	Assistant Professor	FT
Dr. Ignace Djitog	PhD	Computer Science	PhD Computer Science, 2017, AUST, Nigeria	Assistant Professor	FT
Mr. Gabriel Msheila	MSc	ICTs	University of Nigeria, Nsukka	Instructor	FT
Mrs. Chioma Anadozie	MBA, MSc., PhD (ABD)	Information Systems	American University of Nigeria, Yola.	Instructor	FT
Mr. Alexey Vedishchev	Lab Instructor	ICT	Altai State Technical, Russia	Instructor	FT
Mr. Mukhtar Usman	M.Sc.	Software Development	George Mason University, USA	Instructor	FT
SUPPORT STAFF MEMBERS IN SITC					
Ms. Sibo Fabel	B.Sc. Economics		Adamawa State University, Mubi	Executive Assistant	
Mr. Fidelis Sali	HND, Agric Eng		Adamawa State Polytechnic, Nigeria	Administrative Assistant	