

# Computer Science

## Program description

The Department of Computer Science at Effat University offers instruction in the theory, foundations, design, and application of digital computers, artificial intelligence, and cyber security systems. The department prepares students to be active participants in the information revolution, and to use computers in solving the problems of modern life using Data, Artificial Intelligence, and Cyber Security technologies. The department offers Bachelor of Science in Computer Science with two concentrations Artificial Intelligence concentration and Cyber Security concentration as follows.

- The Artificial Intelligence (AI) concentration allows students to specialize in a scientific area of interest such as Internet of Things, Smart Cities, Big Data, Visualization of Scientific data, and Robotics.
- The Cyber Security (CS) concentration prepares the students with the skills to investigate the vulnerability of hardware and software as well as the measures for protecting against security threats.

Depending on their interest and plan, students can choose to complete their degree in one of the concentrations, or with no concentration by completing 18 credits of technical electives (subject to departmental approval and in consultation with academic advisor).

## Educational objectives

Graduates from the Bachelor of Science in Computer Science (BSc. CS) program are expected to attain the following Program Educational Objectives within a few years of graduation:

1. Demonstrate a solid understanding of a variety of Computer Science approaches;
2. Contribute to the development of computer based intelligent and secure systems that help satisfy various demands of the society;
3. Demonstrate successful professional and career growth in Computer Science, Artificial Intelligence, and Cyber Security;
4. Demonstrate critical problem-solving skills in Computer Science;
5. Engage in constant learning to keep up with the rapidly changing developments within the computing field;
6. Demonstrate high ethical and responsibility values.

## Learning outcomes

1. By completing the BSc of Computer Science Program with Artificial Intelligence concentration, students will be able to:

- analyse complex computing problems and to apply principles of Computer Science, and other relevant disciplines to identify solutions.
- design, implement, and evaluate computing-based solutions to meet a given set of computing requirements in the context of Computer Science.
- communicate effectively in a variety of professional contexts.
- recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- function effectively as a member or leader of a team engaged in activities appropriate to the Computer Science fields.
- apply computer science theory and software development fundamentals to produce computing-based solutions utilizing Computer Science skills.
- demonstrate broad understanding and critical view of the principal theories, concepts and terminology of Artificial Intelligence and related Computing fields;
- integrate knowledge from Computing and Cyber Security fields to develop practical Artificial Intelligence solutions that work successfully in real organizations.

2. By completing the BSc of Computer Science Program with Cyber Security concentration, students will be able to:

- analyse complex computing problems and to apply principles of Computer Science, and other relevant disciplines to identify solutions.
- design, implement, and evaluate computing-based solutions to meet a given set of computing requirements in the context of Computer Science.
- communicate effectively in a variety of professional contexts.
- recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- function effectively as a member or leader of a team engaged in activities appropriate to the Computer Science fields.
- apply computer science theory and software development fundamentals to produce computing-based solutions utilizing Computer Science skills.
- demonstrate broad understanding and critical view of the principal theories, concepts and terminology of Cyber Security and related Computing fields;

- integrate knowledge from Computer Science fields to develop practical cybersecurity solutions that work successfully in real organizations.

3. By completing the BSc of Computer Science Program with No Concentration, students will be able to:

- analyse complex computing problems and to apply principles of Computer Science, and other relevant disciplines to identify solutions.
- design, implement, and evaluate computing-based solutions to meet a given set of computing requirements in the context of Computer Science.
- communicate effectively in a variety of professional contexts.
- recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- function effectively as a member or leader of a team engaged in activities appropriate to the Computer Science fields.
- apply computer science theory and software development fundamentals to produce computing-based solutions utilizing Computer Science skills.
- demonstrate broad understanding and critical view of the principal theories, concepts and terminology of related Computing fields;
- integrate knowledge from different Computing fields to develop practical solutions that work successfully in real organizations.

## Career Opportunities

- Programmer (Apps, Robotics, Web, etc.)
- Programming Analyst
- Software Developer
- Software Development Manager
- Software Engineer
- Software Test Engineer
- Database Designer
- Database Developer
- Database Administrator
- Web Developer
- Artificial Intelligence developer
- Machine Learning Engineer
- Business Intelligence Developer
- Big Data Engineer
- Data Scientist
- Data Architect
- Data Analyst
- Data Mining Analyst
- IT Security Analyst
- IT Security Engineer
- IT Security Consultant
- Computer Forensic Examiner
- IT Security Officer
- Network Security Administrator
- Information Security Consultant
- Security Penetration Tester
- Software Security Specialist
- Digital Forensics Scientist
- Malware Analyst
- Cyber Security Auditor
- Computer Forensics Investigator
- Computer and Information Research Scientist.
- Computer and Information Systems Manager
- Further their studies in Computer Science, Cyber Security, and Artificial Intelligence or related fields

### Designation of the digits used for the course numbering

Letters	Digit 1	Digit 2	Digit 3
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Letters: Department Code (such as CS for the Computer Science program)

- Digit 1: designates the year at which the course is taken.
- Digit 2 & Digit 3: designates the area of specialization of the course. (Areas of knowledge listed in the table below).
- Digit 4: designates the sequence of the course for the same area.

The numbering is based on ACM (Association of Computing Machinery) areas of knowledge.

### Designation of the Second and Third digit of the course numbers

Digit	Topic	Digit	Topic
00	Computational Science [CS]	09	Networking and Communications [NC]
01	Algorithms and Complexity [AL]	10	Operating Systems [OS]
02	Architecture and Organization [AR]	11	Platform-based Development [PBD]
03	Discrete Structure [DS]	12	Parallel and Distributed Computing [PD]
04	Graphics and Visualization [GV]	13	Programming Languages [PL]
05	Human Computer Interaction [HCI]	14	Software Development fundamentals [SDF]
06	Information Assurance and Security [IAS]	15	Software Engineering [SE]
07	Information Management [IM]	16	Systems Fundamentals [SF]
08	Intelligent Systems [IS]	17	Social Issues and Professional Practice [SP]

### Explanation of Credit Hour Notation

Credit hours are listed throughout the document in the following format: (3-0-3). The first digit indicates the number of lecture hours, the second digit indicates the number of practical hours (if applicable), and the third digit indicates the total number of credit hours for the course.

## Graduation requirements

This section explains in detail the total credit hour requirements and the distribution of credit hours among the general education, core, and concentrations requirements. The BSc. CS program duration will be four years and the number of credit hours required for graduation is 133 credits.

### Major Requirements: 133 Credit Hours

Requirements	CV/GID Concentrations	No Concentration
General Education Program	42	42
Basic Science and Mathematics	21	21
Major Core requirements (compulsory)	52	52
Concentration requirements (if any)	12	-
Technical Electives (if any)	6	18
<b>TOTAL</b>	<b>133</b>	<b>133</b>

### General education requirements: 42 credit hours

Pillar	Credits	Category	Courses	Credits
Skills development	20	Linguistic Communication (English)	GENG 161	2
		Linguistic Communication (Arabic)	Any course from the category	2
		Linguistic Communication (Foreign Languages)	Any two courses from the category	3
		Quantitative Reasoning	GMTH 141E	3
			GSTA 140	3
		Information, Media and Technology	GCS 150	3
Literacies	9	Scientific Literacy	GPHY 112	3
		Global Awareness	Any course from the category	3
		Cultural Literacy	Any course from the category	3
Cultivating positive disposition	10	Physical and Environmental Wellbeing	Any course from the category	2
		Islamic Thought and Ethics	GISL 171	2
			Any two courses from the category	4
		Civic Engagement	Any course from the category	2
Interdisciplinary research	3		GSEM 200	3
<b>TOTAL CREDIT HOURS</b>	<b>42</b>			<b>42</b>

Basic Science and Mathematics requirements: 21 credit hours

Course no.	Course title	Credits	Prerequisite(s)
BIO 112	Introduction to Biology	2-3-3	CS 1001
MATH 101	Calculus for Engineers I	3-0-3	GMTH 141E
MATH 201	Calculus for Engineers II	3-0-3	MATH 101
MATH 203	Discrete Mathematics	3-0-3	MATH 201
MATH 310	Numerical Analysis	3-0-3	MATH 201 & CS 1131
MATH 307	Linear Algebra	3-0-3	MATH 201
STAT 201	Statistics for Computing	3-0-3	MATH 201 & GSTA 140
<b>TOTAL</b>		<b>21</b>	

Major core requirements: 52 credit hours

Course no.	Course title	Credits	Prerequisite(s)
CS 1001	Introduction to Computing	2-2-3	Co-requisite GCS 150
CS 1021	Computer Architecture and Organization	2-2-3	CS 1001
CS 1131	Advanced Programming	2-2-3	GCS 150
CS 2011	Data Structures and Algorithms	2-2-3	CS 2132
CS 2071	Database Systems	2-2-3	GCS 150
CS 3081	Artificial Intelligence	2-2-3	CS 2011 & STAT 201
CS 2091	Computer Networks	2-2-3	CS 1001
CS 2132	Object Oriented Programming	2-2-3	CS 1131
CS 2171	Ethics in Computing	2-0-2	None
CS 3012	Algorithm Analysis	2-2-3	CS 2011
CS 3067	Information and Cyber Security	2-2-3	CS 1001
CS 3072	Data Sciences	2-2-3	CS 2071
CS 3101	Operating Systems	2-2-3	CS 1021 & CS 2011
CS 2111	Web Application Development	2-2-3	CS 2071
CS 3172	Research Projects in Computing	2-2-3	GSEM 200
CS 3173	Summer Training	0-0-2	CS 3172
CS 4174	Senior Project 1	0-0-3	CS 3172
CS 4175	Senior Project 2	0-0-3	CS 4174
<b>TOTAL</b>		<b>52</b>	

Technical Requirements: 18 Hours

CS students, in consultation with an academic advisor and department approval, must complete technical courses that total 18 credits hours as follows:

- Students who are registered in the AI or CS concentrations are required to take 12 credit hours from the concentration requirements courses as listed below; and 6 credit hours from the list of technical electives.
- Students who choose to have a no-concentration career path are required to fulfill 18 credits of technical electives.

Artificial Intelligence (AI) Concentration Requirements: 12 Credit Hours

Course no.	Course title	Credits	Prerequisite(s)
CS 4082	Machine Learning	2-2-3	CS 3081
CS 4083	Text Mining and Natural Language Processing	2-2-3	CS 3081
CS 4084	Internet of Things and Smart Cities	2-2-3	CS 4111
CS 4102	Embedded Operating Systems	2-2-3	CS 3101
CS 4111	Programming Embedded Systems	2-2-3	CS 3081
CS 4166	Robotics	2-2-3	CS 2011
CS 4073	Analysing and Visualizing Data	2-2-3	CS 3072

Cyber Security (CS) Concentration Requirements: 12 Credit Hours

Course no.	Course title	Credits	Prerequisite(s)
CS 3061	Computer Network Security	2-2-3	CS 2091
CS 3062	Cryptography	2-2-3	MATH 307
CS 3063	Web Security	2-2-3	CS 2111
CS 4064	Penetration Testing	2-2-3	CS 3061
CS 4065	Digital Forensics	2-2-3	CS 3061
CS 4066	Wireless Infrastructure Security	2-2-3	CS 3061
CS 4092	Personal Area Networks	2-2-3	CS 3061

Technical Electives Courses:

Course no.	Course title	Credits	Prerequisite(s)
CS 2041	Introduction to Multimedia	2-2-3	CS 1001
CS 3002	AI and Security Seminar 1	3-0-3	Junior Standing
CS 3133	Programming Languages	3-0-3	CS 2011
CS 3151	Software Engineering	2-2-3	CS 2011
CS 4003	Independent Study in AI and Cyber Security	3-0-3	Junior Standing
CS 4004	Advanced Topics in AI and Cyber Security	3-0-3	Junior Standing
CS 4112	Cloud Computing	3-0-3	CS 3101
CS 4121	High Performance Computing	2-2-3	CS 3012
CS 4177	AI and Security Seminar 2	3-0-3	Junior Standing
	Any course that is in one of the concentrations but not already taken	3	
	Any course from the list of technical electives of the Effat College of Business as listed below	3	
	Any course from the Computer Engineering Concentration of the ECE department as per the approval of the department	3	

Technical Electives from Effat College of Business:

Course no.	Course title	Credits	Prerequisite(s)
ACCT 140	Accounting 1	3-0-3	MGT220
ENTP 350	Entrepreneurship	3-0-3	MGT 220
MGT 220	Principles of Management	3-0-3	--
MGT 326	Organizational Behaviour	3-0-3	MGT 220
MKT 210	Principles of Marketing	3-0-3	--
OPIM 330	Operations Management	3-0-3	Junior Standing

### Computer Science – Artificial Intelligence Concentration: Study plan

Foundation 1 – Semester 1		CR	Prereq.	Foundation 1 – Semester 2		CR	Prereq.
LANG 011	Reading and Critical Thinking 1	3	None	LANG 012	Reading and Critical Thinking 2	3	LANG 011
LANG 013	Academic Writing 1	3	None	LANG 014	Academic Writing 2	3	LANG 013
LANG 015	Listening and Speaking 1	3	None	LANG 016	Listening and Speaking 2	3	LANG 015
SSKL 021	Independent Learning and Research Skills 1	2	None	SSKL022	Independent Learning and Research Skills 2	2	SSKL 021
ENG 051	Introduction to Engineering 1	3	None	ENG054	Introduction to HSS 2	3	ENG 051
ENG 055	Basic Physics for Engineering 1	2	None	ENG056	Basic Physics for Engineering 2	2	ENG 055
MATH 041	Basic Math 1	3	None	MATH 042	Basic Math 2	3	MATH 041
CL 031	Computer Literacy	1	None	IL 032	Information Literacy	-	CL 031
<b>TOTAL</b>		<b>19</b>		<b>TOTAL</b>		<b>18</b>	
Freshman – Semester 1		CR	Prereq.	Freshman – Semester 2		CR	Prereq.
CS 1001	Introduction to Computing	3	GCS 150	CS 1131	Advanced Programming	3	GCS 150
GMTH141E	Pre-Calculus for Engineering	3	None	MATH 101	Calculus for Engineers I	3	GMTH 141E
GCS 150	Digital Skills	3	None	Choice	Linguistic Communication (LC) (English)	2	None
GENG 161	Linguistic- Communication (English)	2	Placement	CS 1021	Computer Architecture and Organization	3	CS1001
GISL 171	Social and Moral Values in Islam	2	None	GSTA 140	Elementary Statistics	3	None
GPHY 112	Foundations in Physics	3	None	BIO 112	Introduction to Biology	3	None
<b>TOTAL</b>		<b>16</b>		<b>TOTAL</b>		<b>17</b>	
Sophomore – Semester 3		CR	Prereq.	Sophomore – Semester 4		CR	Prereq.
CS 2071	Database Systems	3	GCS 150	CS 2111	Web Application Development	3	CS 2071
CS 2132	Object Oriented Programming	3	CS 1131	Choice	Physical and Environmental Wellbeing (PEW)	2	NONE
CS 2171	Ethics in Computing	2	None	CS 2011	Data Structures and Algorithms	3	CS 2132
MATH 201	Calculus for Engineers II	3	MATH 101	STAT 201	Statistics for Computing	3	MATH 201 & GSTA 140
CS 2091	Computer Networks	3	CS 1001		Technical Elective 1	3	
Choice	Linguistic- Communication (Arabic)	3	None	Choice	Linguistic Communication (Foreign Languages) (LCFL)	2	None
<b>TOTAL</b>		<b>17</b>		<b>TOTAL</b>		<b>16</b>	
Junior – Semester 5		CR	Prereq.	Junior – Semester 6		CR	Prereq.
Choice	Islamic Thought and Ethics Requirement (ITER)	2	None	Choice	Art and Humanities Requirement- Culture Literacy (CL)	3	None
CS 3081	Artificial Intelligence	3	STAT 201 & CS 2011	CS 3067	Information and Cyber Security	3	CS 1001
MATH 203	Discrete Mathematics	3	MATH 201	CS 3172	Research Projects in Computing	3	GSEM 200
CS 3012	Algorithm Analysis	3	CS 2011	MATH 310	Numerical Analysis	3	MATH 201 & CS 1131
CS 3101	Operating Systems	3	CS 1021 & CS 2011	Choice	Social Science Requirement- Global Awareness (GA)	3	None
GSEM 200	Interdisciplinary Seminar and Research	3	GENG 161 & GSTA 140	Choice	Civic Engagement Requirement (CER)	2	None
<b>TOTAL</b>		<b>17</b>		<b>TOTAL</b>		<b>17</b>	
Junior – Semester 7		CR	Prereq.	Summer Semester		CR	Prereq.
Choice	Islamic Thought and Ethics Requirement (ITER)	2	None	CS 3173	Summer Training	2	CS 3172
MATH 307	Linear Algebra	3	MATH 201		Technical Elective 2	3	
CS 3072	Data Sciences	3	CS 2071		Artificial Intelligence Requirement 2	3	
	Artificial Intelligence Requirement 1	3			Artificial Intelligence Requirement 3	3	
CS 4174	Senior Project 1	3	CS 3172		Artificial Intelligence Requirement 4	3	
Choice	Linguistic Communication ( Foreign Languages) (LCFL)	2	None	CS 4175	Senior Project 2	3	CS 4174
<b>TOTAL</b>		<b>16</b>		<b>TOTAL</b>		<b>15</b>	

### Computer Science – Cyber Security Concentration: Study plan

Foundation 1 – Semester 1		CR	Prereq.	Foundation 1 – Semester 2		CR	Prereq.
LANG 011	Reading and Critical Thinking 1	3	None	LANG 012	Reading and Critical Thinking 2	3	LANG 011
LANG 013	Academic Writing 1	3	None	LANG 014	Academic Writing 2	3	LANG 013
LANG 015	Listening and Speaking 1	3	None	LANG 016	Listening and Speaking 2	3	LANG 015
SSKL 021	Independent Learning and Research Skills 1	2	None	SSKL022	Independent Learning and Research Skills 2	2	SSKL 021
ENG 051	Introduction to Engineering 1	3	None	ENG054	Introduction to HSS 2	3	ENG 051
ENG 055	Basic Physics for Engineering 1	2	None	ENG056	Basic Physics for Engineering 2	2	ENG 055
MATH 041	Basic Math 1	3	None	MATH 042	Basic Math 2	3	MATH 041
CL 031	Computer Literacy	1	None	IL 032	Information Literacy	-	CL 031
<b>TOTAL</b>		<b>19</b>		<b>TOTAL</b>		<b>18</b>	
Freshman – Semester 1		CR	Prereq.	Freshman – Semester 2		CR	Prereq.
CS 1001	Introduction to Computing	3	GCS 150	CS 1131	Advanced Programming	3	GCS 150
GMTH141E	Pre-Calculus for Engineering	3	None	MATH 101	Calculus for Engineers I	3	GMTH 141E
GCS 150	Digital Skills	3	None	Choice	Linguistic Communication (LC) (English)	2	None
GENG 161	Linguistic- Communication (English)	2	Placement	CS 1021	Computer Architecture and Organization	3	CS 1001
GISL 171	Social and Moral Values in Islam	2	None	GSTA 140	Elementary Statistics	3	None
GPHY 112	Foundations in Physics	3	None	BIO 112	Introduction to Biology	3	None
<b>TOTAL</b>		<b>16</b>		<b>TOTAL</b>		<b>17</b>	
Sophomore – Semester 3		CR	Prereq.	Sophomore – Semester 4		CR	Prereq.
CS 2071	Database Systems	3	GCS 150	CS 2111	Web Application Development	3	CS 2071
CS 2132	Object Oriented Programming	3	CS 1131	Choice	Physical and Environmental Wellbeing (PEW)	2	NONE
CS 2171	Ethics in Computing	2	None	CS 2011	Data Structures and Algorithms	3	CS 2132
MATH 201	Calculus for Engineers II	3	MATH 101	STAT 201	Statistics for Computing	3	MATH 201 & GSTA 140
CS 2091	Computer Networks	3	CS1001		Technical Elective 1	3	
Choice	Linguistic- Communication (Arabic)	3	None	Choice	Linguistic Communication (Foreign Languages) (LCFL)	2	None
<b>TOTAL</b>		<b>17</b>		<b>TOTAL</b>		<b>16</b>	
Junior – Semester 5		CR	Prereq.	Junior – Semester 6		CR	Prereq.
Choice	Islamic Thought and Ethics Requirement (ITER)	2	None	Choice	Art and Humanities Requirement- Culture Literacy (CL)	3	None
CS 3081	Artificial Intelligence	3	STAT 201 & CS 2011	CS 3067	Information and Cyber Security	3	CS 1001
MATH 203	Discrete Mathematics	3	MATH 201	CS 3172	Research Projects in Computing	3	GSEM 200
CS 3012	Algorithm Analysis	3	CS 2011	MATH 310	Numerical Analysis	3	MATH 201 & CS 1131
CS 3101	Operating Systems	3	CS 1021 & CS 2011	Choice	Social Science Requirement- Global Awareness (GA)	3	None
GSEM 200	Interdisciplinary Seminar and Research	3	GENG 161 & GSTA 140	Choice	Civic Engagement Requirement (CER)	2	None
<b>TOTAL</b>		<b>17</b>		<b>TOTAL</b>		<b>17</b>	
Junior – Semester 7		CR	Prereq.	Summer Semester		CR	Prereq.
Choice	Islamic Thought and Ethics Requirement (ITER)	2	None	CS 3173	Summer Training	2	CS 3172
MATH 307	Linear Algebra	3	MATH 201		Technical Elective 2	3	
CS 3072	Data Sciences	3	CS 2071		Artificial Intelligence Requirement 2	3	
	Artificial Intelligence Requirement 1	3			Artificial Intelligence Requirement 3	3	
CS 4174	Senior Project 1	3	CS 3172		Artificial Intelligence Requirement 4	3	
Choice	Linguistic Communication ( Foreign Languages) (LCFL)	2	None	CS 4175	Senior Project 2	3	CS 4174
<b>TOTAL</b>		<b>16</b>		<b>TOTAL</b>		<b>15</b>	



### Computer Science – No Concentration: Study plan

Foundation 1 – Semester 1		CR	Prereq.
LANG 011	Reading and Critical Thinking 1	3	None
LANG 013	Academic Writing 1	3	None
LANG 015	Listening and Speaking 1	3	None
SSKL 021	Independent Learning and Research Skills 1	2	None
ENG 051	Introduction to Engineering 1	3	None
ENG 055	Basic Physics for Engineering 1	2	None
MATH 041	Basic Math 1	3	None
CL 031	Computer Literacy	1	None

**TOTAL** **19**

Freshman – Semester 1		CR	Prereq.
CS 1001	Introduction to Computing	3	GCS 150
GMTH141E	Pre-Calculus for Engineering	3	None
GCS 150	Digital Skills	3	None
GENG 161	Linguistic- Communication (English)	2	Placement
GISL 171	Social and Moral Values in Islam	2	None
GPHY 112	Foundations in Physics	3	None

**TOTAL** **16**

Sophomore – Semester 3		CR	Prereq.
CS 2071	Database Systems	3	GCS 150
CS 2132	Object Oriented Programming	3	CS 1131
CS 2171	Ethics in Computing	2	None
MATH 201	Calculus for Engineers II	3	MATH 101
CS 2091	Computer Networks	3	CS 1001
Choice	Linguistic- Communication (Arabic)	3	None

**TOTAL** **17**

Junior – Semester 5		CR	Prereq.
Choice	Islamic Thought and Ethics Requirement (ITER)	2	None
CS 3081	Artificial Intelligence	3	STAT 201 & CS 2011
MATH 203	Discrete Mathematics	3	MATH 201
CS 3012	Algorithm Analysis	3	CS 2011
CS 3101	Operating Systems	3	CS 1021 & CS 2011
GSEM 200	Interdisciplinary Seminar and Research	3	GENG 161 & GSTA 140

**TOTAL** **17**

Junior – Semester 7		CR	Prereq.
Choice	Islamic Thought and Ethics Requirement (ITER)	2	None
MATH 307	Linear Algebra	3	MATH 201
CS 3072	Data Sciences	3	CS 2071
	Technical Elective 2	3	
CS 4174	Senior Project 1	3	CS 3172
Choice	Linguistic Communication ( Foreign Languages) (LCFL)	2	None

**TOTAL** **16**

Foundation 1 – Semester 2		CR	Prereq.
LANG 012	Reading and Critical Thinking 2	3	LANG 011
LANG 014	Academic Writing 2	3	LANG 013
LANG 016	Listening and Speaking 2	3	LANG 015
SSKL022	Independent Learning and Research Skills 2	2	SSKL 021
ENG054	Introduction to HSS 2	3	ENG 051
ENG056	Basic Physics for Engineering 2	2	ENG 055
MATH 042	Basic Math 2	3	MATH 041
IL 032	Information Literacy	-	CL 031

**TOTAL** **18**

Freshman – Semester 2		CR	Prereq.
CS 1131	Advanced Programming	3	GCS 150
MATH 101	Calculus for Engineers I	3	GMTH 141E
Choice	Linguistic Communication (LC) (English)	2	None
CS 1021	Computer Architecture and Organization	3	CS1001
GSTA 140	Elementary Statistics	3	None
BIO 112	Introduction to Biology	3	None

**TOTAL** **17**

Sophomore – Semester 4		CR	Prereq.
CS 2111	Web Application Development	3	CS 2071
Choice	Physical and Environmental Wellbeing (PEW)	2	NONE
CS 2011	Data Structures and Algorithms	3	CS 2132
STAT 201	Statistics for Computing	3	MATH 201 & GSTA 140
	Technical Elective 1	3	
Choice	Linguistic Communication (Foreign Languages) (LCFL)	2	None

**TOTAL** **16**

Junior – Semester 6		CR	Prereq.
Choice	Art and Humanities Requirement- Culture Literacy (CL)	3	None
CS 3067	Information and Cyber Security	3	CS 1001
CS 3172	Research Projects in Computing	3	GSEM 200
MATH 310	Numerical Analysis	3	MATH 201 & CS 1131
Choice	Social Science Requirement- Global Awareness (GA)	3	None
Choice	Civic Engagement Requirement (CER)	2	None

**TOTAL** **17**

Summer Semester		CR	Prereq.
CS 3173	Summer Training	2	CS 3172

Junior – Semester 8		CR	Prereq.
	Technical Elective 3	3	
	Technical Elective 4	3	
	Technical Elective 5	3	
	Technical Elective 6	3	
CS 4175	Senior Project 2	3	CS 4174

**TOTAL** **15**

### Summary Table Of Computer Science Courses

Course no.	Course title	Credits	Prerequisite(s)
CS 1001	Introduction to Computing	2-2-3	Co-requisite GCS 150
CS 1021	Computer Architecture and Organization	2-2-3	CS 1001
CS 1131	Advanced Programming	2-2-3	GCS 150
CS 2011	Data Structures and Algorithms	2-2-3	CS 2132
CS 2041	Introduction to Multimedia	2-2-3	CS 1001
CS 2071	Database Systems	2-2-3	GCS 150
CS 2091	Computer Networks	2-2-3	CS 1001
CS 2111	Web Application Development	2-2-3	CS 2071
CS 2132	Object Oriented Programming	2-2-3	CS 1131
CS 2171	Ethics in Computing	2-0-2	None
CS 2176	Computing Final Project	0-0-3	-
CS 2177	Cyber Security Final Project	0-0-3	-
CS 2178	Artificial Intelligence Final Project	0-0-3	-
CS 3002	AI and Security Seminar 1	3-0-3	Junior Standing
CS 3012	Algorithm Analysis	2-2-3	CS 2011
CS 3061	Computer Network Security	2-2-3	CS 2091
CS 3062	Cryptography	2-2-3	MATH 307
CS 3063	Web Security	2-2-3	CS 2111
CS 3067	Information and Cyber Security	2-2-3	CS1001
CS 3068	Cybersecurity Design Principles	2-2-3	CS 3067
CS 3072	Data Sciences	2-2-3	CS 2071
CS 3081	Artificial Intelligence	2-2-3	CS 2011 & STAT 201
CS 3101	Operating Systems	2-2-3	CS 1021 & CS 2011
CS 3133	Programming Languages	3-0-3	CS 2011
CS 3151	Software Engineering	2-2-3	CS2011
CS 3172	Research Projects in Computing	2-2-3	GSEM 200
CS 3173	Summer Training	0-0-2	CS 3172
CS 4003	Independent Study in AI and Cyber Security	3-0-3	Junior Standing
CS 4004	Advanced Topics in AI and Cyber Security	3-0-3	Junior Standing
CS 4064	Penetration Testing	2-2-3	CS 3061
CS 4065	Digital Forensics	2-2-3	CS 3061
CS 4066	Wireless Infrastructure Security	2-2-3	CS 3061
CS 4073	Analyzing and Visualizing Data	2-2-3	CS 3072
CS 4082	Machine Learning	2-2-3	CS 3081
CS 4083	Text Mining and Natural Language Processing	2-2-3	CS 3081
CS 4084	Internet of Things and Smart Cities	2-2-3	CS 4111
CS 4092	Personal Area Networks	2-2-3	CS 3061
CS 4102	Embedded Operating Systems	2-2-3	CS 3101
CS 4111	Programming Embedded Systems	2-2-3	CS 3081
CS 4112	Cloud Computing	3-0-3	CS 3101
CS 4121	High Performance Computing	2-2-3	CS 3012
CS 4166	Robotics	2-2-3	CS 2011
CS 4174	Senior Project 1	0-0-3	CS 3172
CS 4175	Senior Project 2	0-0-3	CS 4174
CS 4177	AI and Security Seminar 2	3-0-3	Junior Standing
MATH 308	Operations Research	3-0-3	MATH 307

## Summary Table Of Basic Science And Mathematics Courses

Course no.	Course title	Credits	Prerequisite(s)
BIO 112	Introduction to Biology	2-3-3	CS 1001
MATH 101	Calculus for Engineers I	3-0-3	GMTH 141E
MATH 201	Calculus for Engineers II	3-0-3	MATH 101
MATH 203	Discrete Mathematics	3-0-3	MATH 201
MATH 310	Numerical Analysis	3-0-3	MATH 201 & CS 1131
MATH 307	Linear Algebra	3-0-3	MATH 201
STAT 201	Statistics for Computing	3-0-3	MATH 201 & GSTA 140

## Course descriptions

### CS 1001: Introduction to Computing (2-2-3) Prerequisite(s): Co-requisite GCS 150

This course introduces students to computing as a discipline that has changed the world: new ways for people to connect, design, research, play, create, and express themselves. The course will introduce the idea of moving from a simple user of computing to the real empowering experience of translating real-life problems and ideas into computer solutions. The course will cover the main concepts of computing, such as abstraction, design, recursion, concurrency, problem-solving skills, simulations, and the limits of computation. Applications of computing that have changed the world, The history of computing, and where it will go in the future will be discussed. The overall theme of the course is to enjoy and appreciate the computing discipline. Moreover, the main concepts of Security, Privacy, Artificial Intelligence, and Machine Learning are introduced to students in this course.

### CS 1021: Computer Architecture and Organization (2-2-3) Prerequisite(s): CS 1001

This course provides an overview of the architecture and organization of a computer hardware system and its components. Control Processing unit (CPU), memory architecture, instruction sets, assembly language, control units and data paths, basic computer organization, and memory systems are examined in details and how all these are combined to form a computer system.

### CS 1131: Advanced Programming (2-2-3) Prerequisite(s): GCS154

This course exposes students to the depth and breadth of modern programming practice, with the goal of making students better programmers. Topics include: Program Development Process, Abstract Data Types, Classes and Objects, Functions, Arrays, Pointers and Addressing, New and Delete Operators, Copy Constructor, Operator Overloading, Memory Leaks and Destructor Calls, Simple File I/O and Arguments, and Testing and Debugging.

### CS 2011: Data Structures and Algorithms (2-2-3) Prerequisite(s): CS 2132

This course covers the design, analysis, and implementation of Data Structures and Algorithms to solve engineering problems using an object oriented programming language. Topics include elementary data structures, (including arrays, stacks, queues, and lists), advanced data structures (including trees and graphs), the algorithms used to manipulate these structures, and their application to solving practical engineering problems. This course will use C++ as a main programming language.

### CS 2041: Multimedia (2-2-3) Prerequisite(s): CS 1001

This course introduces students to the exciting world of Multimedia hardware and software. The study of basic design concepts and the use of different multimedia elements, text, graphics, video, sound, animation and interactivity to develop full multimedia applications will be covered. Students will be exposed to several multimedia development applications such as Adobe Photoshop. Project based learning will be used in this course.

### CS 2071: Database Systems (2-2-3) Prerequisite(s): GCS 150

This course introduces database concepts, conceptual data modelling, relational modelling, normalization, database design, query languages, and implementation issues. It also introduces the components of a database system, its functions, and database architecture and data dependency.

### CS 2091: Computer Networks (2-2-3) Prerequisite(s): CS 1001

This course introduces data communication fundamentals and network architectures. It examines the layered approach to networks specifying the OSI and TCP/IP models focusing on the functions performed at each layer of network architectures. It studies various networking protocols, network devices and network addressing schemes. Different types of transmission media are studied as well.

### CS 2111: Web Application Development (2-2-3) Prerequisite(s): CS 2071

This course covers the multidisciplinary process that is used to create quality web applications. Topics covered include: web application development process, limits of current web technologies, service architectures, content management, and testing. The course outcome is a project in cloud computing, location based services, mobile web or mobile application development.

### CS 2132: Object Oriented Programming (2-2-3) Prerequisite(s): CS 1131

This course introduce students to object-oriented programming. The fundamental concepts of object-oriented programming will be studied using the Java programming language. The course covers the definition and use of classes, inheritance, and overloading. The principles of object-oriented design are emphasized. It focuses also on abstraction, interfaces and java collections. In addition, it includes the exceptions use, UML notions and the justification of OO paradigm The course focuses on hands-on programming assignments and projects based on graphical user interfaces programming.

### CS 2171 (Ethics in Computing) (2-0-2) Prerequisite(s): None

This course studies the ethical, social, and professional concerns of the computer science and information systems fields. It covers the impact of computers on society as well as the responsibility of computing professionals towards society. Case studies show the ethical foundations, the intellectual property, privacy, security, and the professional responsibility of computing professionals. This course should finally highlight the danger of some computing practices.

### CS 2176 Computing Final Project (0-0-3) Prerequisite(s): CS 1001

Students work on a real-world project of their interest that integrates and demonstrates skills and knowledge gained in their university courses, which includes both the General Education and Computing components of their education. The focus in this course is on the analysis, design, implementation, and testing phases of the project.

### CS 2177 Cyber Security Final Project (0-0-3) Prerequisite(s): CS 1001

Students work on a real-world project of their interest that integrates and demonstrates Cyber Security skills and knowledge gained in their university courses, which includes both the General Education and Computing components of their education. The focus in this course is on the analysis, design, implementation, and testing phases of the Cyber Security project.

### CS 2178 Artificial Intelligence Final Project (0-0-3) Prerequisite(s): CS 1001

Students work on a real-world project of their interest that integrates and demonstrates Artificial Intelligence skills and knowledge gained in their university courses, which includes both the General Education and Computing components of their education. The focus in this course is on the analysis, design, implementation, and testing phases of the Artificial Intelligence project.

### CS 3002: AI and Security Seminar 1 (3-0-3) Prerequisite(s): Junior Standing

The objective of the course is to introduce the students to a new subject in the field that is not covered by the program offerings such as the latest trends in the field of computing. This course content changes according to student interests and needs. This course is offered at the junior level. The course outline will be specified in the course syllabus for the semester where the course is offered.

### CS 3012: Algorithm Analysis (2-2-3) Prerequisite(s): CS 2011

This course emphasizes the understanding of visual computing data structures and algorithms from an analytical perspective using mathematical techniques. A number of content-relevant areas such as designing efficient algorithms, asymptotic notation, recurrences, worst and average cases, dynamic programming, divide and conquer algorithms, branch and bound, and graph algorithms will be presented throughout this course. Students will also be introduced to NP-complete problems, heuristics and greedy algorithms. There is no restriction in this course on the programming language that the student wants to use.

### CS 3061: Computer Networks Security (2-2-3) Prerequisite(s): CS 2091

Objectives of this course are to learn how to manage the network security aspects of an organization. It explores network vulnerabilities, attacks monitoring and WLAN security, policies and implementation of firewall policies, viruses protection, physical security, risk and disaster recovery or contingency planning issues, policies for avoidance and proactive measure, reduce casual security breaches, and protecting assets and housekeeping procedures.

### CS 3062: Cryptography (2-2-3)

Prerequisite(s): MATH 307

This course examines modern cryptography and communication security. The course focuses on classic historical ciphers including Caesar, Vigenere and Vernam ciphers; modern ciphers including DES, AES, public key cryptography (RSA, elliptic curve cryptosystems) and digests; key exchange; simple protocols; block and stream ciphers; digital certificates and cryptographic systems (SSL/TLS, VPNs, and Kerberos). Efficient hardware and software implementations of cryptographic primitives, copyright protection, data integrity and authentication. Basic cryptanalytic techniques and examples of practical security solutions are explored to understand how to design and evaluate modern security solutions.

### CS 3063: Web Security (2-2-3)

Prerequisite(s): CS 2111

This course discusses the basic issues, principles, concepts and techniques in web security, like the hacking of web applications and its analysis. Topics related to understanding and fixing the vulnerabilities will be discussed with respect to confidentiality, identity, authenticity and availability of data, different protocols and basic security applications/features needed to integrate in a web-based application, identifying common logic flaws in web apps, database and network exploits, and command and SQL injections. The need for web security in software development with respect to cloud computing will also be covered in this course

### CS 3067: Information and Cyber Security (2-2-3)

Prerequisite(s): CS 1001

A study of the Information and Cyber Security. Topics include cyber architecture, cyber services, protocols, algorithms, hardware components, software components, programming languages, various cybersecurity mechanisms, business continuity planning, security management practices, security architecture, operations security, physical security, cyber terrorism, and national security.

### CS 3068: Cybersecurity Design Principles (2-2-3)

Prerequisite(s): CS 3067

This course covers cybersecurity systems engineering principles of design. Students will learn the foundational and timeless principles of cybersecurity design and engineering. They will learn why theories of security come from theories of insecurity, the important role of failure and reliability in security, the fundamentals of cybersecurity risk assessment, the building blocks of cybersecurity, intrusion detection design, and advanced topics like cybersecurity situational understanding and command and control.

### CS 3072: Data Sciences (2-2-3)

Prerequisite(s): CS 2071

The course provides an overview of Data Science, covering a broad selection of key challenges in and methodologies for working with big data. Topics to be covered include data collection, integration, management, modelling, analysis, visualization, prediction and informed decision-making, as well as data security and data privacy. This course is integrative across the core disciplines of Data Science, including databases, data warehousing, statistics, data mining, data visualization, high performance computing, cloud computing, and business intelligence. Professional skills, such as communication, presentation, and storytelling with data, will be fostered. Students will acquire a working knowledge of data science through hands-on projects and case studies in a variety of business, engineering, social sciences, or life sciences domains. Issues of ethics, leadership, and teamwork are highlighted.

### CS 3081: Artificial Intelligence (2-2-3)

Prerequisite(s): STAT 201 & CS 2011

The course covers basic elements of Artificial Intelligence. Topics featured in this course include search, adversarial search, constraint satisfaction, knowledge representation, inference, uncertain knowledge, making decisions under uncertainty, introduction to machine learning, game playing and robotics.

### CS 3101: Operating Systems (2-2-3)

Prerequisite(s): CS 1021 & CS 2011

This course focuses on objectives and structures of operating systems. It includes topics about processes (synchronization and scheduling), threads, multiprogramming and multiprocessing concepts, memory management, paging and segmentation, storage management, input / output and file management and virtual machines.

### CS 3133: Programming Languages (3-0-3)

Prerequisite(s): CS 2011

Programming languages evaluation criteria. Programming languages evolution and history. Topics featured in this course include syntax, semantics, names, binding, type checking, and scopes, data types, assignment statement, subprogram implementation. A project applying learned concepts is required.

### CS 3151: Software Engineering (2-2-3)

Prerequisite(s): CS 2011

This course covers the concepts and methodologies of software engineering. It emphasizes the main phases of the software lifecycle, such as requirements, design, implementation, testing, project planning. Also, it stresses the difference between the software product and process. The course incorporates a class project. Students will work in groups to design and build a robot, according to specifications given in class.

### CS 3172: Research Projects in Computing (2-2-3)

Prerequisite(s): GSEM 200

This course helps students develop technical writing skills in the field of computing. Essentials skills are taught to students to develop their ability to write a research proposal and to build a research methodology. Students are required to produce at the end of the course a research proposal that may be used as a framework for their senior project.

### CS 3173: Summer Training (0-0-2)

Prerequisite(s): CS 3172

This course requires the completion of 180 hours of training in industry where the students will experience a real job environment while being involved in a CS related project. They apply their academic knowledge and acquired skills by working on CS related tasks. This course requires students to document and report on their work experience.

### CS 4003: Independent Study in AI and Cyber Security (3-0-3) Prerequisite(s): Junior Standing

The course features students' participation in discussions held by faculty members and invited guests. Course content changes according to student interests and needs. This course is offered at the senior level. The course allows a student to focus on a computing issue of personal interest, under the supervision of a Computer Science faculty member. The course outline will be specified in the course syllabus for the semester where the course is offered.

### CS 4004: Advanced Topics in AI and Cyber Security (3-0-3) Prerequisite(s): Junior Standing

Course content changes according to the new trends in the field of computer science. This course is offered at the senior level.

CS 4064: Penetration Testing (2-2-3)

Prerequisite(s): CS 3061

This course will introduce students to the principles and techniques of penetration testing/ethical hacking. Topics covered will include planning, reconnaissance, scanning, exploitation, post-exploitation, and result reporting. The student discovers how system vulnerabilities can be exploited and learns to avoid such problems. The course will typically use Linux platforms and the tools associated with it.

### CS 4065: Digital Forensics (2-2-3)

Prerequisite(s): CS 3061

The objectives of this course are to explore the threats/cybercrime, to learn how to conduct computer forensics investigations, and to understand the overall investigative process. Students will gain an understanding of the best practices used to acquire, assemble, secure, process, examine, analyze and report on digital evidences. The course includes the ethical issues, data presentation and chain of evidence procedures and different techniques used to protect copyrights.

### CS 4066: Wireless Infrastructure Security (2-2-3)

Prerequisite(s): CS 3061

This course will cover the architecture, protocols and standards of modern wireless communication systems. Specifically, The course will discuss various wireless protocols/standards such as IEEE 802.11 a/b/g/n/ac) and security techniques and protocols (including WEP, WPA, WPA2, and etc.). The course vulnerabilities, attacks, and countermeasures. Other topics include spectrum allocation, signal propagation, modulation, antennas, network planning and management, troubleshooting etc.

### CS 4073: Analyzing and Visualizing Data (2-2-3)

Prerequisite(s): CS 3072

This course covers various methods for analysing and visualizing the data. It addresses the analysis and visualization principles and practical issues such as data pre-processing, data imputation, data cleaning, data transformation, data visualization, the generation of images based on experimental data or gathered data. The visualization pipeline is introduced covering scalar data visualization, vector data visualization, volume visualization and information visualization. The importance of the use of visualization in understanding observations and theories is emphasized in the course. Applications are taken from science and engineering.

### CS 4082: Machine Learning (2-2-3)

Prerequisite(s): CS 3081

This course covers many topics in Machine Learning such as classification, linear and non-linear regression, statistical pattern recognition, non-parametric methods, hidden Markov models, Bayesian networks, support vector machines and artificial neural networks, and Deep Learning.

### CS 4083: Text Mining and Natural Language Processing (2-2-3)

Prerequisite(s): CS 3081

Natural language processing (NLP) is one of the most significant technologies of the information age, and a critical part of artificial intelligence. In this course, students will learn how to build models, which can understand and generate language, for applications such as information extraction, machine translation, automatic summarization, question-answering, and interactive dialogue systems. The course will cover linguistic (knowledge-based) and statistical approaches to language processing in the three major subfields of NLP: syntax (language structures), semantics (language meaning), and pragmatics/discourse (the interpretation of language in context). In this course, students will be given a thorough overview of Natural Language Processing and how to use classic machine learning methods. They will also learn about Statistical Machine Translation as well as Deep Semantic Similarity Models (DSSM) and their applications.

### CS4084 Internet of Things and Smart Cities: (2-2-3)

Prerequisite(s): CS 4111

This course includes in-depth coverage on existing and emerging IoT application domains, machine learning and deep neural networks, GPU and FPGA programming and optimization techniques for deep learning acceleration, and various computing systems that facilitate the rapid realization and growth of IoT. machine problems working with Raspberry Pi, embedded system (FPGA and GPU), and Node-RED together with homework assignments will be given to reinforce the understanding and learning of the techniques and topics.



### CS 4092: Personal Area Networks (2-2-3)

Prerequisite(s): CS 3061

Basics of mobile and wireless networking. Architectures and communication protocols for wireless sensor networks, wireless local area networks, ad-hoc networks, cellular systems, WiMAX, and Wireless Mesh Networks.

### CS4102: Embedded Operating Systems: (2-2-3)

Prerequisite(s): CS 3101

This course is intended to provide a practical understanding of embedded operating systems. The emphasis is on the hardware and software aspects of embedded computing encompassing the composition of the embedded operating system and the development of embedded systems. It also provides students with the knowledge and skills to begin developing and implementing embedded applications with the practical aspects of embedded computing.

### CS4111: Programming Embedded Systems (2-2-3)

Prerequisite(s): CS 3081

Embedded system is combination of computer hardware and software for specifically designed for a particular function. Embedded systems has been playing important roles in various application areas such as Industrial machines, automobiles, medical equipment, cameras, household appliances, airplanes, vending machines, toys and other uses embedded system. Students will learn fundamental concepts of designing and programming embedded computer systems, including requirements specifications, architectural and detailed design, and implementation, focusing on real-time aspects of programming languages, operating system kernels, and hardware architectures.

### CS 4112: Cloud Computing (3-0-3)

Prerequisite(s): CS 3101

This course describes important concepts of cloud computing such as distributed data, cloud file systems, virtualization, security and privacy, Amazon Web services, and interactive web-based applications. Students are expected to perform research work as well as use one of the available web services for cloud computing.

### CS 4121: High Performance Computing (2-2-3)

Prerequisite(s): CS 3012

This course introduces important concepts of cloud computing such as distributed data, cloud file systems, virtualization, security and privacy, Amazon Web services, and interactive web-based applications. Students are expected to perform research work as well as use one of the available web services for cloud computing.

### CS 4166: Robotics (2-2-3)

Prerequisite(s): CS 2011

This course gives a practical knowledge on robotics including an overview of robot control technology from open-loop manipulators and sensing systems, to single-joint servo-valves and servomotors, to integrated adaptive force and position control using feedback. The course focuses on sensors, transducers and motors. The course exposes the students to data acquisition, analysis and decision-making. It also introduces the machine vision and touch sensing systems. Design emphasis on accurate tracking accomplished with minimal algorithm complexity.

### CS 4174: Senior Project 1 (0-0-3)

Prerequisite(s): CS 3172

Students work on a real-world project of their interest that integrates and demonstrates skills and knowledge gained in their university courses, which includes both the General Education and Computing components of their education. The focus in this course is on the analysis and design phases of the project.

### CS 4175: Senior Project 2 (0-0-3)

Prerequisite(s): CS 4173

Continuation of the senior project-1, focusing on the implementation, evaluation, and documentation phases of their work.

### CS 4177: AI and Security Seminar 2 (3-0-3)

Prerequisite(s): Junior Standing

Course content changes according to student interests and needs. The course emphasizes the various social and ethical responsibilities of the computing professional. It teaches students about the nature of computing as a profession, codes of professional conduct, and ethics & responsibility. The course features students' participation in discussions held by faculty members and invited guests. This course is offered at the senior level.

## Course descriptions

### BIO 112 – Introduction to Biology (2-3-3)

Prerequisite(s): None

This course will introduce the biochemical basis of living organisms, describe the cell and its components, compare plant and animal cells and their metabolism, include the study of chromosomes and cell division (mitosis and meiosis), present some of the principles of genetics, and survey some samples of plant and animal biodiversity.

### MATH 101 - Calculus for Engineers I (3-0-3)

Prerequisite(s): Placement or GMTH 141E

Topics for this course include functions, limits, and continuity; differentiation with applications including maxima and minima, Rolle's Theorem, the Mean Value Theorem; related rates; the theory of integration (with applications and approximations); transcendental functions including logarithmic and exponential functions, trigonometric functions, inverse trigonometric functions, hyperbolic functions, and inverse hyperbolic functions.

### MATH 201 - Calculus for Engineers II (3-0-3)

Prerequisite(s): MATH 101

Topics for this course include theory of integration with applications, including areas, volumes, and arc length; integration techniques, indeterminate forms, L'Hopital's rule and improper integrals; sequences and infinite series and its convergence and divergence, power series, parameterized curves, polar coordinates and integration in polar coordinates.

### MATH 203 - Discrete Mathematics (3-0-3)

Prerequisite(s): MATH 201

This course mainly covers topics considered as backbone for computing. Topics included: logic and proof techniques, mathematical induction, set theory, recursion, relations, functions, graph theory, trees, and Boolean algebra. Topics are covered with emphasis on applications in computing.

### MATH 310 – Numerical Analysis (3-0-3)

Prerequisite(s): MATH 201 & CS 1131

Numerical Solution of Non-linear Equations: Bisection method, Newton-Raphson method, Secant method, Convergence. Interpolation: Lagrange, Newton divided difference formula. Numerical Differentiation: First Derivatives, Higher Derivatives. Numerical Integration: Trapezoidal Rule, Gaussian Integration. Numerical solution of initial value problems: Euler's method, Taylor's method, Ruge-Kutta method.

### MATH 307 - Linear Algebra (3-0-3)

Prerequisite(s): MATH 201

System of linear equations, matrix operations, vectors, vector spaces, linear transformations, orthogonality, determinants, eigenvalues and eigenvectors, diagonalization, linear differential equations and systems with constant coefficients and applications, computer simulation.

### STAT 201 - Statistics for Computing (3-0-3)

Prerequisite(s): MATH 201 and GSTA 140

This course has been designed to extend the student's depth of knowledge in statistical analyses of data. Topics included: probability theory, statistical inference, sampling statistics, modeling, analysis of variance, random variables (discrete and continuous random variables), distributions, estimation theory, and hypotheses testing. The course has practical sessions to facilitate the understanding.

### BIO 112 – Introduction to Biology (2-3-3)

Prerequisite(s): None

This course will introduce the biochemical basis of living organisms, describe the cell and its components, compare plant and animal cells and their metabolism, include the study of chromosomes and cell division (mitosis and meiosis), present some of the principles of genetics, and survey some samples of plant and animal biodiversity.



## Technical Electives From Effat College Of Business Course Descriptions

### ENTP 350: Entrepreneurship (3-0-3) Prerequisite(s): MGT 220

This course offers students the opportunity to learn from case studies why and how some businesses are successful while others fail. Lectures will focus on specific entrepreneurs, their businesses, characteristics, environment, and strategies for success. The course will cover the full range of relevant issues from conception and start-up phase, financial issues, valuation techniques, and exit strategies. Special issues such as ethical considerations, not-for-profit sector entrepreneurship, and turnaround management will also be addressed.

### MGT 220: Principles of Management (3-0-3) Prerequisite(s): None

The basic principles and practices of management in all kinds of enterprises. Such functions as planning, organizing, directing, and controlling are given particular attention. The problems of developing countries including Saudi Arabia are given emphasis.

### MGT 326: Organizational Behavior (3-0-3) Prerequisite(s): MGT 220

This course will examine and develop the interpersonal and social skills needed to effectively direct the activities of others to attain organizational goals. The first step to obtaining these skills is to understand the complexities of human behavior. In this course students will study human behavior in an organizational context with emphasis on: individual characteristics, motivation, learning, communication, leadership, decision making, and group dynamics. Upon completion of this course, students will be able to: 1) understand the factors that influence behavior in organizations; 2) apply behavioral theory to organizational settings; 3) diagnose human resource issues in organizations through the process of observation, interpretation, and analysis of contributing factors; and 4) communicate theoretically sound, yet practical, recommendations in a persuasive and timely manner.

### MKT 210: Principles of Marketing (3-0-3) Prerequisite(s): None

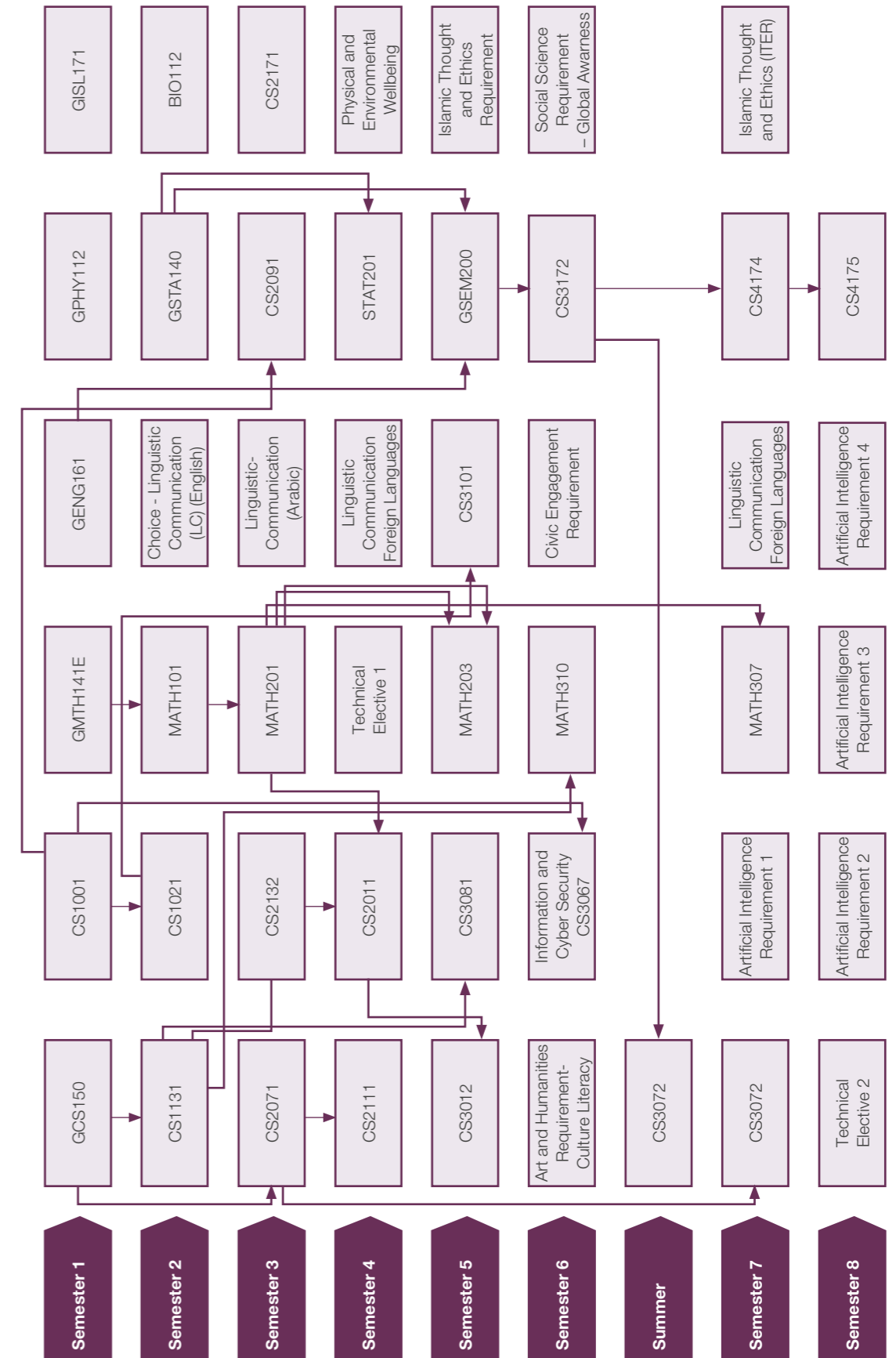
The course provides a broad conceptual introduction to the study of marketing issues in contemporary organizations. Theoretical and quantitative tools pertinent to the identification, understanding, and resolution of specific marketing issues will be addressed within a decision-making framework that puts the marketing function at the centre of an organization's strategic direction. Course objectives include: defining the strategic role of marketing as well as its functional concerns; developing basic marketing decision-making and analytical skills in applied organizational settings; and providing a forum for open debate and critical examination of peers' insights and analyses. By the end of the semester, each student will be able to coherently discuss generic issues of marketing strategy and devise a well-backed marketing plan.

### OPIM 330: Operations Management (3-0-3) Prerequisite(s): Junior Standing

This course focuses on understanding and analysis of processes for production and delivery of goods and services. It covers management of supply chains, inventories and capacities, waiting lines, quality, and projects involving new product development. The concepts, models, and tools covered can be applied in a wide range of manufacturing and service companies- from retailers to restaurants, hospitals to factories, and consulting companies to government agencies. The course emphasizes systems thinking and practical applications of statistical process control and material management. Several real cases are used to mesh theory with practice in an attempt to illustrate the critical importance of aligning operations with other core business functions such as finance and marketing.

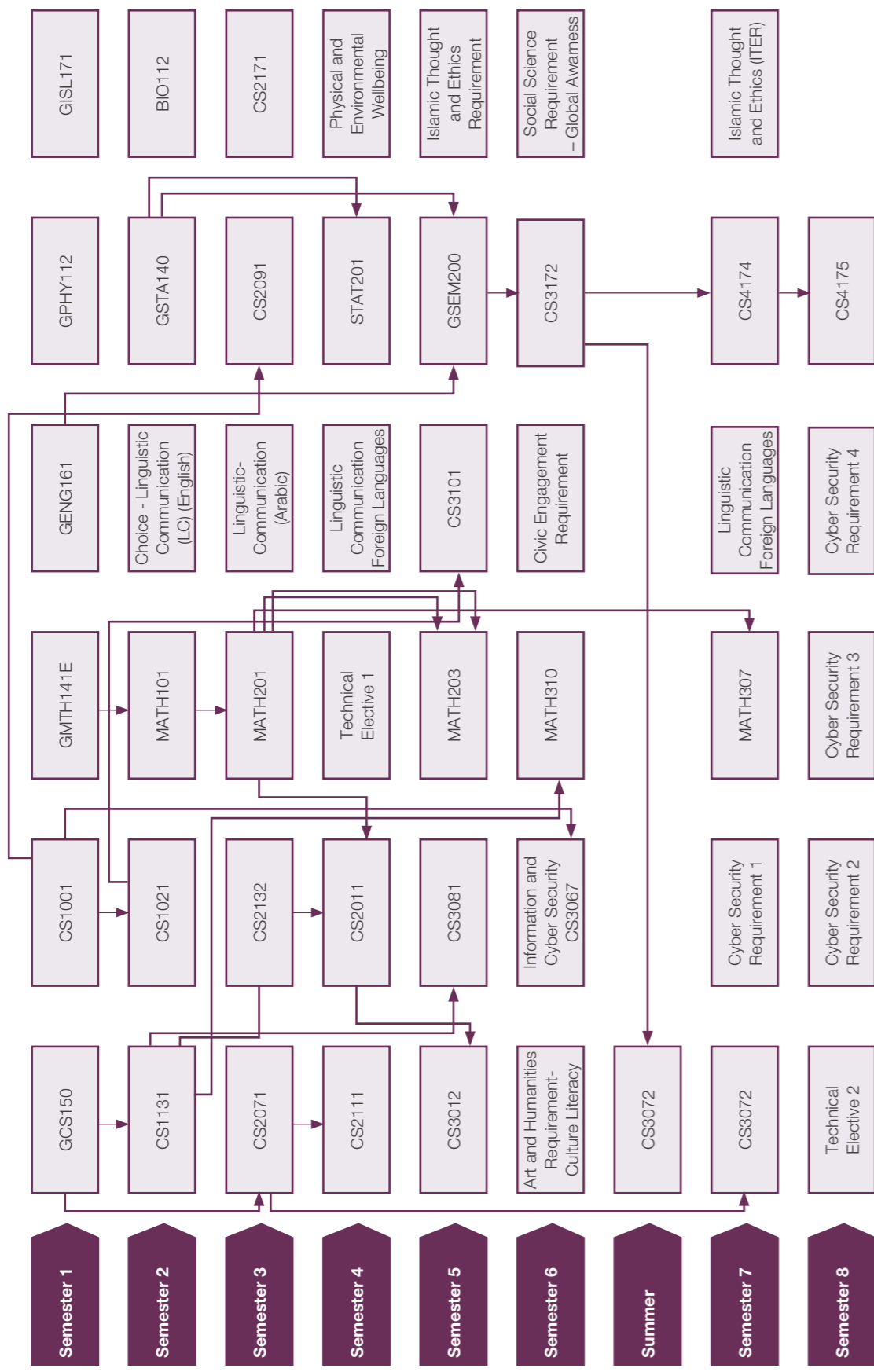
## Computer Science – Artificial Intelligence Concentration

Advising flowchart



# Computer Science – Cyber Security Concentration

Advising flowchart



# Computer Science – No Concentration

Advising flowchart

