GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY

STUDENT HANDBOOK

FACULTY OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE

2017/ 2018

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BSC. (HONS) IN COMPUTER SCIENCE

BSC. (HONS) IN COMPUTER ENGINEERING

BSC. (HONS) IN SOFTWARE ENGINEERING

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Vision

"Be an internationally recognized center for education in Computing and Information Sciences as well as multi-disciplinary research focusing on global needs."

Mission

"To produce internationally recognized graduates in Computing and Information Sciences while providing a productive research environment."

Message of the Dean

Welcome to the Faculty of Computing of the General Sir John Kotelawala Defence University.

Computing and Information Technology touches nearly every aspect of the modern life and is a fast growing area that generates professional opportunities of high potential. In today's world, highly skilled professionals are needed more than ever in the field of Computing to take the social responsibility of generating knowledge and solve the social issues through cutting edge technology. Therefore, our ultimate goal is to provide leading professional to the Military and the industry at large who can face the challenges, with a positive attitude and use technical and theoretical knowledge for the betterment of society through advanced learning. We are committed to be in the forefront of providing quality education to produce high calibre graduates who can provide smart and sustainable solutions.

Faculty of Computing of General Sir John Kotelawala Defence University is the first established Computing Faculty in the Sri Lankan State University System dedicated to offer the broadest range of Computing Degree Programmes. We offer five degree programs in the discipline of computing as BSc(Hons) in Computer Science, Computer Engineering and Software Engineering under the Department of Computer Science and BSc(Hons) in Information Technology and Information Systems under the Department of Information Technology. As the Dean, I am happy to note that we are practicing internationally accepted standards in the development of our course curricula encouraging research and innovations. Finally, I wish you all success in your future endeavours.

Captain Janaka Ushan Gunaseela USP, psc
BSc. (Electrical and Electronic Engineering), MEeg (Electronics and Telecom Engineering), CEng.MIET, CEng.MIESL

Contents

1. General Information

1.1   The University

General Sir John Kotelawala Defence University (KDU) was initially established as the "General Sir John Kotelawala Defence Academy" by the Parliamentary Act No 68 of 1981 and subsequently it was elevated to University status by the Amendment Act No 27 of 1988, thereby empowering it to award Bachelors' and Postgraduate degrees in Defense Studies.

KDU is a member of the Association of Commonwealth Universities (United Kingdom) and maintains necessary standards for educating and grooming officer cadets to meet the challenges of modern defense management.

KDU is now open for civil students who wish to continue their higher studies in the fields of Engineering, Law, Management, Social Sciences and IT.

Officers with exceptional performance in reputed universities/institutions can pursue postgraduate studies in accordance with the requirements of the service to which they belong. Civil professionals are also offered a place at postgraduate studies to excel in and study a post-graduate degree in their related field of expertise.

1.2   Faculty of Computing

In 2015, the Faculty of Computing (FOC) of General Sir John Kotelawala Defence University was established with the dawn of the Southern Campus of KDU at Sooriyawewa. This is the first ever Computing Faculty in the Sri Lankan State University System dedicated to offer the widest spectrum of computing degrees under one umbrella of Computing, and all the computing degrees offered by FOC have been benchmarked with ACM/IEEE international standards.

FOC comprises four departments catering for teaching and research in theoretical foundations of the field of computing, engineering of computer hardware and software, mathematical and statistical requirements of computing, and technological and social aspects of computing. FOC strives to build students' enthusiasm, intellectual capacity, and active involvement in research from the day one of their undergraduate studies. FOC at KDU is the only Computing Faculty in the State University System that offers the widest spectrum of Computing Degrees for students of all streams of G.C.E (A/L) except Technology Stream.

1.3   Faculty Graduate Profile (Programme Outcomes)

Graduate profile depicts the attributes, knowledge, skills and attitudes acquired or expected in a graduate by successfully following the degree programmes offered by the Faculty of Computing. By completion of degree program, the graduates will be able to,

1. Apply core concepts and fundamentals in the investigation, analysis and finding creative and innovative solutions to complex problems by following scientific research methods.
2. Apply current and appropriate tools and technologies to develop practical and sustainable solutions to real world complex problems.
3. Apply communication skills effectively and efficiently to promote ideas, issues and goals in order to positively contribute to the community and society at large.
4. Participate effectively as an individual or as a member of a multi-disciplinary team and undertake a leadership role when appropriate.
5. Take initiative, assume personal responsibility and demonstrate accountability and able to instill entrepreneurship.

6. Apply appropriate computational tools to retrieve, process, analyze and store relevant information for well-informed decision making.

7. Collaborate and cooperate with others to maintain social and professional relationships in order to maximize working potential.

8. Ability to analyze and devise appropriate strategies to embrace changing environments.

9. Adhering to professional and ethical responsibilities while following industrial norms and best practices.

10. Clearly identify own ambition and develop long term goals accordingly.

11. Recognize the need, and have the ability, to engage in independent learning for continuous professional development/ lifelong learning.

1.4   Academic Departments
1.4.1   Department of Computer Science

The Department of Computer Science has been established on 1st of January 2015 with the objective of producing Computer Science professionals of international standard and to fulfill the requirements of booming IT industry and develop researchers. It offers courses related to Scientific and Theoretical aspects of computing and enables introducing new courses on emerging trends in computing with an emphasis on the developments in Artificial Intelligence.

The Department of Computer Science is proud to offer two major computing courses including BSc (Hons) in Computer Science and BSc (Hons) in Software Engineering. These programs are targeting Science students from G.C.E (A/L). This department offers a large percentage of computing courses for BSc (Hons) in Computer Engineering, BSc (Hons) in Information Technology and BSc (Hons) in Information Systems as well. The department engages in a wide spectrum of research in broad

areas of Theoretical Computing and Artificial Intelligence. This department also envisages strengthening the faculty wise research culture.

1.4.2   Department of Information Technology

Department of Information Technology is the oldest department of the Faculty of Computing. This department offers more applications/ practicals oriented IT courses, and courses on organizational behavior, business and management. The department offers two degrees, namely BSc (Hons) in Information Technology and BSc (Hons) in Information Systems targeting candidates from all streams of G.C.E (A/L) except Technology Stream. courses in the first two years are common to both degree programs and specialization in either IT or in IS begins from the third year. These two degree programs produce graduates with two different skills, namely, more technically oriented professionals (IT) and more management/business oriented professionals (IS) with technical knowledge.

1.4.3   Department of Computer Engineering

Department of Computer Engineering is one of the newly established department of the Faculty of Computing. This department offers the BSc (Hons) in Computer Engineering degree. This degree program provides students with an appropriate understanding of Software Technologies and Applications, Software Engineering, Network Technologies, Web Technologies, Leadership and Industrial Knowledge.

1.4.4   Department of Computational Mathematics

Department of Computational Mathematics is a recently established department of the Faculty of Computing. The department offers courses in three specific subject areas, namely, Mathematics & Statistics, Computational Intelligence and Theory of

Computing. The courses primarily provide Mathematics and Statistics knowledge required for the degrees offered by the Faculty of Computing.

2   General Regulations
2.1   Admission Requirement

The durations of the degree programs and the minimum requirements to enter the Computing Programs at KDU are as follows:

Degree Program	Duration	G.C.E (A/L) - Stream
BSc (Hons) in Computer Science (CS)	Military: 04 1/2 Years Civil: 04 Years	Maths
BSc (Hons) in Software Engineering (SE)	Military: 04 1/2 Years Civil: 04 Years	Maths
BSc (Hons) in Computer Engineering (CE)	Military: 04 1/2 Years Civil: 04 Years	Maths
BSc (Hons) in Information Technology (IT)	Military: 04 1/2 Years Civil: 04 Years	Biology / Maths / Commerce or Arts
BSc (Hons) in Information Systems (IS)	Military: 04 1/2 Years Civil: 04 Years	Biology / Maths / Commerce or Arts

Table 1: Degree Programs and Selection Criteria

- The candidate should have a minimum of three Simple (S) Passes at the G.C.E. (A/L) Examination in the relevant stream and be qualified for university admission.

- To follow the degree programs in Computer Science, Software Engineering and Computer Engineering candidates need to have followed Maths Stream or Mathematics, Physics and any one of the following subjects; Chemistry/ Higher Mathematics/ICT at the G.C.E (A/L).

- Those who have followed the G.C.E (A/L) Examination in Biology / Maths/ Commerce or Arts streams (except Technology) are eligible to apply for IT and IS Degree Programs.

- A minimum of a Credit (C) Pass for English Language at G.C.E (Ordinary Level) Examination.

- A pass mark (marks 30 and above) for the Common General Test.

The Following additional requirements are to be fulfilled by those applying as military students.
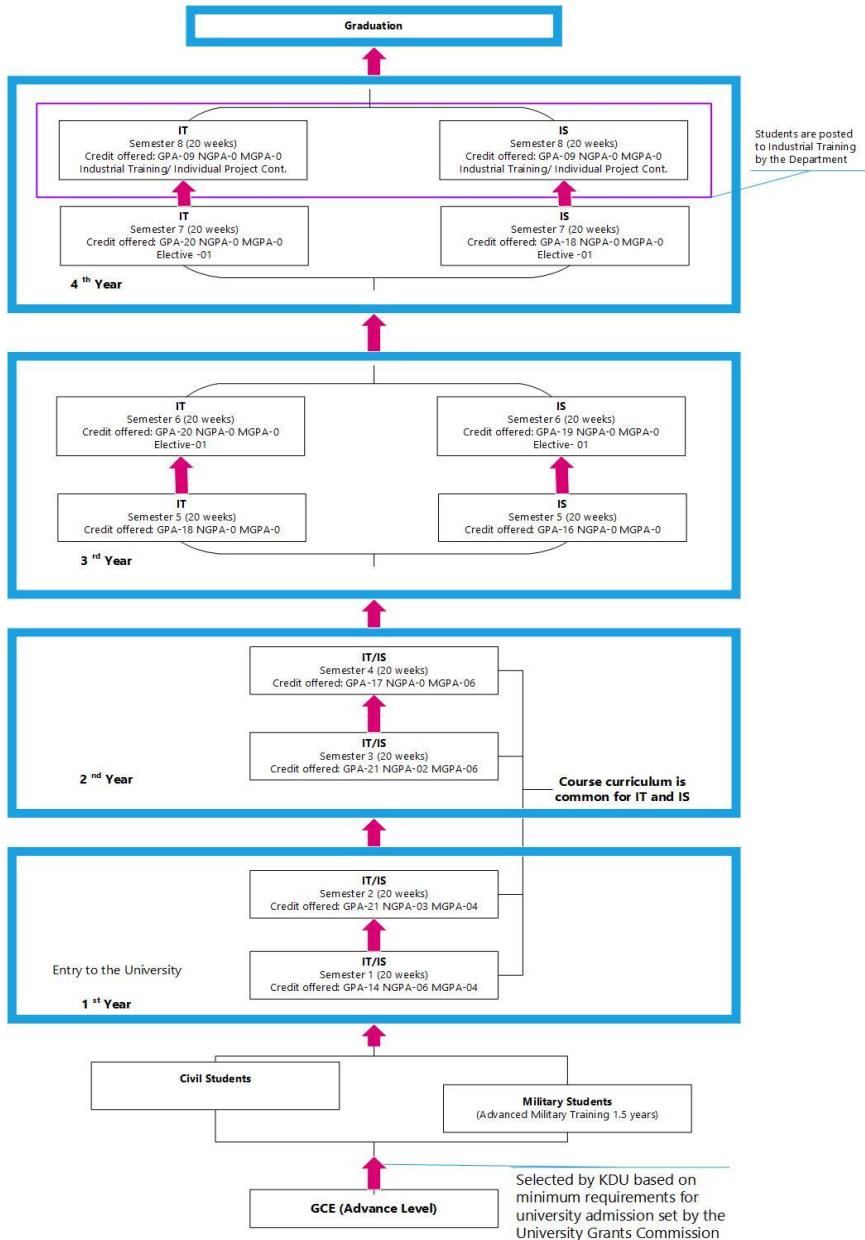
- Be a citizen of Sri Lanka.
- Be not less than 18 years and not more than 22 years of age on the closing date of applications.
- Be unmarried.
- Have a body weight not less than 50 kg (110 lbs).
- Have an unexpanded chest not less than 81.25 cm (32").
- Have a height not less than

	Army	Navy	Air Force
Male	165.1 cm (5'5")	167.6 cm (5'.6")	167.6 cm (5'.6")
Female	152.4 cm (5'3")	160.0 cm (5'.3")	162.5 cm (5'4")
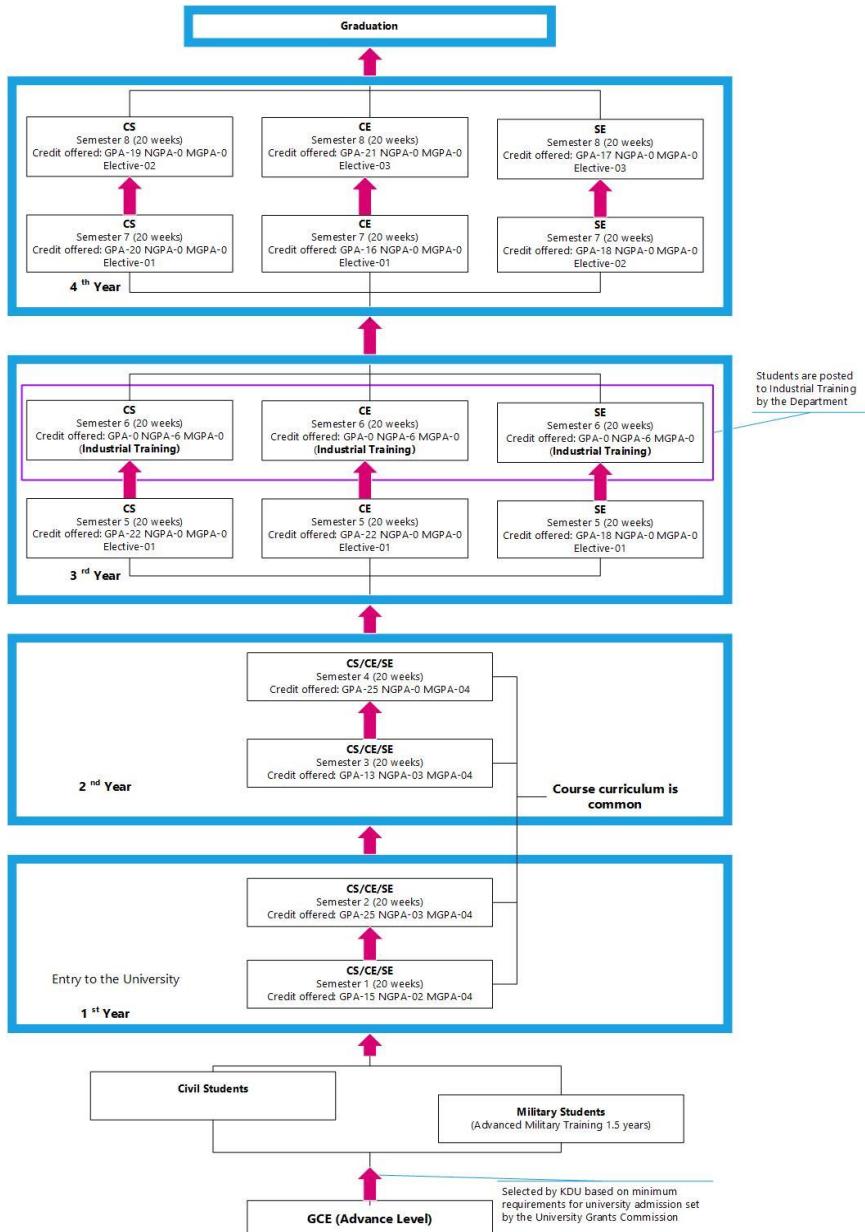
Table 2 Minimum Height Requirement

2.2   Course Structure

2.2.1   BSc (Hons) in Information Technology and BSc (Hons) in Information Systems Degree Programs

2.2.2 BSc (Hons) in Computer Science, BSc (Hons) in Computer Engineering and BSc (Hons) in Software Engineering Degree Programs

Graduation

4th Year

CS	CE	SE
CS Semester 8 (20 weeks) Credit offered: GPA-19 NGPA-0 MGPA-0 Elective-02	**CE** Semester 8 (20 weeks) Credit offered: GPA-21 NGPA-0 MGPA-0 Elective-03	**SE** Semester 8 (20 weeks) Credit offered: GPA-17 NGPA-0 MGPA-0 Elective-03
CS Semester 7 (20 weeks) Credit offered: GPA-20 NGPA-0 MGPA-0 Elective-01	**CE** Semester 7 (20 weeks) Credit offered: GPA-16 NGPA-0 MGPA-0 Elective-01	**SE** Semester 7 (20 weeks) Credit offered: GPA-18 NGPA-0 MGPA-0 Elective-02

3rd Year

Students are posted to Industrial Training by the Department

CS	CE	SE
CS Semester 6 (20 weeks) Credit offered: GPA-0 NGPA-6 MGPA-0 **(Industrial Training)**	**CE** Semester 6 (20 weeks) Credit offered: GPA-0 NGPA-6 MGPA-0 **(Industrial Training)**	**SE** Semester 6 (20 weeks) Credit offered: GPA-0 NGPA-6 MGPA-0 **(Industrial Training)**
CS Semester 5 (20 weeks) Credit offered: GPA-22 NGPA-0 MGPA-0 Elective-01	**CE** Semester 5 (20 weeks) Credit offered: GPA-22 NGPA-0 MGPA-0 Elective-01	**SE** Semester 5 (20 weeks) Credit offered: GPA-18 NGPA-0 MGPA-0 Elective-01

2nd Year

CS/CE/SE Semester 4 (20 weeks) Credit offered: GPA-25 NGPA-0 MGPA-04

CS/CE/SE Semester 3 (20 weeks) Credit offered: GPA-13 NGPA-03 MGPA-04

Course curriculum is common

1st Year — Entry to the University

CS/CE/SE Semester 2 (20 weeks) Credit offered: GPA-25 NGPA-03 MGPA-04

CS/CE/SE Semester 1 (20 weeks) Credit offered: GPA-15 NGPA-02 MGPA-04

Civil Students

Military Students (Advanced Military Training 1.5 years)

GCE (Advance Level)

Selected by KDU based on minimum requirements for university admission set by the University Grants Commission

3   Structure of the Curriculum and Courses

3.1   Courses Offered by The Faculty of Computing

3.1.1   Bachelor of Science (Hons) in Computer Science

Bachelor of Science (Hons) in Computer Science degree program provides an appropriate understanding of theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, and other exciting areas in Computer Science domain. Further, this program generally intends to prepare students with skills of Designing and implementing software solutions, devising new ways to use computers, and developing effective ways to solve computing problems as Computer Scientists. In addition to sound fundamental knowledge, students must possess systems thinking, the ability to analyze business problems, communication skills, and teamwork skills in face-to-face and virtual settings. Bachelor of Science (Hons) in Computer Science Degree Program of KDU has been designed in accordance with ACM/IEEE international guidelines and the requirements of Sri Lanka Qualifications Framework.

3.1.2   Bachelor of Science (Hons) in Software Engineering

Bachelor of Science (Hons) in Software Engineering program is concerned with the development and maintenance of software systems that behave reliably and efficiently. This program is different in character from other engineering disciplines due to both the intangible nature of software and the discontinuous nature of software operation. Courses of this program seek to integrate the principles of mathematics and computer science with the engineering practices developed for tangible, physical artifacts.

Degree programs in Software Engineering have many courses. This program offers more about software reliability and maintenance and focuses more on techniques for

developing and maintaining software that is correct from its inception. The curriculum has been designed according to ACM/IEEE international standard.

3.1.3   Bachelor of Science (Hons) in Computer Engineering

Bachelor of Science (Hons) in Computer Engineering Degree Program involves modeling, designing, implementation, testing, evaluation and integration of computer hardware and software to create computing systems. Computer Engineers use both hardware concepts from electrical engineering and system software concepts from Computer Science. Graduates will be well prepared to work in areas such as Digital Logic Design, Computer Organization/Architecture and Design, Algorithm Design and Analysis, Embedded Systems, Compilers, and Operating Systems. Elective options in the curriculum offer preparation in Software Engineering, Databases, Dependable Systems, Networking and Communications, VLSI, Graphics, Image Processing, Visualization, Artificial Intelligence, and Control Systems. Nearly all students in the Computer Engineering Program engage in collaborative research with faculty, through internships or independent study. These provide students have access to state-of-the-art facilities in computer engineering and computer vision such as those of the Laboratory for Engineering Man/Machine Systems. This degree program of KDU has been designed in accordance with ACM/IEEE international guidelines.

3.1.4   Bachelor of Science (Hons) in Information Technology

Bachelor of Science (Hons) in Information Technology Degree Program at KDU has been designed in accordance with ACM/IEEE international guidelines. BSc (Hons) in IT degree program provides students with an appropriate understanding of Software Technologies and Applications, Software Engineering, Network Technologies, Web Technologies, and Industrial Knowledge. Further, they must understand the concepts and processes for achieving organizational goals with Information Technology. In

addition to sound technical knowledge and organizational understanding, they must possess thinking skills, the ability to analyze business problems, communication skills, and teamwork skills in face-to-face and virtual settings.

3.1.5   Bachelor of Science (Hons) in Information Systems

Bachelor of Science (Hons) in Information Systems degree program at KDU has been designed in accordance with ACM/IEEE international guidelines. BSc (Hons) in IS degree program provides students with an appropriate understanding of Foundations of Information Systems, Data & Information Management, Enterprise Architecture, Project Management, IT Infrastructure, Systems Analysis & Design, and IS Strategies. Further, they must understand concepts and processes for achieving organizational goals with Information Systems. In addition to sound technical knowledge and organizational understanding, they must understand, analyze and make use of the fundamental concepts related to organizational processes and systems, thereby apply various tools and techniques on how vast amount of data collected by modern organizations can be used to review, redesign, and improve processes.

3.2 Credit Ratings and Course Codes

3.2.1 BSc (Hons) in CS, BSc (Hons) in CE and BSc (Hons) in SE (Level 1 and 2)

3.2.1.1 Semester 01

The following table gives an overall summary of the course units entitled for the 1st semester of the BSc (Hons) in Computer Science, BSc (Hons) in Computer Engineering and BSc (Hons) in Software Engineering Degree Programs. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Tutorial Hrs /Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 1												
CS1013	Fundamentals of Programming	C	2	2	3						40	60
CS1022	Foundation of Computer Science	C	2		2						30	70
CS1032	Computer Systems Architecture	C	2		2						30	70
CS1043	Fundamentals of Databases	C	2	2	3						30	70
CS1052	Fundamentals of Visual Computing	C	1	2	2						30	70
CM1012	Probability and Statistics	C	2		2			17	2	4	30	70
CM1022	Engineering Mathematics	C	2		2						30	70
DL1172	Basic Study Skills in English for CS/CE/S	C	2			2					20	80
COE1993	Group Project in Hardware	C		2	1						100	
MS1014	Military Studies	C	2				4				20	80
Total for Semester 1								17	2	4		

Figure 1: Overall Summary of the Course Units

Fundamentals of Programing   **CS1013**

In this course, the student will gain a broad understanding of computer programming. The student will acquire introductory skills in problem analysis, solution design, and program construction Through Theory and practical programming activities. This course guides the process of creating simple C++ programs to advanced features. Topics covered include Introduction to computer programming, generations of computer languages, program design and development process, problem definition, pseudo-code, flowcharting, coding, testing, and debugging Sequence, selection, loops and array processing.

Credits   03   Compulsory – GPA

Foundation of Computer Science   **CS1022**

The course introduces the theoretical foundations of computer science. These form the basis for a more complete understanding of the proficiency in computer science. On completion of this course, students should be able to understand what a computer system is, learn standard methods of input and learn how to measure drive performance.

Credits   02   Compulsory – GPA

Computer Systems Architecture   **CS1032**

This course provides an understanding of the design of computer systems and components. Processor design, instruction set design, and addressing; control structures; memory management, caches, and memory hierarchies.

Credits   02   Compulsory – GPA

Fundamentals of Databases   **CS1043**

The course deals with data models and database systems and has been designed to enable the theoretical basis of databases and be able to apply that knowledge in developing and using relational databases. The lectures are organized around the database design lifecycle.

Credits   03   Compulsory – GPA

Fundamentals of Visual Computing   **CS1052**

The course is designed to teach students the fundamentals of building vector graphics, animations, applications, games, and interactive content with Flash Professionals for e-Learning, web industry and multimedia development.

Credits   02   Compulsory – GPA

Probability and Statistics CM1012

This is a foundation course in probability and statistics. The focus of this course is to help students to work with data and apply the basic concepts in their varied academic disciplines. Applications of Bayer's theorem and basic concepts of probability, making a stem plot and calculating a correlation to choosing and carrying out a significance test will be discussed descriptively in this course.

Credits 02 Compulsory – GPA

Engineering Mathematics CM1022

Provide learners with the knowledge of methods and techniques of Matrix and Determinants, Vector Calculus, Complex Numbers Probability and Statistics, and Graph theory, so that they gain the ability to use that knowledge to analyze problems in the fields of Engineering Sciences.

Credits 03 Compulsory – GPA

Basic Study Skills in English for CS/CE/SE DL1172

This course emphasizes academic support to promote success for students with limited proficiency in English who are taking content courses with native English speakers. Students review content material from their other classes and learn techniques and study skills appropriate to their language ability and the materials they are working with. Students pay particular attention to literacy, comprehension, and composition skills in preparation for tests. Students continue to develop their English by improving language skills in reading/writing/listening/speaking as well as increasing the vocabulary used in the different content areas. Students are encouraged to continue to develop skills in English.

Credits 02 Compulsory – NGPA

Group Project in Hardware COE1993

To build enthusiasm with computing students in the first year so that students pick energy and momentum throughout. Hands -on laboratory experience with more advanced features of Arduino systems and to enhance their programing skills through exploratory lab exercises and final project.

Credits 01 Compulsory – GPA

3.2.1.2   Semester 02

The following table gives an overall summary of the course units entitled for the 2nd semester of the BSc (Hons) in Computer Science, BSc (Hons) in Computer Engineering and BSc (Hons) in Software Engineering Degree Programs. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Tutorial Hrs /Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 2												
CS1062	Developments in Mathematics & Sciences	C	2		2						30	70
CS1073	Object Oriented Programming I	C	2	2	3						30	70
CS1082	Web Development	C	1	2	2						30	70
CS1092	Computer Networks I	C	1	2	2						30	70
EE1102	Fundamentals of Electrical Engineering	C	2		2			17		4	30	70
ET1102	Basic Electronics	C	2		2						30	70
CM1032	Discrete Mathematics	C	2		2						30	70
COE1993	Group Project in Hardware	C		4	2						100	
MS1024	Military Studies	C	3				4				20	80
Total for Semester 2								17	0	4		

Figure 2: Overall Summary of the Course Units

Developments in Mathematics & Sciences   **CS1062**

The course is designed to teach students the basic fundamentals of development in mathematics and science in practical settings. This course covers all the fundamental branches of development in mathematics and science.

Credits   02   Compulsory – GPA

Object Oriented Programming I   **CS1073**

To introduce object-oriented programming concepts, identify real-world problems where object-oriented concepts can be applied, find a solution to the problem identified using OOP concepts. Topics covered including class and Objects, inheritance, packages and data abstraction. In addition, course guides the process of creating Advance Java application including OOP concepts.

Credits   03   Compulsory – GPA

Web Development   **CS1082**

This course introduces World Wide Web Consortium (W3C) standard markup language and services of the Internet. Upon completion, students should be able to create hand-coded web site with mark-up language, and effectively use and understand the function of related technologies.

Credits   02   Compulsory – GPA

Computer Networks I   **CS1092**

The course is designed to teach students to introduce fundamental networking concepts and technologies. The online course materials will assist students in developing the skills necessary to plan and implement small networks across a range of applications.

Credits   02   Compulsory – GPA

Basic Electronics   **ET1102**

The course provides the students with the knowledge of basic Electronic engineering principles and their usage in practice

Credits   02   Compulsory – GPA

Fundamentals of Electrical Engineering   **EE1102**

Introduction to the theory and analysis of electrical circuits; basic circuit elements including the operational amplifier; circuit theorems; dc circuits; forced and natural responses of simple circuits; sinusoidal steady state analysis and the use of a standard computer-aided circuit analysis program. Consideration is given to power, energy, impedance, phasors, frequency response and their use in circuit design.

Credits   02   Compulsory – GPA

Discreet Mathematics   **CM1032**

The purpose of this course is to understand and utilize the mathematical branches graph theory and combinatorics for computer science. In particular, this class is meant to introduce graphs, trees, recurrence relations, counting, with an emphasis on applications in computer science.

Credits   02   Compulsory – GPA

Group Project in Hardware   **COE1993**

To build enthusiasm with computing students in the first year so that students pick energy and momentum throughout. Hands -on laboratory experience with more advanced features of Arduino systems and to enhance their programing skills through exploratory lab exercises and final project.

Credits   02   Compulsory – GPA

3.2.1.3 Semester 03

The following table gives an overall summary of the course units entitled for the 3rd semester of the BSc (Hons) in Computer Science, BSc (Hons) in Computer Engineering and BSc (Hons) in Software Engineering Degree Programs. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lectures Hrs / Week	Lab / Assignments Hrs /	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 3												
CS2013	Data Structures and Algorithms I	C	2	2	3			17	0	4	30	70
CS2022	Operating Systems	C	2		2						30	70
CS2032	Object Oriented Programming II	C	2		2						30	70
CS2042	Computer Networks II	C	2		2						30	70
CS2052	Requirement Engineering	C	2		2						30	70
EE2122	Electronics System	C	2		2						30	70
CM2013	Calculus & Numerical Methods	C	3		3						30	70
CS2993	Group project in Software Development	C		2	1						100	
MS2044	Military Studies	C	3				4				20	80
Total for Semester 3								17	0	4		

Figure 3: Overall Summary of the Course Units

Data Structures and Algorithms - I   **CS2013**

In this course, the student will gain a knowledge in various data structures, their computer representations and associated algorithms and to investigate the running time of an algorithm. The course will cover fundamentals concepts of Abstract data types, Stack, Queues, and Link List with algorithm analysis.

Credits   03   Compulsory – GPA

Operating Systems   **CS2022**

Operating systems are an essential part of any computer system. Operating systems vary significantly, but their fundamental principles remain the same. In this course, the students will be introduced to the basic concepts of operating systems, see how they manage resources such as memory, peripherals, and schedule CPU time, learn how to use the system call interface and how to create processes and synchronize them, learn how applications communicate, understand the memory hierarchy and see how virtual memory is managed, understand how files are managed and stored, and much more.

Credits   02   Compulsory – GPA

Object Oriented Programming II   **CS2032**

In this course, the student will gain a broad understanding of advanced concepts in Object Oriented Programming. The course course will cover OOP concepts including Encapsulation, Inheritance, Polymorphism, Overloading and Overriding and various application and techniques on OOP with Threads, GUI programming and Database connectivity.

Credits   02   Compulsory – GPA

Computer Networks II   **CS2042**

Computer Network Systems part II is designed to the focus of on learning the architecture, components, and operations of routers and switches in a small network. In this course, Students will learn how to configure a router and a switch for basic functionality (This syllabus aligned with CCNA Curricular)

Credits   02   Compulsory – GPA

Requirement Engineering

<div align="right">

CS2052

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The course will discuss concepts for systematically establishing, defining and managing the requirements for a large, complex, changing and software-intensive systems, from technical, organizational and management perspectives. The course will consider the past, present and future paradigms and methodologies in requirements engineering

Credits 02 Compulsory – GPA

Electronics System

<div align="right">

EE2122

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The course is designed to teach students the basic fundamentals of electronic systems in practical settings. This course covers all the fundamental branches of electronic systems.

Credits 02 Compulsory – GPA

Calculus & Numerical Methods **CM2013**

The course is designed to teach students the propositional logic and predicate logic and quantifiers, direct proofs and indirect proofs, sets and relations, functions and their behaviors and mathematical sequences.

Credits 03 Compulsory – GPA

Group project in Software Development **CS2993**

This course provides the student with project experience to complement the studies of the software development process. Students work in small groups and participate in all the development phases (requirements analysis, design, construction, testing and documentation) of a nontrivial software system. As well, each group has to address the control of the development process by constructing and following a detailed software development management plan. This will also develop communication and writing skills of students with peers and supervisors.

Credits 01 Compulsory – GPA

3.2.1.4   Semester 04

The following table gives an overall summary of the course units entitled for the 4th semester of the BSc (Hons) in Computer Science, BSc (Hons) in Computer Engineering and BSc (Hons) in Software Engineering Degree Programs. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lectures Hrs / Week	Lab / Assignments Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 4												
CS2062	Data Structures and Algorithms II	C	2		2						30	70
CS2072	Advance Computer Architecture & Organization	C	2		2						30	70
CS2082	Artificial Intelligence	C	2		2						30	70
SE2012	Software Project Management	C	2		2						30	70
SE2022	Software Process Engineering	C	2		2			16		4	30	70
CM2022	Statistical Distributions and Inference	C	2		2						30	70
EE2222	Computer Interfacing & Micropreocessors	C	2		2						30	70
CS2993	Group project in Software Development	C		4	2						100	
MS2024	Military Studies	C	3				4				20	80
Total for Semester 4								16	0	4		

Figure 4: Overall Summary of the Course Units

Data Structures and Algorithms II   **CS2062**

The purpose of this course is to provide the knowledge in various data structures, their computer representations and associated algorithms and to investigate the running time of an algorithm.

Credits   02   Compulsory – GPA

Advance Computer Architecture & Organization   **CS2072**

The course is designed to teach students to examine the internal architecture and organization of the processor and the parallel organization.

Credits   02   Compulsory – GPA

Artificial Intelligence   **CS2082**

The course is designed to give students an introduction to the theories and algorithms used to create intelligent systems. Topics include search algorithms, logic, planning, knowledge representation, machine learning, and applications from areas such as computer vision, robotics, natural language processing, and expert systems. Programming assignments are an integral part of the course.

Credits   02   Compulsory – GPA

Software Project Management   **SE2012**

This subject is to understand the process of management of the software development project. The content is aligned with the latest version of knowledge areas in the Institute of Project Management (IPM) Project Management Body of Knowledge (PMBOK). Successful completion of the subject will confidence the students to effectively initiate and manage software development projects in real-world.

Credits   02   Compulsory – GPA

Software Process Engineering   **SE2022**

Engineering of the software development process including software life-cycle, maturity models, process programming, and process management. This course considers both theory and practice of engineering large, long-lived software systems, including process analysis, modeling, workflows, standards, process environments and tools, automation, and organizational context. Case studies illuminate the application of software process theory to engineering practice. Students will work in teams to analyze and develop software management plans and tools.

Credits   02   Compulsory – GPA

Statistical Distributions and Inference   **CM2022**

The course is designed to teach students about Random Variable, Probability Mass Function, Bernoulli, Binomial, Hyper geometric, Geometric, Negative Binomial, Poison distribution, Probability density function, Point estimation, Interval estimation and Hypothesis testing.

Credits   02   Compulsory – GPA

Computer Interfacing & Microprocessors   **EE2222**

The course includes interfacing of microcomputers to peripherals or other computers for purposes of data acquisition, device monitoring and control, and other communications. The interfacing problem is considered at all levels including computer architecture, logic, timing, loading, protocols, and software laboratory for building and simulating designs.

Credits   02   Compulsory – GPA

Group project in Software Development   **CS2993**

This course provides the student with project experience to complement the studies of the software development process. Students work in small groups and participate in all the development phases (requirements analysis, design, construction, testing and documentation) of a nontrivial software system. As well, each group has to address the control of the development process by constructing and following a detailed software development management plan. This will also develop communication and writing skills of students with peers and supervisors.

Credits   02   Compulsory – GPA

3.2.2 BSc (Hons) in Computer Science (Level 3 and 4)

3.2.2.1 Semester 05

The following table gives an overall summary of the course units entitled for the 5th semester of the BSc (Hons) in Computer Science Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 5												
CS3012	Human Computer Interactions	C	2		2			19(Including 1 Elective)			30	70
CS3023	Advanced Databases and Big Data Analytics	C	2	2	3						30	70
CS3032	Concurrent Programming	C	2		2						30	70
CS3042	Image Processing & Computer Vision	C	2		2						30	70
CS3052	Essentials of Computer Law	C	2		2						30	70
CS3062	Research Methodology	C	2		2						30	70
CS3072	Logic Programming	C	2		2						30	70
CS3082	Mobile Computing	E	1	2	2						30	70
CS3092	Computer & Network Security	E	2		2						30	70
CS3102	Bioinformatics	E	2		2						30	70
SE3042	Software Design & Architecture	C	2		2						30	70
Total for Semester 5					19							

Figure 5: Overall Summary of the Course Units

Human Computer Interactions **CS3012**

This course uses an integrative and cross-disciplinary approach to bring together a broad variety of topics together in relation to the problem of developing quality user interaction designs to provide an introduction to the field of HCI.

Credits 02 Compulsory – GPA

Advanced Databases and Big Data Analytics **CS3023**

This course aims at furthering database systems concepts through adding complexity and a more hands-on approach. In particular this course will focus on query optimization, query evaluation, transaction processing and concurrency control techniques. Also, this course will focus on storage and file structures, indexing and hashing methods. Apart from that finally this course will be given a brief introduction on big data analytics.

Credits 03 Compulsory – GPA

Concurrent Programming **CS3032**

Many challenges arise during the design and implementation of concurrent and distributed programs. The aim of this course is to understand those challenges, and to see techniques for tackling them. The main paradigm to be considered is message passing concurrency, where independent processes, with private variables, interact by passing messages.

Credits 02 Compulsory – GPA

Image Processing & Computer Vision **CS3042**

The purpose of this course is to provide the knowledge in fundamentals on image processing & computer vision and educate how digital images are represented, manipulated, encoded and processed, with emphasis on algorithm design, implementation and performance evaluation.

Credits 02 Compulsory – GPA

Essentials of Computer Law   **CS3052**

The course is designed to enable students to learn and apply ethics in computing. Topics include Law of Contract, Sources of Law, Introduction to Information Technology Law, Principles of Commercial Law (The Law of Agency), Intellectual Property, Computar Crime.

Credits   02   Compulsory – GPA

Research Methodology   **CS3062**

This course course will provide an opportunity to the understanding of research through an exploration of computer-based research, ethics, and approaches. The course introduces the introduction of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approach. The course will cover Types of Research, Approach to do Research, Scientific Method, Milestone Approach and Reading and Writing.

Credits   02   Compulsory – GPA

Logic Programming   **CS3072**

This course deals with logic programming paradigm and Prolog. We discuss the syntax and the semantics of Prolog, the working of a Prolog interpreter and various applications of Prolog. In particular, we consider the use of Prolog for database querying, parsing, meta-programming, and problem solving in AI. The programming assignments can be coded in SWI_Prolog or XSB.

Credits   02   Compulsory – GPA

Mobile Computing   **CS3082**

An introduction to mobile computing with a strong emphasis on application development for the Android operating system. Students will complete a major project with the goal of releasing an app on the Android Market place.

Credits   02   Elective – GPA

Computer & Network Security   **CS3092**

Security is now a core requirement when creating systems and software. This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems.

Credits   02   Elective – GPA

Bioinformatics   **CS3102**

The course is designed to introduce the field of bioinformatics to learn how to apply computer science in bio science environment. The course will cover computational gene hunting, sequencing, DNA arrays, sequence comparison, pattern discovery in DNA, genome rearrangements, molecular evolution and computational proteomics.

Credits   02   Elective – GPA

Software Design & Architecture   **SE3042**

The course is designed to educate students on software architectures in depth and the principles, techniques and tools for creating, developing and evaluating software architectures.

Credits   02   Compulsory – GPA

3.2.2.2   Semester 06

The following table gives an overall summary of the course unit entitled for the 6th semester of the BSc (Hons) in Computer Science Degree Program. The respective course unit has been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 6												
CS3112	Computer Graphics & Visualization	C	1	2	2			16(Including 2 Elective)			30	70
CS3122	Automata Theory	C	2		2						30	70
CS3132	High Performance Computing	C	2		2						30	70
CS3142	Complex Systems and Agent Technology	C	2		2						30	70
CS3152	Information Security	E	2		2						30	70
CS3162	Social Aspects of Computing	E	2		2						30	70
CS3172	Digital Forensic	E	2		2						30	70
CS3182	Modeling and Simulation	E	2		2						30	70
CS3192	Nature Inspired Computing	E	2		2						30	70
CM3022	Operational Research	C	2		2						30	70
EE 3122	Microcontrollers and Embeded Systems	E	2		2						30	70
CS3992	Independent Study	C	1	2	2						100	
Total for Semester 6					16							

Figure 6: Overall Summary of the Course Units

Computer Graphics & Visualization   **CS3112**

The objective of the course is to introduce theoretical methods for two-dimensional and three-dimensional graphics with applications to visualization techniques. The following topics will be discussed: Raster graphics, geometric transformations, viewing models, projections, parametric curves and surfaces, colour theory, visible surface / line determination, illumination and shading.

Credits   02   Compulsory – GPA

Automata Theory   **CS3122**

The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

Credits   02   Compulsory – GPA

High Performance Computing   **CS3132**

The objective of this course is to develop high performing computing (HPC) systems and study how multicore processing units and multithreading help build power-aware HPC systems. Special attention is given to parallel computer architectures and parallel programming. Topics include Computer architecture, Parallel processing, Parallelism, Concurrency, Parallel programming: OpenMP, Open MPI, GPU/CUDA, Introduction to GPU/CUDA programming model, Parallel algorithms for GPU/CUDA programming, Developing parallel solutions for complex problems and Power-aware high-performance computing systems.

Credits   02   Compulsory – GPA

Complex Systems & Agent Technology   **CS3142**

The course is designed to give students an introduction to the theories and methods used to create multi agent systems using intelligent agents. Topics include Introduction to AI, Intelligent Agents, Types of Agents, Agent Communication, Architecture of the Agents, Multi agent systems developments frameworks and application of the MAS. Programming assignments are an integral part of the course.

Credits   02   Compulsory – GPA

Information Security   **CS3152**

Security is now a core requirement when creating systems and software. This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems. Other topics covered include basics of cryptography (e.g., digital signatures), risk management, security assurance and secure design principles, as well as internet security.

Credits   02   Elective – GPA

Social Aspects of Computing   **CS3162**

This course is intended to introduce people to the wider social implications of computing technology. Topics include how computer use affects social and work relationships and the uses of computers in society. Students analyze scenarios that allow them to view ethical decision making as a crucial part of understanding the world of computing.

Credits   02   Elective – GPA

Digital Forensic   **CS3172**

The purpose of this course is to provide a comprehensive understanding of digital forensics and investigation tools and techniques.

Credits   02   Elective – GPA

Modeling & Simulation   **CS3182**

The course will introduce the basic concepts of computation through modeling and simulation that are increasingly being used by architects, planners, and engineers to shorten design cycles, innovate new products, and evaluate designs and simulate the impacts of alternative approaches. The course focus on System definitions and classification, Basic Static and Dynamic System, Modeling Techniques, Introduction to Discrete Event Simulation, Applications of Discrete Event Simulation.

Credits   02   Elective – GPA

Nature Inspired Computing   **CS3192**

This course is about algorithms that are inspired by naturally occurring phenomena and applying them to optimization, design and learning problems.   The focus is on the process of abstracting algorithms from the observed phenomenon, their outcome analysis and comparison as well as their "science". This will be done primarily through the lens of evolutionary computation, swarm intelligence (ant colony and particle-based methods) and neural networks.

Credits   02   Elective – GPA

Operational Research
                                                                  CM3022

Operational Research (OR) has many applications in science, engineering, economics, and industry and thus the ability to solve OR problems are crucial for both researchers and practitioners. Being able to solve the real-life problems and obtaining the right solution requires understanding and modeling the problem correctly and applying appropriate optimization tools and skills to solve the mathematical model. The goal of this course is to teach you to formulate, analyze, and solve mathematical models that represent real-world problems. We will also discuss how to use EXCEL and LINDO for solving optimization problems.   In particular, we will cover linear programming, network flow problems, integer programs, nonlinear programs, dynamic programming and queuing models.

Credits   02   Compulsory – GPA

Microcontrollers & Embedded Systems   **EE3122**

The aim of this course to provide the student with a detailed understanding of Microcontrollers and Embedded systems. The course covers Introduction to Embedded Systems, Microcontroller architectures, MSP430 Instruction set, Addressing modes, Interrupt signals and routines, Interface circuits and Analog and Digital Peripherals programming: Digital I/Os, Timers, ADC and Communication Peripherals, Low power modes of operation

Credits   02   Elective – GPA

Independent Study   **CS3992**

This course is an opportunity for the student to engage in a research effort to develop research skills and techniques of an independent study in a subject area in which the supervisor and the student have a common interest.

Credits   02   Compulsory – GPA

3.2.2.3   Semester 07

The following table gives an overall summary of the course units entitled for the 7th semester of the BSc (Hons) in Computer Science Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 7												
CS4012	Emerging Trends in Computing	C	2		2						30	70
CS4022	Theory of Programing Languages	C	2		2						30	70
CS4032	Natural Language Processing	C	2		2						30	70
CS4042	Machine Learning	C	2		2						30	70
CS4052	Compilers Design	C	2		2						30	70
CS4062	Artificial Cognitive Systems	E	2		2						30	70
CS4072	Computability and Complexity	E	2		2			18 (Including 2 Elective)			30	70
CS4082	Semantic Web and Ontology	E	2		2						30	70
CS4092	Distributed Systems	E	2		2						30	70
CS4102	Computer Music	E	2		2						30	70
COE4022	Advanced Operating Systems	E	2		2						30	70
COE4042	Robotics & Automation	E	2		2						30	70
SE4012	Formal Methods and Software Verifications	E	2		2						30	70
CM4012	Advanced Topics in Statistics	E	2		2						30	70
CS4999	Individual Research Project (4 Credits in Semester 7	C			4						100	
Total for Semster 7								**18**				

Figure 7: Overall Summary of the Course Units

Emerging Trends in Computing   **CS4012**

The course is to provide students with an opportunity to search for knowledge in areas of new trends in computing and it allow students to explore the emerging trends in a certain computer science area. It is to allow a student to do lightweight research and explore the current trends in a certain computer science area. Topics include Introduction to Emerging Trends in Computing, Familiarizing with new trends, Continuing trends in computing, Programming progression, Agent Technology and Features of Agent.

Credits   02   Compulsory – GPA

Theory of Programming Languages   **CS4022**

This course is an in-depth investigation of the theory of programming languages. The course covers the fundamental tools used in the analysis and design of programming languages, including semantics, type theory, abstract interpretation, meta-programming, and partial evaluation. We will also consider their application to imperative, functional, and object-oriented languages.

Credits   02   Compulsory – GPA

Natural Language Processing   **CS4032**

This course combines a critical introduction to key topics in theoretical linguistics with hands-on practical experience of developing applications to process texts and access linguistic resources. The main topics covered are Accessing text corpora and lexical resources, Processing raw text, Categorizing and tagging, extracting information from text, Analyzing sentence structure.

Credits   02   Compulsory – GPA

Machine Learning   **CS4042**

This course provides a broad introduction to machine learning and statistical pattern recognition. Topics include: supervised learning (generative/discriminative learning, parametric/non-parametric learning, neural networks, support vector machines); unsupervised learning (clustering); reinforcement learning and adaptive control.

Credits   02   Compulsory – GPA

Compilers Design   **CS4052**

This course explores the principles, algorithms, and data structures involved in the design and construction of compilers. Topics include finite-state machines, lexical analysis, context-free grammars and other parsing techniques, symbol tables and an introduction to intermediate code generation.

Credits   02   Compulsory – GPA

Artificial Cognitive Systems   **CS4062**

To introduce the study and development of intelligent systems, including the correspondence with natural cognitive systems and the design of smart tools.

Credits   02   Elective – GPA

Computability & Complexity   **CS4072**

The course provides a challenging introduction to some of the central ideas of theoretical computer science. The main goal of the class is to promote the understanding of computation and its limits. The course will convey the proof techniques that are used to classify problems and it is intended that students learn how to apply them to classify unfamiliar problems for themselves.

Credits   02   Elective – GPA

Semantic Web & Ontology   **CS4082**

The aim of this course is to teach the students the concepts, technologies and techniques underlying and making up the Semantic Web. The central focus is on creating ontologies as a form of information and knowledge organization in a Semantic Web / Linked Web of Data environment.

Credits   02   Elective – GPA

Distributed Systems   **CS4092**

The objective of this course is to provide an in-depth overview of research topics in distributed systems enabling students to master the development skills in providing and constructing distributed services.

Credits   02   Elective – GPA

Computer Music   **CS4102**

The course will cover three key aspects of computer music: representation, creativity and analysis addressed through theory and practice. It will cover sound, music as organized sound, and specific applications (e.g. music information retrieval and musicology). Students will be strongly encouraged to explore both scientific and artistic aspects of the course through programming exercises to generate sound and music in contemporary visual or textual music and arts programming languages

Credits   02   Elective – GPA

Advanced Operating Systems   **COE4022**

The objective of this course is to study, learn and understand the main concepts of advanced operating systems: parallel processing systems, distributed systems, real time systems, network operating systems, open source operating systems and the hardware and software features that support these systems.

Credits   02   Elective – GPA

Robotics & Automation   **COE4042**

The course provides comprehensive knowledge of robotics in the design, analysis and control. It provides an understanding of the principles of operation of automated equipment with particular reference to industrial robots. It focuses on the knowledge needed to select and use such equipment effectively.

Credits   02   Elective – GPA

Formal Methods & Software Verifications   **SE4012**

The aim of this course is to introduce the basic model checking techniques and tools for software verification.

Credits   02   Elective – GPA

Advanced Topics in Statistics　　　　　　　　　　　　　　　　　　　　**CM4012**

The Design and analysis of experiments subject affects student to improve the advanced statistical concepts. This course highly relates with the research activities in statistical field. It prepares student for perform experiments, gain results, perform statistical analysis and interpret the results manually and using statistical software.

Credits　　02　　　　　　　　　　　　　　　　　　　　　　　　Elective – GPA

Individual Research Project　　　　　　　　　　　　　　　　　　　**CS4999**

The aim of this course is to give undergraduate students exposure to research undertaken individually and to achieve a specific objective within a fixed time independently. Additionally, this course allows undergraduate students to conduct research in computer science, with applying techniques learned throughout the program, including the technical skills of analysis, design and implementation.

Credits　　04　　　　　　　　　　　　　　　　　　　　　　Compulsory – GPA

3.2.2.4   Semester 08

The following table gives an overall summary of the course units entitled for the 8th semester of the BSc (Hons) in Computer Science Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Categor y	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 8												
CS4999	Individual Research Project (5 Credits for Semester	C			5						100	
CS4996	Industrial Training	C				6		5	6		100	
Total for Semester 8								5	6			

Figure 8: Overall Summary of the Course Units

Individual Research Project   **CS4999**

The aim of this course is to give undergraduate students exposure to research undertaken individually and to achieve a specific objective within a fixed time independently. Additionally, this course allows undergraduate students to conduct research in computer science, with applying techniques learned throughout the program, including the technical skills of analysis, design and implementation.

Credits   05   Compulsory – GPA

Industrial Training   **CS4996**

The aim of Industrial Training is to expose students to real work of environment experience and at the same time, to gain the knowledge through hands on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and others. Moreover, this practical training program allows students to relate theoretical knowledge with its application in the industry.

Credits   06   Compulsory – NGPA

The course contains 125 GPA credits from core course units, 8 NGPA credits and 16 MGPA credits. The distribution of the academic credits in BSc (Hons) in Computer Science degree program are illustrated in the table below.

	BSc (Hons) in Computer Science		
	GPA Credits	NGPA Credits	MGPA Credits
Semester 1	17	02	04
Semester 2	17	-	04
Semester 3	17	-	04
Semester 4	16	-	04
Semester 5	19	-	-
Semester 6	16	-	-
Semester 7	18	-	-
Semester 8	05	06	-
Total	125	08	16

Figure 9: Overall Summary of the Course Units

MGPA: Military GPA

3.2.3   BSc (Hons) in Computer Engineering (Level 3 and 4)

3.2.3.1   Semester 05

The following table gives an overall summary of the course units entitled for the 5th semester of the BSc (Hons) in Computer Engineering Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 5												
CS3012	Human Computer Interactions	C	2		2						30	70
CS3082	Mobile Computing	C	1	1	2						30	70
CS3023	Advanced Databases and Big data analytics	C	2	1	3						30	70
CS3032	Concurrent programing	C	2		2			19 (Including 1 Elective)			30	70
CS3092	Computer & Network Security	E	2		2						30	70
CS3042	Image Processing & Computer Vision	C	2		2						30	70
CS3102	Bio informatics	E	2		2						30	70
CS3052	Essentials of Computer Law	C	2		2						30	70
CS3062	Research Methodology	C	2		2						30	70
CS3072	Logic Programming	E	2		2						30	70
CM3022	Fluid Mechanics	E	2		2						30	70
ET3132	Digital Signal Processing	C	2		2						30	70
Total for Semester 5								19				

Figure 10: Overall Summary of the Course Units

Human Computer Interactions   **CS3012**

This course uses an integrative and cross-disciplinary approach to bring together a broad variety of topics together in relation to the problem of developing quality user interaction designs to provide an introduction to the field of HCI.

Credits   02   Compulsory – GPA

Mobile Computing   **CS3082**

An introduction to mobile computing with a strong emphasis on application development for the Android operating system. Students will complete a major project with the goal of releasing an app on the Android Market place.

Credits   02   Elective – GPA

Advanced Databases and Big Data Analytics   **CS3023**

This course aims at furthering database systems concepts through adding complexity and a more hands-on approach. In particular this course will focus on query optimization, query evaluation, transaction processing and concurrency control techniques. Also, this course will focus on storage and file structures, indexing and hashing methods. Apart from that finally this course will be given a brief introduction on big data analytics.

Credits   03   Compulsory – GPA

Concurrent Programming   **CS3032**

Many challenges arise during the design and implementation of concurrent and distributed programs. The aim of this course is to understand those challenges, and to see techniques for tackling them. The main paradigm to be considered is message passing concurrency, where independent processes, with private variables, interact by passing messages.

Credits   02   Compulsory – GPA

Computer & Network Security   **CS3092**

Security is now a core requirement when creating systems and software. This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems.

Credits   02   Elective – GPA

Image Processing & Computer Vision   **CS3042**

The purpose of this course is to provide the knowledge in fundamentals on image processing & computer vision and educate how digital images are represented, manipulated, encoded and processed, with emphasis on algorithm design, implementation and performance evaluation.

Credits   02   Compulsory – GPA

Bioinformatics   **CS3102**

The course is designed to introduce the field of bioinformatics to learn how to apply computer science in bio science environment.

Credits   02   Elective – GPA

Essentials of Computer Law   **CS3052**

The course is designed to enable students to learn and apply ethics in computing. Topics include Law of Contract, Sources of Law, Introduction to Information Technology Law, Principles of Commercial Law (The Law of Agency), Intellectual Property, Computer Crimes.

Credits   02   Compulsory – GPA

Research Methodology   **CS3062**

This course course will provide an opportunity to the understanding of research through an exploration of computer-based research, ethics, and approaches. The course introduces the introduction of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approach. The course will cover Types of Research, Approach to do Research, Scientific Method, Milestone Approach and Reading and Writing.

Credits   02   Compulsory – GPA

Logic Programming   **CS3072**

This course deals with logic programming paradigm and Prolog. We discuss the syntax and the semantics of Prolog, the working of a Prolog interpreter and various applications of Prolog. In particular, we consider the use of Prolog for database querying, parsing, meta-programming, and problem solving in AI. The programming assignments can be coded in SWI_Prolog or XSB.

Credits   02   Compulsory – GPA

Fluid Mechanics   **CM3022**

Provides an understanding of basic fluid mechanics and apply the theory to relevant engineering problems.

Credits   02   Elective – GPA

Digital Signal Processing   **ET3132**

The course is designed to educate students on software architectures in depth and the principles, techniques and tools for creating, developing and evaluating software architectures.

Credits   02   Compulsory – GPA

3.2.3.2   Semester 06

The following table gives an overall summary of the course unit entitled for the 6th semester of the BSc (Hons) in Computer Engineering Degree Program. The respective course unit have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 6												
COE3012	Computer Systems Engineering	C	2		2			19 (Including 3 Elective)			30	70
CS3112	Computer Graphics & Visualization	E	1	2	2						30	70
CS3122	Automata Theory	E	2		2						30	70
CS3152	Information Security	E	2		2						30	70
CS3132	High Performance Computing	E	2		2						30	70
CS3142	Complex Systems and Agent Technology	E	2		2						30	70
CS3162	Social Aspects of Computing	E	2		2						30	70
CS3182	Modeling & Simulation	E	2		2						30	70
CS3172	Digital Forensic	E	2		2						30	70
CM3103	Applied Mechanics	C	2	1	3						30	70
EE 3122	Micro-controllers and Embeded Systems	C	2		2						30	70
EE3222	Electrical Properties of Materials	C	2		2						30	70
ET4243	Digital System Design	C	2		2						30	70
COE3992	Independent Study	C	1	4	2						100	
Total for Semester 6					19							

Figure 11: Overall Summary of the Course Units

Computer Systems Engineering   **COE3012**

The course provide the knowledge and skills necessary to advance and develop new paradigms for the design, integration, testing, evaluation and deployment of state-of-the-art hardware and software systems that include computing, communications and networking, control functions, sensing, signal processing and actuation..

Credits   02   Compulsory – GPA

Computer Graphics & Visualization   **CS3112**

The objective of the course is to introduce theoretical methods for two-dimensional and three-dimensional graphics with applications to visualization techniques. The following topics will be discussed: Raster graphics, geometric transformations, viewing models, projections, parametric curves and surfaces, colour theory, visible surface / line determination, illumination and shading.

Credits   02   Elective – GPA

Automata Theory   **CS3122**

The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

Credits   02   Elective – GPA

Information Security   **CS3152**

Security is now a core requirement when creating systems and software. This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems. Other topics covered include basics of cryptography (e.g., digital signatures), risk management, security assurance and secure design principles, as well as internet security.

Credits   02   Elective – GPA

High Performance Computing   **CS3132**

The objective of this course is to develop high performing computing (HPC) systems and study how multicore processing units and multithreading help build power-aware HPC systems. Special attention is given to parallel computer architectures and parallel programming. Topics include Computer architecture, Parallel processing, Parallelism, Concurrency, Parallel programming: OpenMP, Open MPI, GPU/CUDA, Introduction to GPU/CUDA programming model, Parallel algorithms for GPU/CUDA programming, Developing parallel solutions for complex problems and Power-aware high-performance computing systems.

Credits   02   Elective – GPA

Complex Systems & Agent Technology   **CS3142**

The course is designed to give students an introduction to the theories and methods used to create multi-agent systems using intelligent agents. Topics include: introduction to AI, intelligent agents, types of agents, agent communication, multi-agent systems and applications of MAS. Programming assignments are an integral part of the course.

Credits   02   Elective – GPA

Social Aspects of Computing   **CS3162**

This course is intended to introduce people to the wider social implications of computing technology. Topics include how computer use affects social and work relationships and the uses of computers in society. Students analyze scenarios that allow them to view ethical decision making as a crucial part of understanding the world of computing.

Credits   02   Elective – GPA

Modeling & Simulation   **CS3182**

The course will introduce the basic concepts of computation through modeling and simulation that are increasingly being used by architects, planners, and engineers to shorten design cycles, innovate new products, and evaluate designs and simulate the impacts of alternative approaches. The course focus on System definitions and classification, Basic Static and Dynamic System, Modeling Techniques, Introduction to Discrete Event Simulation, Applications of Discrete Event Simulation.

Credits   02   Elective – GPA

Digital Forensic   **CS3172**

The purpose of this course is to provide a comprehensive understanding of digital forensics and investigation tools and techniques.

Credits   02   Elective – GPA

Applied Mechanics   **CM3103**

Provides the students with the knowledge and understanding of the applied mechanics principles and applications.

Credits   03   Compulsary – GPA

Microcontrollers & Embedded Systems   **EE3122**

The aim of this course to provide the student with a detailed understanding of Microcontrollers and Embedded systems. The course covers Introduction to Embedded Systems, Microcontroller architectures, MSP430 Instruction set, Addressing modes, Interrupt signals and routines, Interface circuits and Analog and Digital Peripherals programming: Digital I/Os, Timers, ADC and Communication Peripherals, Low power modes of operation

Credits   02   Compulsory – GPA

Electrical Properties of Materials   **EE3222**

The purpose of this course is to provide the knowledge on the concepts, principles of materials classifications and basic electrical and magnetic properties of materials. The course demonstrates the basic principles of electrons theory and influence of D.C. and A.C. electric field and magnetic field on the materials. Further-more this course is designed to teach students on comparison between the influence of D.C. and A.C. electric field and magnetic field on the materials and way to apply the modern concepts of the electrical and thermal conductivity and smart materials

Credits   02   Compulsory – GPA

Digital System Design   **ET4243**

Design and evaluation of control and data structures for digital systems. Hardware design languages are used to describe and design both behavioral and register transfer level architectures and control units with a microprogramming emphasis. Cover basic computer architecture, memories, and digital interfacing, timing and synchronization, and microprocessor systems.

Credits   02   Compulsory – GPA

Independent Study **COE3992**

This course is an opportunity for the student to engage in a research effort to develop research skills and techniques of an independent study in a subject area in which the supervisor and the student have a common interest.

Credits   02 Compulsory – GPA

3.2.3.3   Semester 07

The following table gives an overall summary of the course units entitled for the 7th semester of the BSc (Hons) in Computer Engineering Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lectures Hrs / Week	Lab / Assignments Hrs /	Credits GPA	Credits NGPA	Credits MGPA	Norm GPA	Norm NGPA	Norm MGPA	Evaluation CA %	Evaluation WE %
Semester 7												
COE4012	Semiconductors and Solid State Devices	C	2		2						30	70
COE4022	Advanced Operating Systems	C	2		2						100	
COE4033	VLSI Design & Fabrication	C	2	2	3						30	70
COE4042	Robotics & Automation	E	2		2						30	70
CS4012	Emerging Trends in Computing	E	2		2			19 (Including 4 Elective)			30	70
CS4022	Theory of Programing Languages	E	2		2						30	70
CS4032	Natural Language Processing	E	2		2						30	70
CS4042	Machine Learning	E	2		2						30	70
CS4052	Compilers Design	E	2		2						30	70
CS4062	Artificial Cognitive Systems	E	2		2						30	70
CS4092	Distributed Systems	E	2		2						30	70
CM4012	Advanced Topics in Statistics	E	2		2						30	70
COE4999	Individual Research Project (4Cr in S7)	C			4						30	70
Total for Semester 7					**19**							

Figure 12: Overall Summary of the Course Units

Semiconductors and Solid-State Devices COE4012

The objective of this course is to give an understanding on the Solid-state physics which applied to electronic devices, semiconductor materials, conduction processes in solids, device fabrication, diffusion processes, and semiconductor devices.

Credits 02 Compulsory – GPA

Advanced Operating Systems COE4022

The objective of this course is to study, learn and understand the main concepts of advanced operating systems: parallel processing systems, distributed systems, real time systems, network operating systems, open source operating systems and the hardware and software features that support these systems.

Credits 02 Compulsory – GPA

VLSI Design & Fabrication COE4033

The course enables students to gain knowledge and understanding in the aspects of Fundamentals of VLSI circuits and systems, VLSI design CAD tools, Hardware Description Languages (VHDL) and VLSI design prototyping using Field Programmable Gate Arrays (FPGAs)

Credits 03 Compulsory – GPA

Robotics & Automation COE4042

The course provides comprehensive knowledge of robotics in the design, analysis and control. It provides an understanding of the principles of operation of automated equipment with particular reference to industrial robots. It focuses on the knowledge needed to select and use such equipment effectively.

Credits 02 Elective – GPA

Emerging Trends in Computing CS4012

The course is to provide students with an opportunity to search for knowledge in areas of new trends in computing and it allow students to explore the emerging trends in a certain computer science area.

Credits 02 Elective – GPA

Theory of Programming Languages   **CS4022**

This course is an in-depth investigation of the theory of programming languages. The course covers the fundamental tools used in the analysis and design of programming languages, including semantics, type theory, abstract interpretation, meta-programming, and partial evaluation. We will also consider their application to imperative, functional, and object-oriented languages.

Credits   02   Elective – GPA

Natural Language Processing   **CS4032**

This course combines a critical introduction to key topics in theoretical linguistics with hands-on practical experience of developing applications to process texts and access linguistic resources. The main topics covered are: Accessing text corpora and lexical resources Processing raw text Categorizing and tagging Extracting information from text Analyzing sentence structure.

Credits   02   Elective – GPA

Machine Learning   **CS4042**

This course provides a broad introduction to machine learning and statistical pattern recognition. Topics include: supervised learning (generative/discriminative learning, parametric/non-parametric learning, neural networks, support vector machines); unsupervised learning (clustering); reinforcement learning and adaptive control.

Credits   02   Elective – GPA

Compilers Design   **CS4052**

This course explores the principles, algorithms, and data structures involved in the design and construction of compilers. Topics include finite-state machines, lexical analysis, context-free grammars and other parsing techniques, symbol tables and an introduction to intermediate code generation.

Credits   02   Elective – GPA

Artificial Cognitive Systems   **CS4062**

To introduce the study and development of intelligent systems, including the correspondence with natural cognitive systems and the design of smart tools.

Credits   02   Elective – GPA

Distributed Systems   **CS4092**

The objective of this course is to provide an in-depth overview of research topics in distributed systems enabling students to master the development skills in providing and constructing distributed services.

Credits   02   Elective – GPA

Advanced Topics in Statistics
                                                                                CM4012

The Design and analysis of experiments subject affects student to improve the advanced statistical concepts. This course highly relates with the research activities in statistical field. It prepares student for perform experiments, gain results, perform statistical analysis and interpret the results manually and using statistical software.

Credits   02   Elective – GPA

Individual Research Project
                                                                                COE4999

The aim of this course is to give undergraduate students exposure to research undertaken individually and to achieve a specific objective within a fixed time independently. Additionally, this course allows undergraduate students to conduct research in computer science, with applying techniques learned throughout the program, including the technical skills of analysis, design and implementation.

Credits   04   Compulsory – GPA

3.2.3.4   Semester 08

The following table gives an overall summary of the modules entitled for the 8th semester of the BSc (Hons) in Computer Engineering Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lectures Hrs / Week	Lab / Assignments Hrs /	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 8												
COE4996	Industrial Training	C				6		5	6		100	
COE4999	Individual Research Project (5Cr in S8)	C			5						100	
Total for Semester 8								5	6			

Figure 13: Overall Summary of the Course Units

Industrial Training   **COE4996**

The aim of Industrial Training is to expose students to real work of environment experience and at the same time, to gain the knowledge through hands on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and others. Moreover, this practical training program allows students to relate theoretical knowledge with its application in the industry.

Credits   06   Compulsory – NGPA

Individual Research Project   **COE4999**

The aim of this course is to give undergraduate students exposure to research undertaken individually and to achieve a specific objective within a fixed time independently. Additionally, this course allows undergraduate students to conduct research in computer science, with applying techniques learned throughout the program, including the technical skills of analysis, design and implementation.

Credits   05   Compulsory – GPA

The course contains 129 GPA credits from core course units, 08 NGPA credits and 16 MGPA credits. The distribution of the academic credits in BSc (Hons) in Computer Engineering degree program are illustrated in the table below.

	BSc (Hons) in Computer Engineering		
	GPA Credits	NGPA Credits	MGPA Credits
Semester 1	17	02	04
Semester 2	17	-	04
Semester 3	17	-	04
Semester 4	16	-	04
Semester 5	19	-	-
Semester 6	18	06	-
Semester 7	19	-	-
Semester 8	05	-	-
Total	128	08	16

Figure 14: Overall Summary of the Course Units

MGPA – Military GPA

3.2.4 BSc (Hons) in Software Engineering (Level 3 and 4)

3.2.4.1 Semester 05

The following table gives an overall summary of the course units entitled for the 5th semester of the BSc (Hons) in Software Engineering Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 5												
SE3012	Engineering Foundation for Software	C	2		2			19(Including 1 Elective)			30	70
SE3022	Software Modeling	C	2		2						30	70
SE3032	Software Construction Technologies and Tools	C	2		2						30	70
SE3042	Software Design and Architecture	C	2		2						30	70
CS3012	Human Computer Interaction	C	2		2						30	70
CS3082	Mobile Computing	E	1	2	2						30	70
CS3023	Advanced database and Big Data Analytics	C	2	2	3						30	70
CS3092	Computer & Network Security	E	2		2						30	70
CS3042	Image Processing & Computer Vision	E	2		2						30	70
CS3062	Research Methodlogy	C	2		2						30	70
CS3072	Logic Programming	E	2		2						30	70
CS3052	Essentials of Computer law	C	2		2						30	70
Total for Semester 5					19							

Figure 15: Overall Summary of the Course Units

Engineering Foundation for Software   **SE3012**

The aim of this course is to provide an understanding on engineering foundation for software and to illustrate the concepts of the value engineering to evaluate the cost-effectiveness in terms of security, reliability, safety and performance of a product. Furthermore, this course describes applications of engineering sciences.

Credits   02   Compulsory – GPA

Software Modeling   **SE3022**

The aim of this course is to introduce the usage of modeling principles in modeling an application and to describe basic concepts of software modeling.

Credits   02   Compulsory – GPA

Software Construction Technologies and Tools   **SE3032**

The aim of this course is to provide an understanding on different software construction technologies and tools in software development.

Credits   02   Compulsory – GPA

Software Design and Architecture   **SE3042**

This course introduces concepts and principles about software design and software architecture. It enables students in evaluating the effect of software design on software quality.

Credits   02   Compulsory – GPA

Human Computer Interactions   **CS3012**

This course uses an integrative and cross-disciplinary approach to bring together a broad variety of topics together in relation to the problem of developing quality user interaction designs to provide an introduction to the field of HCI.

Compulsory – GPA

Credits   02

Mobile Computing   **CS3082**

An introduction to mobile computing with a strong emphasis on application development for the Android operating system. Students will complete a major project with the goal of releasing an app on the Android Market place. Topics will include the Android development environment, user interfaces, audio, persistence, SQLite databases, location, sensors, and graphics.

Credits   02   Elective – GPA

Advanced Databases and Big Data Analytics   **CS3023**

This course aims at furthering database systems concepts through adding complexity and a more hands-on approach. In particular, this course will focus on query optimization, query evaluation, transaction processing and concurrency control techniques. Also, this course will focus on storage, file structures, indexing and hashing methods. Apart from that, this course will give a brief introduction to big data analytics.

Credits   03   Compulsory – GPA

Computer & Network Security   **CS3092**

Security is now a core requirement when creating systems and software. This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems.

Credits   02   Elective – GPA

Image Processing & Computer Vision   **CS3042**

This course introduces fundamental concepts and techniques for image processing and computer vision. Topics to be covered include: image acquisition and display using digital devices, properties of human visual perception, sampling and quantization, image enhancement, image restoration, two-dimensional Fourier transforms, linear and nonlinear filtering, morphological operations, noise removal, image deblurring, edge detection, image registration and geometric transformation, image/video compression, video communication standards, video transport over the Internet and wireless networks, object recognition and image understanding.

Credits   02   Elective – GPA

Research Methodology   **CS3062**

This course course will provide an opportunity to the understanding of research through an exploration of computer-based research, ethics, and approaches. The course introduces the introduction of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approach. The course will cover Types of Research, Approach to do Research, Scientific Method, Milestone Approach and Reading and Writing.

Credits   02   Compulsory – GPA

Logic Programming   **CS3072**

This course deals with logic programming paradigm and Prolog. We discuss the syntax and the semantics of Prolog, the working of a Prolog interpreter and various applications of Prolog. In particular, we consider the use of Prolog for database querying, parsing, meta-programming, and problem solving in AI. The programming assignments can be coded in SWI_Prolog or XSB.

Credits   02   Elective – GPA

Essentials of Computer Law   **CS3052**

The course is designed to enable students to learn and apply ethics in computing. Topics include Law of Contract, Sources of Law, Introduction to Information Technology Law, Principles of Commercial Law (The Law of Agency), Intellectual Property, Computer Crimes.

Credits   02   Compulsory – GPA

3.2.4.2   Semester 06

The following table gives an overall summary of the course unit entitled for the 6th semester of the BSc (Hons) in Software Engineering Degree Program. The respective course unit have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 6												
SE3052	Engineering Economics for Software	C	2		2			18 (Including 4 Elective)			30	70
SE3062	Software Verification and Validation	C	2		2						30	70
SE3072	Software Process	C	2		2						30	70
CS3172	Digital Forensic	E	2		2						30	70
CS3112	Computer Graphics & Visualization	E	1	2	2						30	70
CS3122	Automata Theory	E	2		2						30	70
CS3152	Information Security	E	2		2						30	70
CS3132	High Performance Computing	E	2		2						30	70
CS3142	Complex Systems and Agent Technology	E	2		2						30	70
CS3162	Social Aspects of Computing	C	2		2						30	70
SE3992	Independent Study	C	1	4	2						100	
Total for Semester 6					18							

Figure 16: Overall Summary of the Course Units

Engineering Economics for Software   **SE3052**

Software 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.

Credits   02   Compulsory – GPA

Software Verification and Validation   **SE3062**

The aim of this course is to provide though understanding on software verification and validation techniques. Furthermore, this will provide an understanding on applying various software testing techniques in an effective and efficient manner to undergraduates.

Credits   02   Compulsory – GPA

Software Process   **SE3072**

The aim of this course is to provide an understanding on Engineering of the software development process including software life-cycle, maturity models, process programming, and process management. This course considers both theory and practice of engineering large, long-lived software systems, including process analysis, modeling, workflows, standards, process environments and tools, automation, and organizational context. Case studies illuminate the application of software process theory to engineering practice. Students will work in teams to analyze and develop software management plans and tools.

Credits   02   Compulsory – GPA

Digital Forensic   **CS3172**

The purpose of this course is to provide a comprehensive understanding of digital forensics and investigation tools and techniques.

Credits   02   Elective – GPA

Computer Graphics & Visualization   **CS3112**

The objective of the course is to introduce theoretical methods for two-dimensional and three-dimensional graphics with applications to visualization techniques. The following topics will be discussed: Raster graphics, geometric transformations, viewing models, projections, parametric curves and surfaces, colour theory, visible surface / line determination, illumination and shading.

Credits   02   Elective – GPA

Automata Theory   **CS3122**

The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

Credits   02   Elective – GPA

Information Security   **CS3152**

Security is now a core requirement when creating systems and software. This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems. Other topics covered include basics of cryptography (e.g., digital signatures), risk management, security assurance and secure design principles, as well as internet security.

Credits   02   Elective – GPA

High Performance Computing   **CS3132**

The objective of this course is to develop high performing computing (HPC) systems and study how multicore processing units and multithreading help build power-aware HPC systems. Special attention is given to parallel computer architectures and parallel programming. Topics include Computer architecture, Parallel processing, Parallelism, Concurrency, Parallel programming: OpenMP, Open MPI, GPU/CUDA, Introduction to GPU/CUDA programming model, Parallel algorithms for GPU/CUDA programming, Developing parallel solutions for complex problems and Power-aware high-performance computing systems.

Credits   02   Elective – GPA

Complex Systems & Agent Technology   **CS3142**

The course is designed to give students an introduction to the theories and methods used to create multi-agent systems using intelligent agents. Topics include: introduction to AI, intelligent agents, types of agents, agent communication, multi-agent systems and applications of MAS. Programming assignments are an integral part of the course.

Credits   02   Elective – GPA

Social Aspects of Computing   **CS3162**

This course is intended to introduce people to the wider social implications of computing technology. Topics include how computer use affects social and work relationships and the uses of computers in society. Students analyze scenarios that allow them to view ethical decision making as a crucial part of understanding the world of computing.

Credits   02   Compulsory – GPA

Independent Study   **SE3992**

This course is an opportunity for the student to engage in a research effort to develop research skills and techniques of an independent study in a subject area in which the supervisor and the student have a common interest.

Credits   02   Compulsory – GPA

3.2.4.3 Semester 07

The following table gives an overall summary of the course units entitled for the 7th semester of the BSc (Hons) in Software Engineering Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 7												
SE4012	Formal Methods and Software verification	C	2		2			18(Including 4 Elective)			30	70
SE4022	Software Evolution	C	2		2						30	70
SE4032	Software Quality	C	2		2						30	70
CS4012	Emerging Trends in Computing	E	2		2						30	70
CS4022	Theory of programing Languages	E	2		2						30	70
CS4032	Natural Language Processing	E	2		2						30	70
CS4062	Artificial Cognitive Systems	E	2		2						30	70
CS4052	Compilers Design	E	2		2						30	70
CS4082	Semantic web & Ontology	E	2		2						30	70
CS4092	Distributed Systems	E	2		2						30	70
CM4012	Advanced topics in Statistics	E	2		2						30	70
SE4999	Individual Research Project (4 Credit in S7)	C	2		4						100	
Total for Semester 7					**18**							

Figure 17: Overall Summary of the Course Units

Formal Methods and Software verification   **SE4012**

The aim of this course is to provide an understanding on fundamentals of formal methods and software verification and explain the necessity of formal methods in designing complex software systems.

Credits   02   Compulsory – GPA

Software Evolution   **SE4022**

The course is designed to provide an understanding on fundamentals of software evolution and explain the System Reengineering Approaches, Software Maintenance, Change Prediction, etc.

Credits   02   Compulsory – GPA

Software Quality   **SE4032**

The course enables students to gain knowledge and understanding of the importance of software quality and software quality concepts in software development.

Credits   02   Compulsory – GPA

Emerging Trends in Computing   **CS4012**

The course is to provide students with an opportunity to search for knowledge in areas of new trends in computing and it allow students to explore the emerging trends in a certain computer science area.

Credits   02   Elective – GPA

Theory of Programming Languages   **CS4022**

This course is an in-depth investigation of the theory of programming languages. The course covers the fundamental tools used in the analysis and design of programming languages, including semantics, type theory, abstract interpretation, meta-programming, and partial evaluation. We will also consider their application to imperative, functional, and object-oriented languages.

Credits   02   Elective – GPA

Natural Language Processing   **CS4032**

This course combines a critical introduction to key topics in theoretical linguistics with hands-on practical experience of developing applications to process texts and access linguistic resources. The main topics covered are: Accessing text corpora and lexical resources, Processing raw text, Categorizing and tagging, extracting information from text Analyzing sentence structure.

Credits   02   Elective – GPA

Artificial Cognitive Systems   **CS4062**

Introduces the study and development of intelligent systems, including the correspondence with natural cognitive systems and the design of smart tools.

Credits   02   Elective – GPA

Compilers Design   **CS4052**

This course explores the principles, algorithms, and data structures involved in the design and construction of compilers. Topics include finite-state machines, lexical analysis, context-free grammars and other parsing techniques, symbol tables and an introduction to intermediate code generation.

Credits   02   Elective – GPA

Semantic web & Ontology   **CS4082**

The aim of this course is to teach the students the concepts, technologies and techniques underlying and making up the Semantic Web. The central focus is on creating ontologies as a form of information and knowledge organization in a Semantic Web / Linked Web of Data environment.

Credits   02   Elective – GPA

Distributed Systems   **CS4092**

The objective of this course is to provide an in-depth overview of research topics in distributed systems enabling students to master the development skills in providing and constructing distributed services.

Credits   02   Elective – GPA

Advanced Topics in Statistics   **CM4012**

The Design and analysis of experiments subject affects student to improve the advanced statistical concepts. This course is highly related to the research activities in statistical field. It prepares student for perform experiments, gain results, perform statistical analysis and interpret the results manually and using statistical software.

Credits   02   Elective – GPA

Individual Research Project   **SE4999**

The aim of this course is to give undergraduate students exposure to research undertaken individually and to achieve a specific objective within a fixed time independently. Additionally, this course allows undergraduate students to conduct research in computer science, with applying techniques learned throughout the program, including the technical skills of analysis, design and implementation.

Credits   04   Compulsory – GPA

3.2.4.4 Semester 08

The following table gives an overall summary of the course units entitled for the 8th semester of the BSc (Hons) in Software Engineering Degree Program. The respective course units have been outlined in detail beneath the table.

Module Code	Module Name	Category	Lecture Hrs / Week	Lab Hrs / Weeks	Credits			Norm			Evaluation	
					GPA	NGPA	MGPA	GPA	NGPA	MGPA	CA %	WE %
Semester 8												
SE4999	Individual Research Project (5 Credits for S8)	C			5			5	6		30	70
SE4996	Industrial Training	C				6					30	70
Total for Semester 8					5	6		5	6			

Figure 18: Overall Summary of the Course Units

Individual Research Project   **SE4999**

The aim of this course is to give undergraduate students exposure to research undertaken individually and to achieve a specific objective within a fixed time independently. Additionally, this course allows undergraduate students to conduct research in computer science, with applying techniques learned throughout the program, including the technical skills of analysis, design and implementation.

Credits   05   Compulsory – GPA

Industrial Training   **SE4996**

The aim of Industrial Training is to expose students to real work of environment experience and at the same time, to gain the knowledge through hands on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and others. Moreover, this practical training program allows students to relate theoretical knowledge with its application in the industry.

Credits   06   Compulsory – NGPA

The course contains 127 GPA credits from core course units, 08 NGPA credits and 16 MGPA credits. The distribution of the academic credits in BSc(Hons) in Software Engineering degree program are illustrated in the table below.

	BSc (Hons) in Software Engineering		
	GPA Credits	NGPA Credits	MGPA Credits
Semester 1	17	02	04
Semester 2	17	-	04
Semester 3	17	-	04
Semester 4	16	-	04
Semester 5	19	-	-
Semester 6	18	-	-
Semester 7	18	-	-
Semester 8	05	06	-
Total	127	08	16

Figure 19: Overall Summary of the Course Units

MGPA – Military GPA

4   Examinations

4.1   Examination Criteria

Each course of the program is assessed independently. The assessment has two components: Continuous Assessment (CA) and End Semester Written Examination (WE). The CA component is generally 30% and the WE component is 70% (The weightage of a component might change based on the nature of the course). The relevant percentages of assessment for a course are incorporated into the curriculum. In order to complete a course, the student has to earn a minimum of 35% of the allocated marks for each component and a total pass mark of 45% **"C"** grade.

The CA component includes laboratory work, tutorials, take home assignments, in class tests, case studies, quizzes, presentations, field visits and mid semester examinations. These are conducted during the semester.

4.2   Maximum Allowed Duration of Study

Degree Program	Max. No. of years in which a degree can be completed
Computer Science	8
Software Engineering	8
Computer Engineering	8
Information Technology	8
Information Systems	8

Table 3: Maximum Allowed Durations

The BoS (Senate)/ BOM (Council) on the recommendation of the Faculty Board of Faculty of Computing may grant permission to extend the duration of study beyond the maximum period allowed on medical grounds or under exceptional circumstances other than medical grounds on a case by case basis.

4.3 Attendance

The eligibility requirement to sit an End Semester examination paper in a Course Unit, relevant to the field of study in a particular semester, as a first-time candidate, is an attendance record of not less than 80%. However, an attendance record of not less than 70% may be considered on valid medical grounds and/or due to any other valid reason by the Faculty Board for the purpose of calculating the required attendance.

4.4 Grading System

There are two categories of Academic Credits: GPA (Grade Point Average) and NGPA (Non-Grade Point Average). Each course in the curriculum is assigned with a credit value and its category. Only the GPA credits are considered when calculating SGPA (Semester Grade Point Average), YGPA (Year Grade Point Average) and FGPA (Final Grade Point Average).

Military courses offered to the military students are assigned with a credit value of a third category, called MGPA (Military Grade Point Average). Both GPA and MGPA credits are considered when calculating the SGPA, YGPA and FGPA of military students. A prescribed minimum MGPA credits, over and above the Academic Credits, must be earned by a military student to qualify for graduation. The following table describes the grade point values (GPV) dedicated for each grade.

Marks	Grade	GPV
85-100	A+	4.2
75-84	A	4.0
70-74	A-	3.70
65-69	B+	3.30
60-64	B	3.00
55-59	B-	2.70
50-54	C+	2.30
45-49	C	2.00
40-44	C-	1.70
35-39	D+	1.30
<35	I	0.00
CAS* <35%	E	0.00
not eligible	ne	0.00
absent	ab	0.00
excused	ex	

Table 4: Details of Grades and GPVs

Ab = Absent for a course unit   Ex = Excused on a valid reason

Pass Marks and Grades

The details of the grades and Grade Point Value (GPV) corresponding range of marks are described in the above table. Grading for MGPA courses are decided by the senate, considering the raw marks submitted by Military Training Academies and the pass mark of the respective Academies of the Army, Navy and Air Force. The semester Grade Point Average (SGPA) is calculated from GPV earned for individual courses in a semester as per the following formula,

$$SGPA = \frac{\sum[\text{GradePoint scored for Course Unit} \times \text{Credit value of Course Unit}]}{\text{Cumulative credit value of all GPA Course Units of the Semester}}$$

For the further information of YGPA and FGPA, refer the section 3.7 of the Faculty of Computing By-Laws.

4.5 Criteria for Completing a Semester

4.5.1 Passing a Semester

A student shall satisfy the following minimum requirements to successfully complete a semester:

a) obtain a "C" grade or above for all Course Units, other than as specified in b,

b) obtain not more than one "D+" or "C-" grade for a GPA Course Unit per semester subject.

4.5.2 Re-sitting a Course Unit

a) Re-sitting a Course Unit for which an Excuse has been granted would be on the same basis as a normal first attempt candidate.

b) A charge shall be levied by the registry as approved by the BOM, for re-sitting a course unit.

c) All the Course Units having grade "I" shall be completed by re-sitting the ES component.

d) The earned CA mark in the first attempt would be carried over when re-sitting of the ES component.

e) The CA component can only be upgraded in project-based course units, and the maximum mark attainable for such CA component is 45%.

f) All NGPA Course Units having a grade less than 'C' shall have to be repeated to obtain a pass grade.

g) All GPA Course Units having a grade less than 'C', except those "weak passes" permitted under section 3.5.4, shall be repeated to obtain a pass grade.

h) Any NGPA Course Unit having a grade 'C ' or higher may be repeated if desirous of upgrading the given grade.

i) Any GPA Course Unit with a permitted "Weak Pass" may be repeated if desirous of upgrading the given grade up to a maximum of grade 'C'.

4.5.3 Supplementary Examinations

a) Supplementary Examinations will not be held following the Semesters 1 to 7.

b) To allow students to graduate without delay, a supplementary examination may be held at end of the 7th and 8th Semester to permit students to complete all incomplete Course Units in 7th and 8th Semesters.

5 Discontinuing A Student

5.1 Discontinuation from the Degree

A student shall be deemed to have discontinued a degree programme at the University under any of the following conditions.

a) When a student has been unable to complete the degree programme within the maximum period of sixteen semesters.

b) When a student has been determined to be unfit to continue his/her studies at the University by a competent medical board recommended by the University on account of an illness.

c) Following punishment for an examination offence in terms of the provisions of the "Bylaws pertaining to the conduct of examinations" approved by the BOM.

d) When a student has been absent for two continuous semesters without informing the faculty and getting its acceptance.

5.2 Poor Performance of Students

a) Any student will be allowed to progress through the semester whilst being in the original batch whilst completing low performed academic course units through subsequent examinations during the maximum duration of sixteen semesters.

b) A warning shall be issued to students who have failed to obtain a minimum SGPA of 2.0 at any stage of progression of the degree.

5.3 Relegation

Procedure for relegation of officer-cadets for poor performance shall be according to the FDSS By-Law.

6 Awards and Trophy

6.1.1 Criteria for Awarding Degrees

Following criteria are considered for awarding degrees,

a) Following the programme in the specified field of study for the minimum stipulated period of time;

b) Satisfactory completion of the academic requirements of all semesters of the Degree Programme;

c) As stipulated in the respective Degree Programme Curriculum obtaining a minimum of GPA credits and a minimum of NGPA credits

d) Fulfilment of the criteria for completing the examinations within the maximum stipulated time period;

e) Earning a GPA of not less than 2.00 for the entire degree programme;

f) Not having more than 1 D+ or C- grades per semester in the entire programme.

A student shall be entitled to the award of the Hons Degree unless he/she has completed the above requirements (a – f) within four academic years.

6.1.2   Criteria for Awarding Classes

Awarding of classes shall be determined at the completion of all requirements for graduation within the minimum time stipulated for each degree program. Classes shall be awarded based on the FGPA as indicated below.

Students obtaining the highest FGPA in Military Studies and/or Academic Studies shall be entitled for the respective Awards/Trophies of merit.

FGPA	Final Result
FGPA >= 3.70	First Class
3.30 <= FGPA and FGPA < 3.70	Second Class (Upper Division)
3.00 <= FGPA and FGPA < 3.30	Second Class (Lower Division)
2.00 <= FGPA and FGPA < 3.00	Pass

Table 5: FGPA for the Award of Classes

First Class

For the award of a First Class, a student shall:
a) have received a FGPA of not less than 3.70 for the entire Degree Programme.
     and
b) not have received any failure grade at any time during the entire Degree Programme
     and
c) not have carried over any weak passes for the entire Degree Programme at the time of finalizing the awarding of classes.

Second Class (Upper Division)

For the award of a Second Class (Upper Division), a student shall:
a) have received a FGPA of not less than 3.30 for the entire Degree Programme.
   and
b) not have received more than one failure grades at any time during the entire Degree Programme
   and
c) not have received any failure grade during the semesters 7 and 8
   and
d) not have carried over any incomplete or failure grades or weak passes for the entire Degree Programme at the time of finalizing the awarding of classes.

Second Class (Lower Division)

For the award of a Second Class (Lower Division), a student shall:
a) have received a FGPA of not less than 3.00 for the entire Degree Programme.
   and
b) not have received more than two failure grades at any time during the Programme
   and
c) not have received any failure grade during the semesters 7 and 8
   and
d) not have carried over any incomplete or failure grades for the entire Degree Programme at the time of finalizing the awarding of classes.

6.1.3   Dean's List and Vice-Chancellor's List

Any student who achieves a YGPA of 3.90 or above as per the merit order list shall be eligible to be in the Vice Chancellor's list and student who achieves a YGPA of 3.70 and above as per the merit order, who do not qualify for the Vice Chancellor's list, shall be eligible to be in the Dean's list. Recognition for inclusion in the VC's List or in the Dean's List will only be if they have not been subjected to severe punishment on disciplinary grounds or guilty of any serious violation of the code of conduct.

6.1.4   Merit Awards

Students obtaining the highest GPA in Academic Studies shall be entitled for the respective Awards of merit. Awards to which students may be eligible on the recommendation of relevant authorities and the approval of the Board of Management are:

a)   Trophy for the Best Graduant in Computer Science.

b)   Trophy for the Best Graduant in Software Engineering.

c)   Trophy for the Best Graduant in Computer Engineering.

d)   Trophy for the Best Graduant in Information Technology.

e)   Trophy for the Best Graduant in Information Systems.

f)   Trophy for the Best Overall Performance in Academic Studies Computing Stream.

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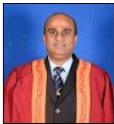
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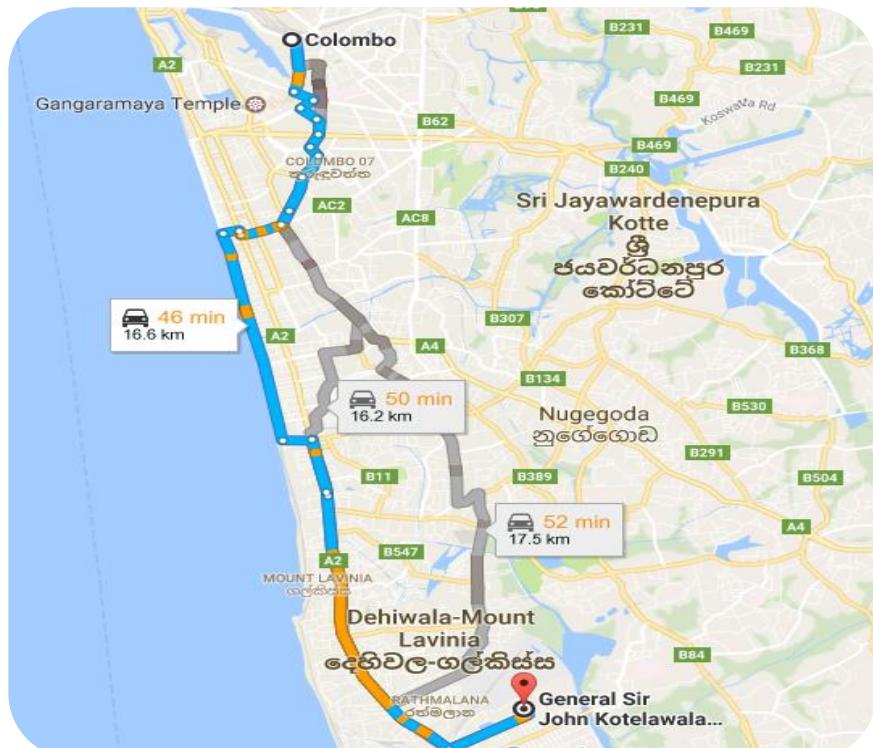
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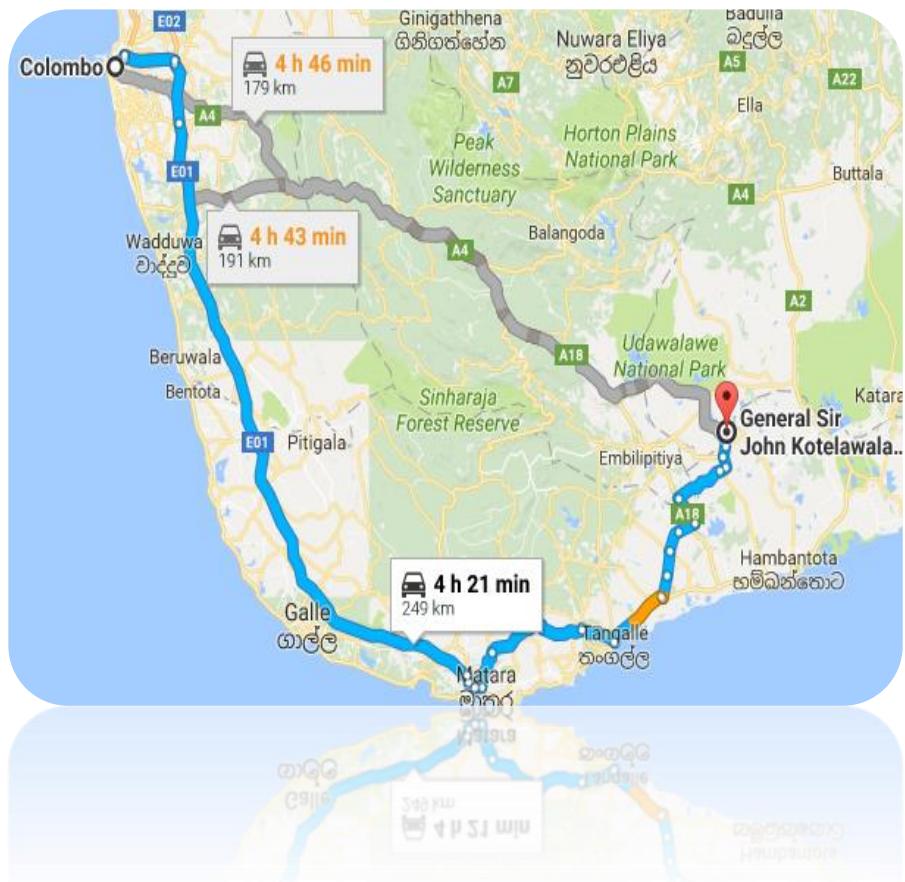
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